Sample Proposal of Research Project

2018-2019

SWAMI VIVEKANAND SUBHARTI UNIVERSITY

MEERUT

MTV Buddhist Religious and Charitable Trust

(Formerly known as SUBHARTI K.K.B. CHARITABLE TRUST)
Registered Head Office : Tathagat Buddha Block, Subhartipuram, Delhi Roorkee Meerut By-Pass Road, Meerut -250005
Ph. 0121-2439043, 2439052, 3058031, 3058032; Telefax : 0121-2439067
Regional State Office: Kotda Santaur, Nanda Ki Chowki, Prem Nagar, Dehradun.
Ph. 0135-2978410
e-mail: subharti@subharti.org, Website : www.subharti.org

Ref. No.: MTVBRCT/2019/7463 Date: 19.11.2019

To,

The Registrar
Swami Vivekanand Subharti University
Meerut.

Sub: Scheme of Development of Buddhist/Tibetan Culture & Art, Ministry of Culture, Government of India - Research Project done by Samrat Ashok Subharti School of Buddhist Studies (SASSBS), Swami Vivekanand Subharti University, Meerut.

Dear Sir,

This is in reference to the Expenditure Statement and bills submitted by the University from time to time relating to the project "**Development of Buddhist/Tibetan Culture & Art, Ministry of Culture, Government of India**".

Total amount reimbursed to the University by the Trust under the scheme till now comes to Rs.14,65,158/- from February 2019 to August 2019. Out of this amount, an amount of Rs.3,34,600/- was spent on purchase of assets namely, **Audio Visual Equipments**.

Trust has decided to donate the audio visual equipments worth Rs. 3,34,600/- to Samrat Ashok Subharti School of Buddhist Studies, Swami Vivekanand Subharti University after closure of the project.

Dr. Krishna Murty
Secretary

Copy to:

1. Hon'ble President,
2. The Vice-Chancellor, SVSU
3. HOD, SASSBS
4. Finance Officer

Dr. Krishna Murty
SECRETARY
M.T.V. Buddhist Religious and Charitable Trust

SUBHARTI INSTITUTE OF TECHNOLOGY & ENGINEERING
SWAMI VIVEKANAND SUBHARTI UNIVERSITY

Hover Craft

REPORT

under
Resource Mobilization for Research

Er. Harpreet Singh

(Principal Investigator)

Assistant Professor,
Department of ME
SITE, SVSU

2018-19

Summary Sheet

1. **Name of the Principal Investigator:**Er. Harpreet Singh

   PhoneNo:+917015573312 Email: har29243@gmail.com

2. **Institution :**Subharti Institute of Technology & Engineering
3. **Project Title: Hover Craft**
4. **Date of Sanction :**28/12/2019
5. **Abstract :** A Hovercraft is a vehicle that flies like a plane but can float like a boat, can drive like a car but will traverse ditches and gullies as it is a flat terrain. A Hovercraft also sometimes called an air cushion vehicle because it can hover over or move across land or water surfaces while being held off from the surfaces by a cushion of air. A Hovercraft can travel over all types of surfaces including grass, mud, muskeg, sand, quicksand, water and ice .Hovercraft prefer gentle terrain although they are capable of climbing slopes up to 20%, depending upon surface characteristics. Modern Hovercrafts are used for many applications where people and equipment need to travel at speed over water but be able load and unload on land. For example they are used as passenger or freight carriers, as recreational machines and even use as warships. Hovercrafts are very exciting to fly and feeling of effortlessly traveling from land to water and back again is unique. Hovercraft use blowers to produce a large volume of air below the hull, or air cushion that is slightly above atmospheric pressure. The pressure difference between the higher pressure air below the hull and lower pressure ambient air above it produces lift, which causes the hull to float above the running surface. For stability reasons, the air is typically blown through slots or holes around the outside of a disk- or oval-shaped platform, giving most hovercraft a characteristic rounded-rectangle shape. Typically this cushion is contained within a flexible "skirt", which allows the vehicle to travel over small obstructions without damage.

6. **Major Work Done:**

The Hull For demonstration purposes, let the craft be designed to carry one person of weight 70kg + 15% of 70kg = 80.5kg Let length of hull = twice the width If width =1.22m; length =2W= 2.44m; Surface Area = 1.22 X 2.44 = 2.98m 2 **Width = 1.22m = 4 feet; length = 2.44m = 8feet Material of construction is plywood**

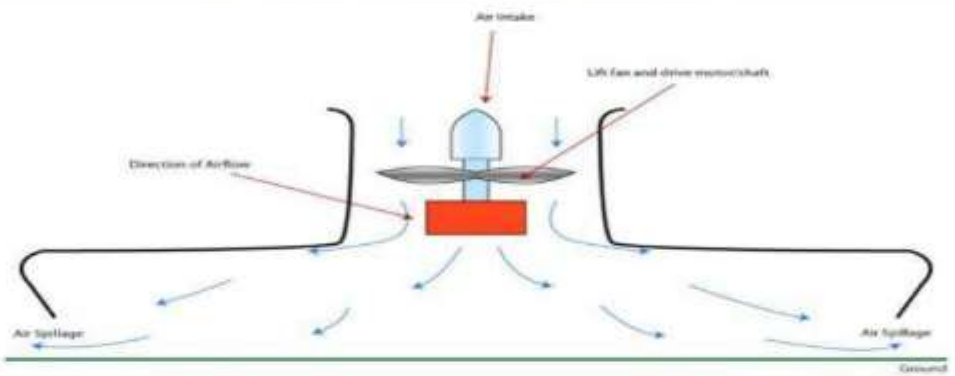
Lower Hull: It is the basic structure on which the Hovercraft floats when the engine is stopped while moving over water. It supports the whole weight of the craft. As the lower hull of the craft we will include the craft floor, side panels, forward and aft panels till the top skirt attachment line. Most commercially build craft in polyester resin (build out of a female mold) will use this section to transfer to the top hull. The lower hull : needs to have adequate size for the total weight of craft and payload. Must be strong enough to support craft off cushion (on landing pads). Have enough freeboard to support craft in displacement mode on water. Must be watertight and as smooth as possible

In detail: before you can start you must know the approximate craft weight as well as.

Methodology: The principle of working of a Hovercraft is to lift the craft by a cushion of air to propel it using propellers. The idea of supporting the vehicle on a cushion of air

developed from the idea to increase the speed of boat by feeding air beneath them. The air beneath the hull would lubricate the surface and reduce the water drag on boat and so increasing its speed through water. The air sucked in through a port by large lifting fans which are fitted to the primary structure of the craft. They are powered by gas turbine or diesel engine. The air is pushed to the under side of the craft. On the way apportion of air from the lift fan is used to inflate the skirt and rest is ducted down under the craft to fill area enclosed by the skirt.

Figure 1: Pressure Development in Skirt



Basic Principles of the Hovercraft:
Open plenum, no Momentum Curtain effect

7. **Major outcomes;** The unique capabilities of Hovercrafts are recognized and appreciated by a diverse group of its end users. Hovercrafts are in use worldwide with search research groups, fire departments, airport emergency response units and scientific research teams. Hovercrafts are an integral part of numerous commercial operations including driving, tourism, water taxi, ferry service, ice breaking, goods delivery, survey, environmental monitoring and guide outfitting. The Hovercraft as a vehicle is still in common use but not in large volumes. As engine and materials technology progress the Hovercraft may yet make a comeback but for now it is a special vehicle for special application.

PERFORMA FOR PROJECT COMPLETION REPORT

To,

Head of Department

Date: 20/12/2019

Name of Department: ME

Name of College: S.I.T.E

Findings of the project: (Max-100 words): It is an integral part of numerous commercial operations including diving, water taxi, ferry services, ice breaking, goods delivery, Environmental monitoring and guide vessel fitting. The hovercraft as a vehicle is still in common use but not in large vol:

External Support:

Adeeba books

Name of PI: Harpreet Singh.

Name of the Department: Mechanical Engineering

Name of College: SITE

Title of the Project: Hovercraft

Duration of the Project: 1 year

Signature of the P.I.

Employee Code of PI:

Registrar
Swami Vivekanand
Subharti University
MEERUT

MTV Buddhist Religious and Charitable Trust

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Ph. 0135-2978410

e-mail: subharti@subharti.org, Website : www.subharti.org

Ref. No.: MTVBRCT/2019/4804 Date: 10.08.2019

To

The Registrar,
Swami Vivekanand Subharti University,
Meerut.

Sub: **Preservation and Development of Cultural Heritage of Himalayas, sanctioned by the Ministry of Culture, Government of India: Research Project done by Dr. Neeraj Karan Singh, Associate Professor, Faculty of Journalism and Mass Communication of Swami Vivekanand Subharti University, Meerut..**

Dear Sir,

This is in reference to the Expenditure Statement and bills submitted by the University from time to time relating to the project **of Preservation and Development of Cultural Heritage of Himalayas, sanctioned by the Ministry of Culture, Government of India.**

Total amount reimbursed to the University till now comes to Rs.2,53,866/- from February 2019 to July 2019.

Trust is thankful to Dr. Neeraj Karan Singh, Associate Professor, Faculty of Journalism and Mass Communication who worked very well as Principal Investigator of the project.

Dr. Krishna Murty
Secretary

Copy to:

1. Hon'ble President,
2. The Vice-Chancellor, SVSU
3. Dr. Neeraj Karan Singh, Associate Professor – Faculty of Journalism, SVSU.
4. Finance Officer.

Dr. Krishna Murty
SECRETARY
M.T.V. Buddhist Religious
and Charitable Trust

SUBHARTI INSTITUTE OF TECHNOLOGY & ENGINEERING
SWAMI VIVEKANAND SUBHARTI UNIVERSITY

Video captioning

REPORT

under
Resource Mobilization for Research

SHIKHA RANI

(Co- Investigator)

Er. Konika

(Principal Investigator)

Assistant Professor,
Department of CSE,
SITE, SVSU

2018-19

Summary Sheet

1. **Name of the Principal Investigator:** Er. KonikaAbid

   PhoneNo: 7500112501 **Email: konikaa9@gmail.com**
2. **Institution :** Subharti Institute of Technology & Engineering
3. **Project Title:** Video captioning
4. **Date of Sanction :12/09/18**
5. **Abstract :**

Video Captioning is a task of automatic captioning a video by understanding the action and event in the video which can help in the retrieval of the video efficiently through text.

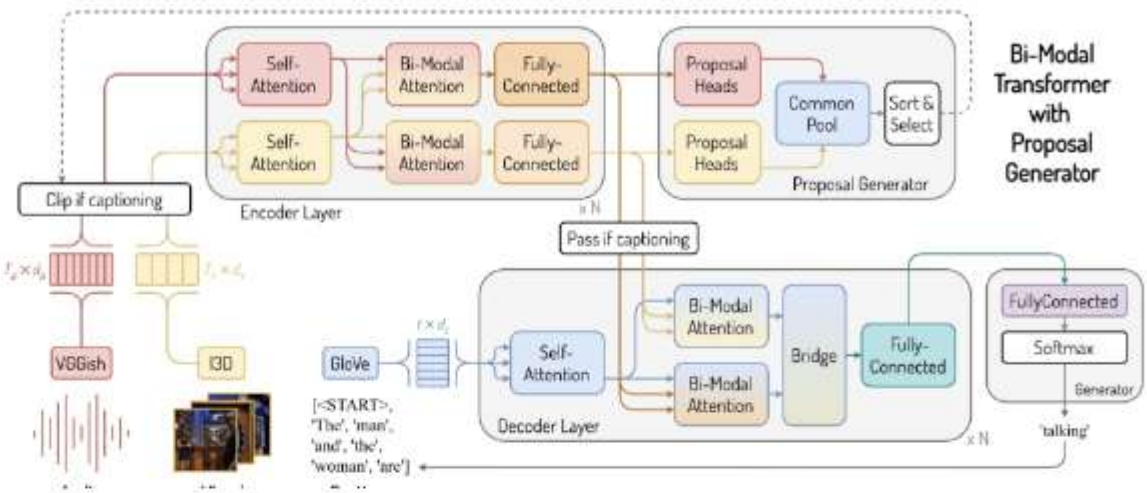
The deep learning task, Video Captioning, has been quite popular in the intersection of Computer Vision and Natural Language Processing for the last few years. In particular, Dense Video Captioning, which is a subfield, has been gaining some traction among researchers. Dense Video Captioning is the task of localizing interesting events from an untrimmed video and producing individual textual description for each event.

MajorWork Done

Following models were used to achieve the dense video captioning

Dense Video Captioning is challenging as it requires a strong contextual representation of the video, as well as being able to detect localized events. Most models tackle this problem by decomposing it into two steps: detecting event proposals from the video and then,generate sentences for each event.

The current state-of-the-art algorithm Bi-modal Transformer with Proposal Generator (BMT) proposes to combine two channels of inputs in order to conduct dense video captioning: visual and audio information. It achieves state-of-the-art performance on ActivityNet Captions Dataset, which consists of thousands of videos paired with captions associated with certain timeframes.



The BMT architecture consists of three main components: Bi-modal Encoder, Bi-modal Decoder, and finally the Proposal Generator.

6. Methodology :

The process for creating captions using each tool is approximately the same:

Upload the video to the web (most services can caption any video as long as it has a public URL, including videos on YouTube). To keep the video private during the captioning process, don't publish it's URL (YouTube offers this as one of its privacy options).
Provide the video's URL to the captioning service. Some services also support uploading a video directly to their site.Use the service's captioning tool to watch the video and transcribe it. Caption text is displayed in real time on the video as you type.
Review and edit the captions to be sure they're accurate and easy to follow. The Described and Captioned Media Program (DCMP) provides a Captioning Key with guidelines for effective captioning.

Download the captions as a caption file in the appropriate format for your needs.
The end product generated by this process is a caption file. Most caption files are plain text files with time codes indicating start and stop times for each caption. However, there are various types of caption files with slight variations in their syntax. The type of file you need depends on how your video is ultimately being provided. See the following section for links to pages that include this information.

Majoroutcomes

This project helps the video content developer to develop captioning of their videos by their own by more effective method as there are variety of tools available with the help of which this could be done easily

PERFORMA FOR PROJECT COMPLETION REPORT

To,

Head of Department

Date: 17/02/2020

Name of Department: CSE/IT DEPARTMENT

Name of College: SUBHARTI INSTITUTE OF TECHNOLOGY AND ENGINEERING

Findings of the project: (Max-100 words):

This project helps the video content developer to develop captioning of their videos by their own by their own by more effective method as there are variety of tool available with the help of which this could be done easily.

External Support:

DHS Foundation

Name of PI: Er. Konika Abid

Name of the Department: CSE/IT

Name of College: SITE

Title of the Project: VIDEO CAPTIONING

Duration of the Project:

Signature of the P.I.

Employee Code of PI:

Registrar
Swami Vivekanand
Subharti University
MEERUT

SUBHARTI INSTITUTE OF TECHNOLOGY & ENGINEERING
SWAMI VIVEKANAND SUBHARTI UNIVERSITY

MICRO-STRUCTURE AND MECHANICAL BEHAVIOR OF THERMAL BARRIER OF COATING PERFORMED ON P91 STEEL

REPORT

Under
Resource Mobilization for Research

Er. Guru Sewak Kesharwani

(Principal Investigator)

Assistant Professor,
Department of ME,
SITE, SVSU

2018-19

Summary Sheet

1. **Name of the Principal Investigator:** Er. Guru Sewak Kesharwani

   Phone No: 9027358394 **Email: guruk0042@gmail.com**

2. **Institution :** Subharti Institute of Technology & Engineering
3. **Project Title** MICRO-STRUCTURE AND MECHANICAL BEHAVIOR OF THERMAL BARRIER OF COATING PERFORMED ON P91 STEEL
4. **Date of Sanction :** 24/11/2019
5. **Abstract :**

Year 1991, revolution emerged in world of welding as solid process Fiction Stir Welding replaced Fusion Technology, for alloys, high strength materials (Aluminium, Magnesium, Steel, Brass, Polymers and dissimilar materials. As green technology, less energy consuming with no flux, no filler materials and smokeless. High strength good fatigue strength, high quality weld joint and good surface finish.

Design of Equipment, tensile properties attained with different process parameter, defects morphologies, hardness, mechanical and designed microstructure properties are discussed. Non consuming rotating welding tools, generated heat , plastic deformation, process parameter, percentage elongation, effect on tensile strength at 1400rpm and 22 mm/rev.

FSW, conventional welding process, a potential to revolutionise the aerospace, automobile, ships and marine, electrical and construction industry as versatile commercial application dramatic production cost reduction.

Numerous advantages and application of welding in aerospace technology, railways industry, pipeline industry, automobile industry, and many other industries add advantages to time saving and fast production.

Process employs forging and stirring of non- consumable rotating tool, with pin indulge into adjacent mating edge, produce frictional heat on solidification transfer to a solid weld.

1. HAZ is near weld centre.
2. Material region séance thermal cycle.
3. Frictional force makes plastic deformation of metal when tool opposes traversing direction as a rotating side, intense plastic deformation by plastic atomic diffusion elevated temperature.

1. Friction Stir Welding results in dynamically recrystallized grain structure in welding

nugget.

6. Major Work Done

The aspects which dominate on FSW Factor Stir Welding are as follows:

a) **Rotational Speed** which create frictional heat, material steering, form oxide layer, material breakdown and mixing for joint.

b) **Welding Speed** consecution appearance and heat control.

c) **Pressure on tools** (downward force) affect in frictional heat, maintaining.

d) **Tilting angles** for stirring material, appearance of weld thinning.

7. Methodology:

Friction Welding Tools Processes:

Tool pin is the part which indulge in to material or work piece and stir midway edges of work piece to weld.
The stir friction welding pin starting at a zero penetration and extending to depth needed to repair a weld or to make a weld.
Then withdrawing the pin at zero penetration as the work is translated.
The weld path is thus ramped into and out of work piece leaving no holes which need to be repaired
Circumferential welds can be made keeping the pin extended to the welding path for at least one complete revolution of weld.

There are three major steps in friction stir welding as,

Plunging – Plunging is operation of localized indulging into the work piece and making a hole in work piece. it is done in two stages as a hole is pierced in the work at required position by tool pin, the pierced hole in work piece is shape of pin of tool.

Bonding – The tool pin stir edges of work piece and plasticize material and these discharge plasticized metal back to mix together in the groove and make a bonding on solidification of the materials. This process is known as bonding.

Drawing out – The tool pin is inserted into work piece is drawn out leaving a hole of pin size. The pin hole is the drawback of friction stir welding.

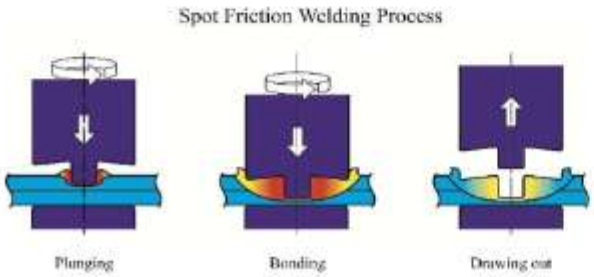


Fig. Spot Friction Welding Process.
Process Parameter Framework-

Tool Design –

- Weld Quality ,
- Securing maximal accessible welding speed,
- Pre-strong, tough and hard wearing,
- High welding temperature.

Tool Rotational Speed-

- Solid state joining process
- Process between tool pin profile and plate.
- Friction generation depends on Rotational speed.
- Rotational speed increase or decrease weld quality will likely to increase or decrease accordingly.

Welding Feed Speed-

- Temperature decreases when an increase in welding speed the temperature at local position.
- When there is slow feed speed the temperature increas-es.

Axial Force-

Material thickness increased enhances axial force.

FSW practice for base metal or work piece metal are-

- Lead, Copper and its alloys, Titanium and its alloys, Magnesium alloys, Zinc, Plastics, Mild steel, Stainless Steel, Nickel Alloys.

Consideration of material specification before selecting tool materials:

- Wear resistance and tool resistivity.
- Coefficient of Thermal Expansion.
- Ambient and elevated temperature Strength
- Elevated temperature stability, easy material availability.
- Fracture toughness, Easy Machine ability.
- Uniform at microstructure and density,

Microstructure Studies:

Super plasticity in friction stir processing parts is limited at ele-vated temperatures due to the evolution of a very coarse-grained microstructure. When downward force is applied on tool, too tip is inserted to metal work piece material, the fractional heat is generated as stirring tools contain pin which probe and shoulder. Work piece and pin contact generate frictional

and deformational heating and plasticizing and moderates the work piece material, contain the deformed material.

Microstructure in friction stir welding is composed of grains and different structure as there are mainly two phases confliction is produced.

- HAZ- Heat Affected Zone
- Thermo Mechanically Affected Zone (TMAZ).

HAZ transfer to TMAZ. The plasticized material flow in HAZ and TMAZ is result of thermal effect and plastic shear stress caused by plastic material flow HAZ. The grains are appreciably elongated along direction of maximum shear stress. HAZ affected by sub-size concave shoulder and rotating tool pin.

Microstructure is HAZ are characterized by fine and equal - size grains, formed accordingly to dynamic recrystallization mechan-ism. As it experience high temperature and intense plastic defor-mation. Intense Stirring effects of rotating tool pin HAZ expe-rience high temperature and plastic deformation, and microstruc-ture in their zone are characterized by fine and equal size grain structure owning to dynamic recrystallization mechanism which is usual phenomenon when affected high temperature intense plastic deformation.

Welding parameters (e.g., tools rotation rotate and welding speed) dictate, for given tool geometry and thermal boundary conditions, the temperature and strain history of material being welded.

Detailing Micro structural Analysis:

Different zones in a weld specimen

- Unaffected material
- Heat affected zone (HAZ)
- Thermo-mechanically affected zone (TMAZ)
- Weld nugget (Part of thermo-mechanically affected zone)

Unaffected Material or Parent Metal:

This is material remote from the weld, which has not been de-formed, it may have experienced a thermal cycle from the weld is not affected by the heat in terms of microstructure or mechanical properties.

Heat Affected Zone (HAZ):

The region of the parent metal which has undergone a metallur-gies change as a research of the thermal cycle is called heat af-fected zone or thermally affected zone.

Thermo-Mechanically Affected Zone (TMAZ):

In this region, the material has been plastically deformed by the friction stir welding tool, and the heat from the process will also have exerted some influence on the material. In the case of alu-minum, it is possible to get significant plastic strain without re-crystallization in this region.

Weld Nugget:

The recrystallized area in the TMAZ in aluminum alloys has tra-ditionally been called the nugget. The microstructure analysis is carried out to determine the flow of the material and change in the microstructure and grain size of the material. The second microstructure photo shows the heat affected zone with the parent material. This photo helps in the comparison of the two. Cracks are found in the heat affected zone. The third picture shows the structure of weld nugget .Formation of small cracks due to improper fusion can be seen. The metal flow is seen clearly. Incomplete metal flow resulting in incomplete convergence and void formation. The fourth photo shows the flow pattern of metal.

Base Metal:

Base metal is the material in original form. Micro structure test of material before welding. In this situation base metal is in its real form without any change in micro structure of material

7. Major outcomes

FSW has achieved worldwide accomplishment and progress has established itself as a viable joining option for automotive industries, aerospace industries, ships and marine industries, space technology.

However more research required in future to analyses and optimize process and applications.

Tool Design another very important input which reduces cost and tool wear rates. Tool geometry and process parameters would provide desired weld quality.

Proper mechanical selection for tool is very important aspect.
Although ability of FSW to weld light weld, high strength, dissimilar material, from high melting temperature to low melting temperature (plasticizing)of material has its own benefits success rate of practice FSW.

Review demonstrate extensive study and research effort that continues to progress and update the understand FSW.
It enhances the microstructure and mechanical properties. It identifies a number of areas that are worth wile for further study.

For engineering and application perspective a numerous of uses practiced in many industries

and has many advantages, and disadvantages and limitation process are being reduced by intensive research and development.
It influence tool design on flow occurrence and development of testing techniques to identify flow in both lap and butt weld would be beneficial.

Metal for molding capture aspect of thermo mechanical behavior for significant challenges.

Tensile strength also provides a better weld joint. The hardness of weld region is higher than that of parent material. This revels that the welding is proper.

A lot of advantages and benefits added to strength in evolution of FSW. Some of benefits are- welding process id economical, low energy consuming, non-consuming tool, no fillet material, environment friendly, no smoke, high welding strength, high tensile strength, high welding quality, dissimilar material welding, clean welding process.

PERFORMA FOR PROJECT COMPLETION REPORT

To,

Date: 11/12/2014

Head of Department

Name of Department: Mechanical Engineering

Name of College: Subharti Institute of Technology & Engineering

Findings of the project: (Max-100 words):

FSW has achieved worldwide accomplishment and progress has established itself as a viable joining option for automobile industry, aerospace industries, ship and marine industry, space technology. We achieved economical welding process, low energy consuming non-consuming tool, no filler material environment, no smoke and clean welding Products.

External Support: Support financially By Adelia Books.

Name of PI: Er. Gurusewak Kesarwani

Name of the Department: M.E.

Name of College: S.I.T.E.

Signature of the PI:

Title of the Project: Micro-Structure and Mechanical Behavior of Thermal Barrier of Coating Depositing on P91 Steel

Employee Code of PI:

Duration of the Project: 01 year

Registrar
Swami Vivekanand
Subharti University
MEERUT

SUBHARTI INSTITUTE OF TECHNOLOGY & ENGINEERING
SWAMI VIVEKANAND SUBHARTI UNIVERSITY

Use of GA to Develop Economic Design of X-Bar Chart

REPORT

Under
Resource Mobilization for Research

Er. Krishna Kumar Sharma
(Principal Investigator)

Assistant Professor,
Department of ME,
SITE, SVSU

2019-20

Summary Sheet

1. **Name of the Principal Investigator:** Er. Krishna Kumar Sharma
   Phone No: 7905121871 **Email: kkkesaath@yahoo.co.in**
2. **Institution :** Subharti Institute of Technology & Engineering
3. **Project Title :** Use of GA to develop economic design of X bar chart
4. **Date of Sanction :** 30/10/2020
5. **Abstract:** One very important factor for any business or manufacturers or service provider to understand is that nothing stays the same as time changes. With time a lot of factors change, quality changes, variation occur, a lot of factor come and go as process continues, and therefore we end up with some variation.

   But for a product if there is a lot of variation, the customer or user will not be satisfied with that. Hence for this purpose we need some sort of control device, which will inform us when there is too much variation, i.e. there will be some kind of feedback mechanism. It will look at the result of the output, compare with the desired result or nominal level of quality and if the deviation is too large it will trigger a control action. This is the basic principle of any type of control. In case of statistical process control what we do is we let this control be activated when the data shows an exceptional behavior, then we apply some sort of corrective measures or decisions to minimize these variations.

   Types of variations:

   There are two types of variation. They are:
   (i) Random variation
   - ✓ They are common cause variation,
   - ✓ they are generally inherent in the process, and
   - ✓ their elimination is only possible by improvement in the system.

   (ii) Non-Random variation
   - ✓ They are special cause variation,
   - ✓ they occur due to recognizable factors, and
   - ✓ they can be modified either by management actions or by operator.

These non-random or special cause variations are the ones which we generally identify by control chart, and are the one which we need to minimize.

Common cause variations are present in large number but cause very small variation. They do not have very large impact on the process.

Control Chart : Control chart is a key tool in Statistical Process Control (SPC). Control chart is a type of statistical tool which is used to check the quality of a product. They make the behavior of the process visible to us. They are used for finding any variation present in any process. Control charts display the variation in a process, so that anyone can easily determine whether the process is within control or it is out of control.

6. Major Work Done

We are going to use genetic algorithm for optimizing X-bar control chart. For this purpose we are going to solve some problems reported in past and check whether genetic algorithm can provide us better result.

7. Methodology :

Development of genetic algorithm involves:

I. First a population is created comprising of random solutions.

II. Then we have to repeat the following steps until termination criteria is met:

(a) Random selection of two individual from population. More fit the individual more is its chance of selection.

(b) Cross-over between the two to get a better one.

(c) New individuals have a random chance to mutate. However this chance is very small, because we do not want the individuals to chance completely.

(d) Replace old solutions with new one.

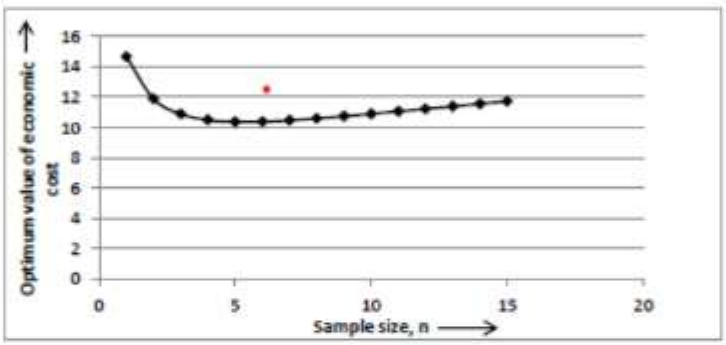
III. Finally the one with the highest fitness value is selected as the solution.

IV. After the develpoment of genetic alogorithm we have taken an example which has been already been solved by Montgomery alorithm, and compared our result with that of theirs.

8. Major outcomes

In our work we have made the economic design of X-bar control chart and using Genetic Algorithm. Following are the conclusion which we arrived based on the result obtained.

- Genetic Algorithm provided superior result than that provided in the literature.
- For Montgomery problem minimum value of cost function was found to be 10.3675, and was obtained for n=5, h=0.815 and k=2.982.
- By increasing the number of generation the cost function reduces, i.e. we are able to find more optimal solution.



Optimum Design of X-bar control chart

Sample size, n	Optimum sampling interval, h	Optimum width of control limit, k	Optimum cost, E(L)
1	0.499	2.296	14.6581
2	0.618	2.512	11.8766
3	0.706	2.679	10.8827
4	0.769	2.834	10.4901
5	**0.815**	**2.982**	**10.3675**
6	0.852	3.125	10.3804
7	0.882	3.263	10.4656
8	0.913	3.399	10.5897
9	0.942	3.531	10.7344
10	0.967	3.656	10.8903
11	0.993	3.788	11.0512
12	1	3.908	11.2147
13	1	4.032	11.3808
14	1	4.152	11.5484
15	1	4.269	11.7168

PERFORMA FOR PROJECT COMPLETION REPORT

To,

Date: 15/12/2020

Head of Department

Name of Department: Mechanical Engineering

Name of College: S.I.T.E. Meerut

Findings of the project: (Max-100 words):

→ Genetic Algorithm provided superior result than that provided.

→ For Montgomery problem minimum value of cost function was found to be 10.5675, and was obtained for $n=5$, $h=0.815$ and $k=2.182$

→ By increasing the number of generation the cost function reduces, i.e. we are able to find more optimal solution.

External Support: Support received from Academic Book.

Name of PI: Er. Krishna Ku. Sharma

Name of the Department: ME

Name of College: S.I.T.E.

Title of the Project: Use of G.A. to Develop Economic Design of x-Bar chart

Duration of the Project: 01 year

Signature of the P.I.

Employee Code of PI:

Registrar
Swami Vivekanand
Subharti University
MEERUT

GRADE 'A' ACCREDITED BY NAAC

A Research Proposal

On

A Study to Compare the Efficacy of Visual Cues and Wobble BoardTraining in Recovery Stage of Stroke Patients in Improving Balance

Submitted to

Swami VivekanandSubharti University, Meerut

Name of P.I: Dr.Shikha Singh, Assistant Professor

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INTRODUCTION

Stroke is also known as cerebrovascular accident (CVA), is the rapid loss of brain function(s) due to disturbance in the blood supply to the brain. This can be due to ischemia (lack of blood flow) caused by blockage (thrombosis, arterial embolism), or a haemorrhage (leakage of blood) [1]. As a result, the affected area of the brain cannot function, which might result in, inability to move one or more limbs on one side of the body, inability to understand or formulate speech, or an inability to see one side of the visual field [2].

The traditional definition of stroke, devised by the World Health Organization in the 1970s, is a "neurological deficit of cerebrovascular cause that persists beyond 24 hours or is interrupted by death within 24 hours" [3].

Each year, >1 million patients experience a stroke in the European community, and ~30% of the survivors experience a severe upper limb paresis without volitional distal activity [4]. Their prognosis for regaining functional hand activity 6 months later is very poor [5].

Stroke is the third leading cause of death in the United States and the leading cause of adult disability [6]. Annually, approximately 750 000 Americans suffer a stroke [7]. Although incidence rates have remained constant over the last 3 decades; mortality has declined, leaving an increasing number of patients requiring rehabilitation [8]. Approximately two thirds of stroke survivors have residual neurological deficits that persistently impair function.

Cerebral infarction (thrombosis or embolism) is the most common form of stroke, accounting for 70% of all strokes. Hemorrhages accounts for another 20%, and 10% remains unspecified.

The three most commonly recognized risk factors for cerebrovascular diseases are hypertension, diabetes mellitus, and heart disease. The most important of these factors is hypertension [9].

Strokes can be classified into two major categories: ischemic and hemorrhagic [10]. Ischemic strokes are those that are caused by interruption of the blood supply, while hemorrhagic strokes are the ones which result from rupture of a blood vessel or an abnormal vascular structure. About 87% of strokes are caused by ischemia and the remainder by hemorrhage. Some hemorrhages develop inside areas of ischemia ("hemorrhagic transformation"). It is unknown how many hemorrhages actually start as ischemic stroke [2].

The focal neurological deficit resulting from a stroke, whether embolic, thrombotic, or hemorrhagic, is a reflection of the size and location of the lesion and the amount of collateral blood flow.

Unilateral neurological deficits results from interruption of the carotid vascular system which includes, middle cerebral artery, anterior cerebral artery, posterior cerebral artery and internal carotid artery.

Among this the most common is middle cerebral artery [9]. Whereas the bilateral neurological deficit result from interruption of the basilar vascular system [11].

The clinical symptom varies according to the involvement of the specific arteries and anatomical structures.

The Major Impairments following Stroke are

1. Somato-sensory,
2. Speech and language,
3. Perceptual dysfunction,
4. Cognitive dysfunction,
5. Affective disorder,
6. Behavioral hemispheric difference,
7. Bladder and bowel dysfunction,
8. Motor deficits.

Balance is frequently disturbed following stroke with impairments, steadiness, symmetry, and dynamic stability. Problems may exist when reacting to a destabilizing external force or during self-initiated movements as the major requirement for good balance are an accurate sense of being balanced, the ability of muscles, particularly of the lower limbs, to produce force rapidly and at the appropriate time,and muscles which are extensible, i.e. not stiff or shortend the system involves need to be adaptive, sincebalance control requires the ability to adopt themovements for changes occurring both internallyand in our external environment.

Thus a stroke patient may be unable to maintain a sitting or standing posture to move into a weight-bearing posture without loss of balance. Disruptions of central sensorimotor processing may lead to inability to adapt postural movements to change in task and environmental demands and impaired motor learning.

Patients with stroke typically demonstrate asymmetry with most of the weight in sitting orstanding shifted to the non-paretic side. They alsodemonstrate increased postural sway in standing.

Balance dysfunction, particularly in standing, is a devastating sequel of stroke since the ability to balance the body mass over the base of support under different task and environmental condition is one of the most critical motor control factors in daily life. Balance involves the regulation of movements of link body segments over supporting joints and base of support.

Training balanced movement may be the most significant part of rehabilitation. When training a patient it's not sitting up or standing up straight that is important, but the taking up of a position which optimizes performance and maximize success, because when we are about to carry out an action we make certain preparations to ensure effective performance. This postural alignment is one which favours the necessary activity and feels comfortable [12].

Muscle weakness or abnormal tone leads to atypical alignment patterns in the trunk, shoulder and pelvic girdle. This loss of alignment creates an atypical starting position for functional movement, interferes with muscle activation pattern, and limits weight transfers between extremities. In standing, because the need for leg stability and movement control is much greater than in sitting, trunk alignment patterns change to accommodate the demands on the leg.

The atypical alignment pattern in one patient may be different in sitting and standing as a result of the pattern of loss of control in the leg [9].

When standing quietly an individual can use visual information from fixed visual environment to reduce atypical alignment. It is thought that by giving additional visual information to the patients, they will become more aware of the body's displacement and orientation in space [13].

Vision also plays a key role in motor learning and is probably the most widely used source of information feed-back in performing motor task.
Vision provides powerful intrinsic feedback, information about environmental conditions and exproprioceptive information for determining theindividual's relative position within theenvironment [12].

Use of a mirror can be an effective adjunct for some patients to improve visual feedback especially during postural and positioning activities [10]. Visual feedback related to weight distribution has also shown to be an efficacious method to gain symmetrical stance following stroke [14].
In the adults, vision also reinforces movement, manual contact may also be used to place a demand on the patient and gives the patient security, manual contact with slight pressure is more helpful as it acts as a sensory cue and helps the patient to understand the direction of the anticipated movement.

This interaction between therapist and patient is a form of social tracking. The therapist responseprovides guidance by which the patient can directhis own movement [15].

Physiotherapists often assess and prescribe intervention to address balance impairments that results from cerebrovascular accident [16,17]. The most common scale used by the clinicians to assess balance impairments is Berg balance scale.

NEED OF THE STUDY

The literature reveals that balance master increases balance aspect in individual with stroke (Ruth Ann Geiger et al). Balance master is an expensive modality and is rarely available in the Indian set up, at present.

By keeping this fact in view the present study has been considered as the alternate method of improving balance in the recovery stage of stroke by using visual mirror.

Operational Definitions

Balance

"Balance refer to an individual to maintain their LOG with in their BOS. It can also be described as the ability to maintain equilibrium ,where equilibrium can be defined as any condition in which all acting force are cancelled by each other resulting in a stable balance system"[18].

Berg Balance Scale[18]
It is widely used clinical test of a person static and dynamic balance abilities.

Berg balance test consist of 14 different function tasks which the patient needs to perform the. Therapist grades the performance of each task with the scores ranging from 0 to 4. "0" is for unable to perform and "4" is for ability to perform without difficulty. The tasks consist of:

- Sitting to Standing
- Standing unsupported for 2 minutes without holding on to an external support
- Sitting unsupported with feet on floor for 2 minutes
- Standing to sitting
- Transfers
- Standing unsupported with eyes closed for 10seconds.
- Standing unsupported with feet together
- Reaching forward with outstretched arm
- Pick up object from the floor
- Turn 360 degrees
- Count number of times the step stool is touched
- with the foot
- Standing unsupported one foot in front
- Standing on one leg.

Visual Feedback

Vision can assist in guiding movement, maintaining balance as well as improving accuracy of discrimination task; visual feedback can be an effective mechanism to compensate partially for Dorsal column medial leminisceal pathology [19].

METHODOLOGY

INCLUSION CRITERIA

1. Recovery stage of stroke.
2. Unilateral hemiparesis as a result of stroke.
3. Maintain independent stance for 1 minute.
4. Ability to follow simple instructions.
5. Patients with no orthopaedic or no other neurological deficits.
6. Brunnstrom recovery stage of lower limb (stage 5)(Annexure 2)

EXCLUSION CRITERIA

1. Bilateral stroke.
2. Visual impairment.
3. Absence of active movements in paretic limb.
4. Medically unstable (uncontrolled hypertension).
5. Uncooperative patients in hospital.
6. Perceptual, Cognitive and Comprehensive impairment.

Participants

After considering, about the inclusion and exclusion criteria, the subjects will be randomly divided into two groups- Group A and Group B. The study will consist of 30 subjects in the age group of 30-60 years. Both males and females are included.

Sampling
Total of 30 subjects assigned 15 each randomly to either Group 1 or Group 2.

Study Design
Experimental study.

Source of Data
KMC Hospital, Baghpat road, Meerut & Saran hospital and institute of paramedical science Bareilly.

Subjects
1. 30 subjects (includes male and female subjects)
2. Age group (30years - 60 years)
3. Randomly assigned to either Group I or Group II.

Data Collection
After completing the inclusion criteria, subjects will randomly assigned to either control group or experimental group.
- A written consent will be taken from the patient.
- The measurements are going to be through Berg balance scale. On 1st day, 15th day and on 30^{th} day as the study is for 30 days or 4 weeks.

Group 1: 15 patients will receive visual feedback therapy for 2 hours/day, 5 days/week for 4 weeks.
Group 2: 15 patients will receive balanced board therapy for 2 hours/day, 5 days/week for 4 weeks.

Duration of study: 1 year

PROCEDURE

Assessment before starting the protocol, consent form will be filled up by the patient. Balance berg scale examination then will beconducted to check the balance of the patient. Brunnstorm recovery stages of the patient will also assessed to see whether the patient is fulfilling the inclusion criteria. Furthermost, the evaluation performa will filled up. They will be evaluated at the day 1 pre-treatment and on 31 day post treatment.

Visual Training

In front of the mirror by placing vertical line (red) on the mirror. The effect of a mirror is enhanced by making the patient wear a white T-Shirt with a vertical stripe (red) down the center and asking him or her to try to match the stripe on the T-shirt to a vertical stripe on the mirror.

The patient can use the mirror and T-shirt approach when performing a variety of tasks, such as reaching for an objects and picking of the objects from the floor, which require that the body may be moved away from the vertical line and then re-establish a vertical position.

Visual training of 2 times/week for 15 min for 4 weeks.

Balance Board Training

The basic exercise is standing on the wobble board with both feet and tilting in any direction without letting the board tilt so far that its edge touches the ground. Some of the many other common exercises are squats; standing on the board with one foot while keeping the other foot off the ground; push-ups (pressing down on the board with the hands while lying face-down with only the knees or toes contacting the ground); and sit-ups (with the board under one's rear end).

With your feet planted squarely on the Wobble Board, begin a slow controlled movement from side-to-side without the front or back touching the floor.
Position your feet shoulder width apart, centrally on the Rocker Board. Begin by slowly moving the Board side-to-side, or front-to-back with a controlled movement. Try adding in other exercises while attempting to maintain control. Some suggestions are squats, lunges, push-ups and ball tossing/bouncing. Incorporate other equipment such as a Body Blade. Advanced users may Attempts these exercises on one foot for greater challenge. Begin with a gentle Range of Motion (R.O.M.) on the Wobble Board until you become familiar with the movement. Exercises such as side-to-side, front-to-back, and circular rotation are all excellent basic exercises to start with. By rotating your stance on the Rocker Board, you can gently increase your ankle's R.O.M. Helps to restore stability.

Keep the heel of your back leg on the floor and lean forward until you feel a stretch. Effectively stretches the calf (gastrocnemius & soleus). Rotate the Wobble Board using a controlled circular motion. Remain balanced on the sphere without the sides touching the floor. Slowly move the Wobble Board front-to-back, feeling the movements you are going through. It is important to always maintain stable upright body position and proper heads-up posture with eyes looking straight ahead when using your Balance Board. Balance Aids can be used by individuals with limited balance and during early rehabilitation for additional safety and support.

Wobble Board Exercises

Basic

Begin with a gentle Range of Motion (R.O.M.) on the Wobble Board until you become familiar with the movement. Exercises such as side-to-side, front-to back, and circular rotation are all excellent basic exercises to start with.

Beginner Wobble Board Exercises

Side to Side

With your feet planted squarely on the Wobble Board, begin a slow controlled movement from side-to- side without the front or back touching the floor.

Front to Back

Slowly move the Wobble Board front-to-back, feeling the movements you are going through.

Rotation

- Rotate the Wobble Board using a controlled circular motion.
- Remain balanced on the sphere without the sides touching the floor.

Calf Stretch

- Keep the heel of your back leg on the floor and lean forward until you feel a stretch.
- Effectively stretches the calf muscles.

Intermediate Wobble Board Exercises

Balanced Push-ups

- Start on your knees and work up to full push-upsas you become more comfortable with the challenge.
- Use caution and be aware that the wrists are in afully flexed position for this activity.
- Ensure that your hands stay on top of the WobbleBoard or your fingers may get pinched!
- Improves core stability.

Abdominal Training

- Sit upright on the Wobble Board keeping your back straight and the Board level to improve stability and coordination.
- For improved mobility, use your hips to tap the Wobble Board side to side and front to back.
- Closing your eyes will increase the difficulty and enhance body awareness.
- Improves core strength, R.O.M. and mobility in the lower back and trunk.

Kneeling Exercises

- Kneel on the Wobble Board with your hands on your hips, or by your side.
- Use your trunk muscles to begin a slow rotational movement.
- After several rotations, stop and rotate the Wobble Board in the opposite direction.
- Increases R.O.M. and stability of the trunk and pelvic areas

Advanced Wobble Board Exercises

Motor Skill Training

- Perform any of the previous exercises while bouncing or throwing a ball or some other dynamic activity.
- Enhances eye-hand coordination and subconscious reaction.
- Your conscious mind focuses on one activity while your subconscious mind is working on ankle R.O.M. and overall stability.

One Leg Exercises

- Perform the basic moves while balancing on one leg.
- Position the arch of your foot directly over the center of the Wobble Board, so that you can comfortably move the Board in any direction.
- These exercises require more strength and stability. You may feel that one leg is much stronger than the other.

Eyes Closed

- This is the most diff cult way to use Wobble and Rocker Boards.
- Always start the exercise with your eyes open. When you and your spotter are ready, close your eyes only until you feel off balance.
- Enhances proprioceptive response and reaction time.
- Only attempt when you have achieved an advanced level of stability and balance.

DATA ANALYSIS

The data will beanalyzed for the inter group conversion of Group I (Control group) and Group II (experimental group) for assessment of balance in patients with Berg balance scale by student "t"-Test (unpaired).

MATERIAL REQUIRED

- Mirror
- Chair with armrest
- Rocker board/Wobble Board
- Measuring tape/Scale
- Stop watch
- T. Shirt with vertical strips
- Stepper

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PERFORMA FOR PROJECT COMPLETION REPORT

To,

Date: 01-11-2019

Head of Department

Name of Department: -

Name of College: Jyotirao Phule Subharti College of Physiotherapy

Findings of the project: (Max-100 words): -

Both the treatment methods Visual cues and Wobble board are effective in the treatment of training balance in the recovery stage of stroke. Group II (Blance board) showed higher scores on Berg Balance scale than Group I (Visual feedback).

External Support:

Supported by Entice Way Trade Link pvt. Ltd.

Name of PI: Dr. Shikha Singh

Name of the Department: -

Name of College: JRPSCPT

Signature of the P.I. Shikha

Employee Code of PI: Tamil

Title of the Project: "A study to compare the efficacy of Visual Cues and Wobble Board traing in Recovery stage of stroke patient in improving balance"

Duration of the Project: -

Registrar
Swami Vivekanand
Subharti University
MEERUT

A study to assess the effectiveness of video assisted teaching program in terms of knowledge and attitude regarding prevention of cardiovascular complications among patient with diabetes mellitus in selected hospital at Meerut

Research Proposal Submitted

By

Mrs. Hepsi Natha

Faculty of Nursing

.1 INTRODUCTION

Diabetes is a disease of the endocrine system where the body is not able to maintain the blood sugar at the required level for good health and well being. Diabetic has become a problem of great magnitude recently. It is estimated that 10-12% of the urban and 4-6% of rural population of India are now diabetic. There is also a corresponding increasing in the diabetic related complication which includes cardiovascular complications, diabetic neuropathy, diabetic retinopathy, and diabetic nephropathy. The Even minor trauma can lead to infection of foot ulcers and amputation is major course of morbidity, disability and cost for people with diabetes mellitus.

Cardiovascular complications are mainly responsible for the high morbidity and mortality in people with diabetes. The awareness for the importance of primary prevention increased lately and numerous strategies have been developed. A major problem of the primary prevention is the choice of the method applied for screening, the criteria used to classify risk patients, as well as the choice of therapy. When primary prevention fails, it is advocated for more aggressive treatment of critically ill patients, followed by optimal secondary prevention meeting on-target goals precisely.

Diabetic complications are of two types, they are short term complication and long term complication. Short term complications are like diabetic ketoacidosis, hyperosmolar non ketotic coma and hypoglycemia. Long term complications are like diabetic nephropathy, diabetic retinopathy, diabetic micro angiopathy, diabetic neuropathy, heart disease stroke and Arteriosclerosis. Prevalence of diabetes mellitus is much higher in Asian countries then European countries. One fourth to one half of patients with diabetes develop cardio vascular complication. An approximately 58.9% to 77.8% of all diabetics will develop evidence of cardio vascular complication. There are different types of cardio vascular complications in diabetics are Atherosclerotic chronic heart disease, diabetic cardiomyopathy, stroke and renal disease.

- Charles et al., 2010

7.2 BACKGROUND OF THE STUDY

All the living beings require wellness in all the aspect to live a happy and good quality of life. Wellness is an active process of becoming aware of and making choices towards a healthy and fulfilling life. Wellness is more than being free from illness but which cannot be acquired in the presence of illness. It is a dynamic process of change and growth.

-The National Wellness Institute(2016)

As wellness and health is an essential for all the individuals to maintain good quality of life. It is the duty of each individual to be aware of their health status and to take an intervention accordingly. Today, one of the major and common health burden in worldwide is diabetes mellitus and its complications, and its prevalence rate is increasing to alarming rate globally. Diabetes is a complex metabolic disease which can give rise to many circulatory and neurological disorders.

Diabetes is considered as mother for all diseases. Too much glucose in the blood for a long time can cause diabetes problems can damage many parts of the body, such as heart, blood vessels, eyes and kidneys. Heart and blood vessels diseases can lead to heart attacks and strokes, which are main killer of mankind.

People with type 1 and type 2 diabetes are at significantly increased risk of developing atherosclerotic cardiovascular disease. Diabetes is associated with microvascular and macrovascular complications, and is a major and independent risk factor for CVD. The lifetime risk for CVD in people with diabetes is high, about 67% in men and 57% in women at age 50 years. In a meta-analysis of 37 prospective cohort studies of fatal coronary heart disease among a total of 447 064 people, the rate of fatal coronary heart disease was about 3.5-fold higher in patients with diabetes than in those without DM. The relative risk for fatal coronary heart disease associated with diabetes is 50% higher in women than it is in men. This greater excess coronary risk may be explained by more adverse cardiovascular risk profiles among women with diabetes, combined with possible disparities in treatment that favour men

-Canadian Journal of Diabetics (2017)

Diabetes mellitus remains a key risk factor for cardiovascular disease and is widely recognized as

	coronary artery disease risk equivalent. It is associated with a 2 to 4 times higher risk of cardiovascular disease as well as increased risk mortality by up to 3 times.Patient with diabetes mellitus continue to remain at a higher risk of all cause and cardiovascular disease mortality than those without diabetes. Diabetes mellitus are more likely to have coronary artery, which is more often multi vessel, and to have episode of silent myocardial ischemia. Traditional coronary heart disease risk factors such as hypertension, dyslipidemia and obesity cluster in patient with diabetes mellitus, but this clustering does not account for all of the increased risk in these patient. Cardiovascular disease is responsible for the biggest proportion of deaths in the world despite disparities related to gender and socio professional categories. Patient with diabetes have an increased risk of cardiac disease and die earlier. Moreover, cardiovascular complications are the leading causes of mortality and morbidity among the patients with diabetes. Chronic hyperglycemia is the cornerstone in the initiation and progression of cardiovascular complications of diabetes. Hyperglycemia has been implicated in long lasting chronic inflammation that drives major cardiac complication such as atherosclerotic coronary heart disease. Additionally. Diabetes could also directly affect the myocardial function and viability, even in the absence of atherosclerotic occlusion disease, hence leading to heart failure and diabetic cardiomyopathy. However, many mechanism that leads to compromised cardiac cell functions remain to be elucidated. Current treatment of common cardiac problem that accelerated by diabetes is not different to that of nondiabetic patients with cardiac pathologies.
7.3	**NEED FOR THE STUDY** It is projected that diabetes mellitus will be the 7th leading cause of death in 2030. The number of people with diabetes has risen from 108 million in 1980 to 422 million in 2014, and predicted to increase by 7.7% which will be affecting 439 million adults by 2030. The complications of diabetes mellitus mainly includes damage to the eyes, kidney, nerves and arteries and cardiovascular disease is the leading cause of morbidity and mortality in the patient with diabetes mellitus. **-WHO(2014)** A study was conducted to estimate the prevalence of diabetes and the number of all age which diabetes for year 2000 and 2030.The prevalence of diabetes for all age group worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030..Diabetes mellitus has emerged as a major health care problem in India. According to diabetes atlas published by (IDF) there were estimated 40 million people with

diabetes in 2007 and this number predicted to rise to almost 70 million people by 2025. The countries with largest number of diabetes will be in India, China and USA by 2030. It is estimated that every 5th person with diabetes will be an Indian. China tops the list of countries for the number of people with diabetes followed by India. **-International Diabetic Federation (2007)**

The prevalence of diabetes mellitus in India ranges from 10.9 to 14.2 percent. In urban 3 percent and in rural 8.3%. Chandigarh 0.12 million, Jharkhand 0.96 million, Maharashtra 9.2 million, Tamil Nadu 4.8 million. **- Indian Council Of Medical Research (2000)**

A survey was conducted across the metropolitan cities of India and reported as 11.7% in Kolkata, 6.1% in Kashmir valley,11.6 % in New Delhi and 9.3% in Mumbai , 13.55 in Chennai, 16.6 % in Hyderabad and 12.4% in Bangalore. **-National Urban Survey (2012)**

Uncontrolled diabetes can cause a huge burden to the individual, family and society. Chronic complications of diabetes mellitus are important implications for planning nursing care irrespective of where the patient is at home or in hospital. The nurse should carefully assess his nursing needs giving special consideration to risk associated with impaired circulation and sensation, increased risk of infection and delayed healing. Recognition of these risk factors will enable care to accommodate the patient's particular vulnerabilities and will help to ensure that suitable educational support is provided to prevent complications.

The management of diabetes mellitus is one of the most important subject in the clinical areas and practice. The complications of diabetes can bring an economic burden into the individual and family as well as into the community due to its expensive treatment and prolong hospitalization. And cardiovascular disease is the most common cause of mortality and morbidity. But, the micro vascular diseases is also contributory factors. With the proper plan action we can overcome or prevent those complications, early detection is one of the best action which can be done and which reflects on early treatment and management of the cardiovascular related diabetes mellitus complications.

Uncontrolled diabetes can cause a huge burden to the individual, family and society.Chronic complications of diabetes mellitus is important implications for planning nursing care irrespective of where the patient is at home or in hospital. The nurse should carefully assess his nursing needs giving special consideration to risk associated with impaired circulation and sensation, increased risk of

	infection and delayed healing. Recognition of these risk factors will enable care to accommodate the patient's particular vulnerabilities and will help to ensure that suitable educational support is provided to prevent complications.
7.4	**STATEMENT OF THE PROBLEM** A study to assess the effectiveness of video assisted teaching program in terms of knowledge and attitude regarding prevention of cardiovascular complications among patients with diabetes mellitus in selected hospital at Meerut.
7.5	**OBJECTIVES OF THE STUDY** 1. To develop and validate effective Video Assisted Teaching program regarding prevention of cardiovascular complications among patients with diabetes mellitus. 2. To assess and evaluate the knowledge and attitude on prevention of cardiovascular complications among patients with diabetes mellitus. 3. To find out the co-relation between post testknowledge and attitude score on prevention of cardiovascular complications among patients with diabetes mellitus 4. To find out the association between the post test knowledge score among patients with Diabetic Mellitus with their selected demographic variables.
7.6	**OPERATIONAL DEFINITIONS** 1. **Assess:** It refers to the evaluation of the level of knowledge and attitude regarding cardiovascular complications of Diabetic Mellitus. 2. **Effectiveness:** It refers to the improved post test score of knowledge and attitude regarding prevention of cardiovascular complications among patients with diabetes mellitus after attending video assisted teaching program. 3. **Video assisted teaching:** It refers to the system of planned instructional design to impart information in order to bring a change in knowledge and attitude regarding the cardiovascular complications among patient with Diabetic Mellitus. 4. **Prevention:** It refers to the action measures adopted by the subject to avoid selected diabetes complications.

	5. **Attitude**: It refers to the predisposition or a tendency to respond positively or negatively towards knowledge and attitude regarding the cardiovascular complication among patient with Diabetic Mellitus. 6. **Knowledge:** It refers to the information gained related to knowledge and attitude regarding the cardiovascular complication among patient with Diabetic Mellitus through video assisted teaching 7. **Complication:** In this study complication refers cardiovascular diseases as a consequence of Diabetes Mellitus 8. **Patient with diabetes mellitus**: It refers to the person with hyperglycemia due to endocrine disorder which leads to deficit in insulin production or insensitive towards the insulin produced by the body.
7.7	**RESEARCH HYPOTHESIS** The following hypothesis will be tested on 0.05 level of significance **H1**=There will be a significant difference between pre test and post test knowledge and attitude score of the patient with Diabetic Mellitus after video assisted teaching program on prevention of cardiovascular complications. **H2**=There will be a significant relationship between knowledge and attitude score on prevention of Cardiovascular Complications among patient with Diabetic Mellitus **H3**= There will be a significant association between the post testknowledge scores on prevention of cardiovascular complicationsamong patient with Diabetic Mellitus with their selected demographic variables.
7.8	**ASSUMPTIONS** 1. Lack of knowledge regarding the prevention of cardiovascular complication among the subject will have an impact on healthy lifestyle. 2. Video assisted teaching program will be beneficial for preventive measures among the sample.
7.9	**DELIMITATIONS OF THE STUDY** 1) The study is limited to diabetic patients from CSSH hospital

	2) The sample for the study is limited to 60 samples
7.10	**CONCEPTUAL FRAMEWORK** King Levin's Goal Attainment Theory will be applied in the study
8.	**REVIEW OF LITERATURE** Literature review was done for the present study and presented under the following headings. **1. Studies related to cardiovascular complication of diabetes mellitus.** **Bhushanam.Y,et,al**conducted a study on prevention of microvascular and macrovascular complications of diabetes mellitus at KC general hospital, Bangalore. The sample size consist of 50 DM patients, 25 in control and 25 in experimental group, a structured knowledge questionnaire was administered to assess knowledge in pretest among experimental and control group on the first day. Structured Teaching Program (STP) was administered on the same day of pretest to Experimental Group. SKQ was administered after 7 days of administration of STP to assess its effectiveness. In the posttest the knowledge of the DM patients of the experimental group was 77.1% in which there is a significant difference of 56.8% which is a net benefit to the patients of experimental group due to the effectiveness of structured teaching program and the post test knowledge of control group was 23.3% in which there is a less difference of 3.2% shows inadequate knowledge in the posttest also. **Backer.G, et.al (2013)** conducted a study to determine the tight control of blood pressure prevent macrovascular and microvascular complication in patient with type 2 diabetes, Reduction is risk in the group assigned to tight control were 24% in diabetes related end point(95%% confidence interval 8% to 38%)(p=0.0046), 32% in deaths related to diabetes(6% to 50%)(p=0.013), and 37% in microvascular end point(11% to 56%). (p=0.0092).predominantly owing to reduction of renal photocoagulation. There was a non reduction in all cause mortality. After nine years of follow up the groupassign to tight blood pressure control had a 34% reduction in the proportion of patient with deterioration of retinopathy by two step(99% confidence interval 11% to 50%)(p=0.004) and 47% reduced risk (7% to 70%)(p0.004) of deterioration in visual acuity by three lines of the early treatment of diabetes retinopathy study. After 9 years of follow up 29% of patient in the group assigned to tight control required three or more treatment to lower the blood pressure to achieved target blood pressure.

2. **Studies related to the knowledge regarding the complications of Diabetic mellitus.**

Obirikorang Yaa (2016) conducted a studyto determine the knowledge of diabetic complications among diabetes mellitus clients visiting the Diabetic Clinical at Sampa Government Hospital, Ghana.This questionnaire-based descriptive study recruited a total 630 patients visiting the Diabetes Clinic at the Sampa Government Hospital. Structured questionnaire was used to obtain information such as socio-demographic and knowledge on complications of diabetes. Out of total 630 participants, 325 (51.5 %) knew diabetic foot as the most common complication followed by hypertension 223(35.4 %), neuropathy 184 (29.2 %), hypoactive sexual arousal 160(25.4 %), arousal disorder 135(21.5 %), eye diseases 112(17.7 %), heart disease 58(9.2 %), and renal disease 34(5.4 %). Comprehensive assessment of level of knowledge on the complications showed that majority 378(60.0 %) of T2D patients did not have knowledge on diabetes complications, 169(26.9 %) had inadequate knowledge on diabetics complication while 82(13.1 %) had adequate knowledge.

3. **Studies related to the effectiveness of patient teaching program knowledge regarding the complications of Diabetic mellitus.**

Kaur Guramrit, et.al, (2015) conducted a study on Knowledge Regarding Prevention of Complications of Diabetes Mellitus. The objective was to evaluate the effectiveness of Individualized Planned Teaching Programme (IPTP) on knowledge regarding prevention of complications of Diabetes Mellitus among Diabetic patients. A quasi experimental study conducted in selected IPDs of Gian Sagar Hospital. Fifty diabetic patients were chosen by purposive sampling technique. Self reported structured knowledge questionnaire was used to assess the knowledge of the diabetic patients. Reliability of the tool was calculated by split half method. Tool was found reliable (r=0.82). The findings revealed that the mean post-test knowledge scores of Experimental group & control group was 31.12 ± 1.590 & 21.32 ± 1.952 respectively with Mean difference of 9.80 & also findings were found statistically significant (p0.05). According to the result of this study, IPTP has a favorable impact on knowledge regarding prevention of complications of Diabetes Mellitus among Diabetic patients.

Khunti.K (2012) conducted a study to evaluate the effectiveness of types of patient teaching program that is agent initiated and instruction teaching method for diabetes self care ability among non insulin dependent diabetic patient. Three small groups of 50 patients each have assigned 2 experimental

group and one control group. The experiment groups were exposed to either agent initiate teaching or auto-instructional learning agent. The control group was given only regular incidental health teaching. Findings revealed significantly higher knowledge and skill gain and reduction in stress level in the two experimental groups.

9. MATERIALS AND METHODS OF STUDY

9.1 RESEARCH APPROACH / RESEARCH DESIGN

- Quantitative research approach will be used .
- Pre Experimental one group pre testpost test research design will be used in the study

GROUP	PRE TEST	INTERVENTION	POST TEST
Group	01	X	02

01 - Pre-test knowledge and attitude regarding prevention of cardiovascular complications

X - Video Assisted teaching regarding prevention of cardiovascular complications

02 - Post-test knowledge and attitude regarding prevention of cardiovascular complications

9.2 VARIABLES

- **Dependent Variable:** Knowledge and attitude regarding the cardiovascular complications among patient with Diabetic Mellitus.
- **Independent Variable:** Video assisted teaching onknowledge and attitude regarding the cardiovascular complication among patient with Diabetic Mellitus

9.3 STUDY SETTING-

- The study will be conducted in CSSH, Meerut.

9.4 TARGET POPULATION / SAMPLE:

- The study sample will be patient with diabetes mellitus

9.5	**SAMPLING TECHNIQUE** ➢ Non Probability Purposive sampling technique will be used for selecting the sample.
9.6	**SAMPLE SIZE** ➢ 60 samples will be selected for accomplishing the study
9.7	**CRITERIA FOR SAMPLE SELECTION** **INCLUSION CRITERIA** • Diabetic patients who are willing to participate in the study. • Diabetic patient who knew to read and write in Hindi/English. **EXCLUSION CRITERIA** • Diabetes patient with cardiovascular complications. • Diabetic patients who are critically ill.
9.8	**TOOLS FOR DATA COLLECTION** Instrument consist of three parts **Part I** It consists of demographic variables such as Age, Gender, Duration of illness, Educational Status, Residence, Previous Knowledge regarding complications of DM. **Part II** Structured Knowledge Questionnaire will be used to assess the knowledge regarding Cardiovascular Complications among patients with Diabetic Mellitus. **Part III** Structured checklist will be used to assess the attitude regarding Cardiovascular Complications among patients with diabetic Mellitus. **VALIDITY AND RELIABILITY**

	➢ The validity of the tool will be established a Physician and 5 nursing experts ➢ Reliability of the tool will be established by Split –half method.
9.9	**PILOT STUDY** Pilot study will be done to find out the feasibility of conducting the study. It will be conducted in selected hospital at Meerut with 10% of total sample.
9.10	**PLAN FOR DATA ANALYSIS** **Descriptive statistics:**Frequency, percentage, Mean, Standard deviation will be used ➢ To assess the frequency of demographic variables. ➢ To assess the pre and post-test knowledge and attitude regarding Cardiovascular Complications among patients with diabetic Mellitus. **Inferential Statistics:** ➢ Paired 't' test will be used to find the correlation between knowledge and attitude score on prevention of Cardiovascular Complications among patient with Diabetic Mellitus ➢ Chi Square Test will be used to find the association between the post-test knowledge score with their selected demographic variables.
9.11	**TIME AND DURATION OF THE STUDY** The time and duration of the study will be one and half months.
9.12	**DOSE THE STUDY REQUIRESANY INTERVENTION OR INVESTIGATIONS TO BE CONDUCTED ON PATIENT OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE.** Video Assisted Teaching will be given to samples regarding the prevention of Cardiovascular Complications.
9.13	**ETHICAL CLEARANCE. (IF ANY)**

	The main study will be conducted after the approval of research committee; permission will be obtained from the concerned head of the institution. The purpose and details of the study will be explained to the study subjects and informed consent will be obtained from them, assurance will be given to the subjects on the confidentiality of the data collected from them.
	REFERENCES: 1. Marshall Sally M, Flybjergallan , Complication Of Diabetes, Prevention And Early Detection Of Vascular Complication. British Medical Journal, 2006,333,475-480. 2. Bhushanamyc..Prevention Of Microvascular And Macrovascular Complication In Diabetes Mellitus, American Journal Of Phytomedicine And Clinical Therapeutics(1)[5]920130 445-469, 3. Mamta, International Journal Of Recent Scientific Research(2016 Dec) Vol.7,,14621 -14621. 4. Rastogi Ashu, Diabetic Foot Infection: The Journal Of Foot Ankle Surgery(Asia Specific) July December 2016,3(2):71-79 5.Bunner And Siddarth, Medical Surgical Nursing Textbook,9th edition, Lippincott,1011-1023. 6. Gutch Manish, Diabetes Mellitus : Trends In Northern India, Indian Journal Of Endocrineology And Metabolism, 2014 Sept-Oct, 18(5): 731- 734. 7. Cornwall Jon, The Current State Of Diabetes Melllitus In India, Australasian Medical Journal,2014:Vol 7(1):45 -48. 8. Nanditha, Diabetes In Asia And The Pacific: Implication For The Global Epidemic, American Diabetes Association. Diabetes Care,2016 Mar:39(3): 472 -485.

PERFORMA FOR PROJECT COMPLETION REPORT

To.

Date: 30.08.2019

Head of Department

Name of department: Medical Surgical Nursing

Name of College:PannaDhaiMaaSubharti Nursing

Findings of the project: (Max -100 words):

The study showed that the mean post test knowledge score of diabetic patients in the experimental group (16.60) and mean post test knowledge score of the control group is (12.20). The unpaired 't' value is 4.9193 for the df (48) was found to be a statistically significant at 0.05 level of significance. Thus it was inferred from the findings that the video assisted teaching program was effective in increasing the knowledge regarding prevention of cardiovascular complication.

External Support: Received Support from Entieway Pvt. Ltd.

Name of PI: Ms. HepsiNatha

Name of the Department: Medical Surgical Nursing

Name of College: PannaDhaiMaaSubharti Nursing College

Title of the Project: Effectiveness of Video Assissted teaching programme in terms of knowledge and attitude regarding prevention of cardiovascular complication among patient with diabetes mellitus.

Hepsi. (Hepsi Natha)

Signature of the P.I.

Duration of the Project: 54 weeks

Employee Code of PI:

Registrar
Swami Vivekanand
Subharti University
MEERUT

A

RESEARCH PROJECT

ENTITLED

"Implementation of Wireless Patient Body Monitoring System using RTOS"

By

Mr. Sanjeev Panwar
ASSISTANT PROFESSOR
COMPUTER APPLICATION

KERAL VERMA SUBHARTI COLLEGE OF SCIENCE

SWAMI VIVEKANAND SUBHARTI UNIVERSITY, MEERUT

Introduction:

In the past decades, the requirement in the health care field is rising rapidly, and therefore we need well-equipped efficient monitoring systems for health care centers. In general, most of the hospitals, manual inspection is done in order to collect the records of patient's condition. Continuous and frequent monitoring of patients is required based on their health state. This leads to disadvantages like long measurement time, low monitor precision, and deployment of more manpower, this paper provides a fully automated and wireless monitoring system.

In this paper, a wireless network is created for remotely monitoring of patient's health parameters like Temperature, ECG, Heartbeat, Coma recovery and saline level indication. All these parameters are continuously measured using appropriate efficient low cost modules, which are designed for each parameter. The measured data from the patients are transferred to a central monitoring station via a Zig-bee. In this a PC acts as a central monitoring station which runs LabVIEW for monitoring theparameters.

In present scenario, patient health parameters are adopting rapidly. For implementing automated measurements each patient is given a dedicated system and does not works on centralized mode of operation. If a patient is admitted in ICU a regress monitoring of health parameters is done but consider if a patient is admitted in a normal ward there advance measurement systems doesn't exist. In such cases nurse goes to ward and measures patient's body parameters for every certain interval of time, During this manual measurement there is chance of missing the accuracy during to inefficient nurses, the measurement records which taken by nurses are can be analyzed by doctors as reference of disease diagnosis. If the measurement goes wrong the diagnosis fails or

misleads. This term of conventional not only wastes nurses' massive manpower, but also aggregation, query analysis to measurement result is miscellaneous, as well as cannot feedback in time when patient appears special condition, which can cause delay of treatment time. Through analysis we can see, this kind of style has bigger limitation, especially, to those patients with infectious diseases, monitoring personnel is inconvenience tocontact.

So, aiming to this problem, by sensor technology, single chip microprocessor technology, etc., we design a wireless remote monitoring system. This system uses wireless communication (Zig-bee) technology, which eliminates the manual measurements. Monitoringof each patient sub-system in real time, as well as communicating with central monitoring station, we can increase work efficiency, and data reliability,etc.

SYSTEM ANALYSIS

EXISTING SYSTEMS

In this Project we have mentioned the existing and proposed system as follows

In-Home Wireless Monitoring Of Physiological Data for Heart FailurePatients

This system proposes an integrated system (hardware and software) for real-time, wireless, remote acquisition of cardiac and other physiologic information from HF patients while in the home environment. Transducers for measurement of electrocardiogram (ECG), heart rate variability (HRV), acoustical data are embedded into patient clothing for unobtrusive monitoring for early, sensitive detection of changes in physiologic status. Sampling rate for this system is 1 kHz per channel. Signal conditioning is performedinhardware by the patient wearable system, after which information is wirelessly transmitted to a central server located elsewhere in the home for signal processing, data storage, and data trending. The dynamic frequency ranges for the ECG and heart sounds (HS) are 0.05-160 Hz and 35-1350 Hz, respectively. The range-of-operation for the current patient-wearable physiologic data capture design is 100±10 feet with direct line-of-sight to the home server station. Weight measurements are obtained directly by the in-home medical server using a digital scale. Physiologic information (ECG, HRV, HS, and weight) are dynamically analyzed using a combination of the LabVIEW (National Instruments, Inc.; Austin, TX) and MATLAB (MathWorks, Inc.;Inc

Natick, MA) software strategies. Software-based algorithms detect out-of-normal or alarm conditions for HR and weight as defined by the health care provider, information critical for HF patients. Health care professionals can remotely access vital data for improved management of heart failure.

A wireless surface electromyographysystem

Surface electromyography (SEMG) systems are utilized throughout the medical industry to study abnormal electrical activity of the human muscle. Historically, SEMG systems employ surface (skin) mounted sensors that transmit electrical muscle data to a computer base via an umbilical cord. A typical SEMG analysis may exercise multiple sensors, each representing a unique data channel, positioned about the patient's body. Data transmission cables are linked between the surface mounted sensor nodes and a backpack worn by the patient. As the number of sensors increases, the patient's freedom of mobility decreases due to the lengthy data cables linked between the surface sensors and the backpack. An N-channel wireless SEMG system has been developed based on the ZigBee wireless standard. The system includes N-channels, each consisting of a wireless ZigBee transmitting modem, an 8-bit microcontroller, a low-pass filter and a pre-amplifier. All channels stream data to a central computer via a wireless receiving modem attached directly to the computer. The data is displayed to the user through graphical development software called LabView. The wireless surface electromyography (WSEMG) system successfully transmits reliable electrical muscle data from the patient to a central computer. The wireless EMG system offers an attractive alternative to traditional wired surface

electromyography systems as patient mobility is lesscompromised

Automatic Mental Health Assistant: Monitoring and Measuring Nonverbal Behavior of the Crew during Long-Term Missions

This system presents a method for monitoring the mental state of small isolated crews during long-term missions (such as space mission, polar expeditions, submarine crews, meteorological stations, and etc.) The research is done as a part of Automatic Mental Health Assistant (AMHA) project which aims to develop set of techniques for automatic measuring of intra- and inter- personal states in working groups. The method is focused on those aspects of psychological and sociological states that are crucial for the performanceof the crew. In particular, we focus on measuring of emotional stress, initial signs of conflicts, trust, and ability to collaborate. The developed method is also currently tested by usage of a web-basedplatform.

DRAWBACKS

1. The above mentioned three systems were having some drawbacks as follows Any one of the parameter is taken and measured.
2. Long Measurement
3. Difficulty in monitoring patient
4. connection of many instruments are tedious process

PROPOSED SYSTEM

This Project uses a wireless medium for communication between sub-system and main monitoring station. In this system six parameters are measured.

1. Body
2. Temperatur
3. Saline Level
4. Indication
5. Comma
6. level

These parameters will be measured for a specific interval of time continuously and these data will be collected by the monitoring sub- system. Now the data will be sent from sub-system to the main monitoring station via Zig-bee network. The data will be fetched by the software (LABVIEW) and the data will be processed by software. If the parameter goes beyond the predefined values at once it sends an SMS to the concerned doctor that the patient is in seriousstage.

The block is as follows

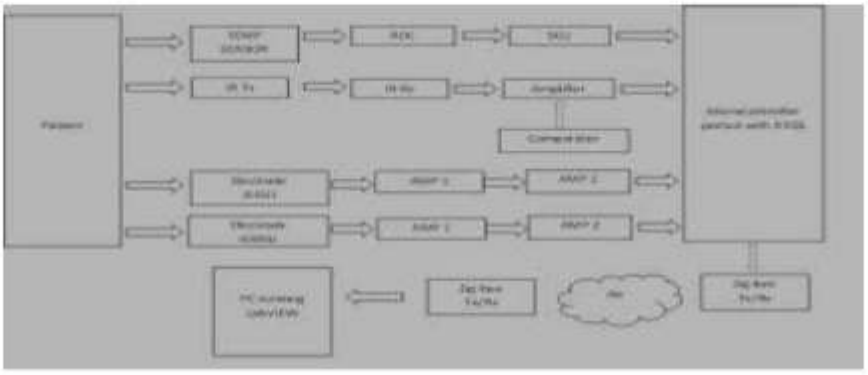


Fig 2.1 System Block Diagram

ADVANTAGES

Eliminates the manual system measurements and monitoring processes Temperature measurement has high accuracy as LM35 is used.

The patient status is sent effectively to the doctor via SMS.

Very instantly the status of the patient is monitored with high accuracy.

All the parameters are embedded in to single system which easy to handle by a normal person.

FEASIBILITY STUDY

In our analysis the methodology we use is more feasible than the existing methods of measuring the patient body parameters.

ECONOMICALFEASIBILITY

The existing methods are not so cheaper because it has many disadvantages like all systems are being designed for measuring a specific parameter only. The systems which are existing today are also so costly. And these systems must be stored in a certain temperature for a perfect working. So, for the maintaining of these system air conditioners will be used this consumes much electricity and we have to pay for electricity board a lot.

OPERATIONALFEASIBILITY

When compared with the existing methods the proposed system is not as complex as the existing methods because no manual operations are carried out. All the equipment will be controlled from a pc by software. No manual attention is needed until the emergency alarm rings. And an alert SMS is sent to the concerned doctor. For that we have to simply feed the mobile number of doctor. And if anything badly occurs it will inform through a message todoctor.

TECHNICALFEASIBILITY

The existing methods must have a trained person to operate that system any one cannot operate the easily. If problem comes to user end it is not easy to solve. In our system it is very easy to operate and ordinary person who know to operate a pc can operate the software very easily for monitoringpurpose.

SOFTWAREDESCRIPTION

We are using two software in our project they are explained below as follows

NILabVIEW

LabVIEW (Laboratory Virtual Instrumentation Engineering Workbench) is a platform and a development environment for a visual programming language from National Instruments. The purpose of such programming is to automate the usage of decicision making and measuring equipment in a laboratory setup. The graphical language named "G" was originally released for the Apple Mac systems, LabVIEW is commonly used for data acquisition, complex processing, instrument control, industrial automation etc.. ona various platforms including Microsoft Windows, UNIX, Linux, and Mac OS X. The recent versions of LabVIEW provides more features and interfacemodules.

Descriptions

PROBLEMDEFINITION

- Long measurement time
- Low monitorprecision
- Difficulty in automatic monitoringpatient
- connection of many instruments are tediousprocess
- difficulty in monitoring patient body temperature bythermometer
- Heart beat is measuredmanually
- Como patients should be monitored closely inperson
- No indication for salinelevel

Overview of theProject:

Now-a-days every instrument is automated. In medical field also the automation is developing very rapidly. Large hospital and medical research centre are adopting towards automation. But the cost implementing automated systems is very huge. For each patient an individual monitoring system shouldkept.

This drastically increases the implementing cost and also the system occupied space. To overcome this problem this projecthas been framed with methodologies which can be used for this monitoring system.

This paper presents a wireless patient body monitoring system in which Zig-bee is used for wireless communication. The sub-systems are integrated with main monitoring server with a mesh network formed using Zig-bee communication. 4.3 MSP430F5438

MSP430F4538 microcontroller comes under MSP430 family of ultralow-power microcontrollers which is a product of Texas Instruments. This device consists of several different sets of peripherals targeted for various applications. The architecture supports five modes. These are optimized to extended battery life in portable high precision monitoring and control applications. This microcontroller has a powerful 16-bit RISC CPU and constant generators that can produce maximum code efficiency.

The digitally controlled oscillator (DCO) allows the microcontroller wake-up from low-power modes to active high performance mode in milli-seconds. The MSP430F5438 microcontrollers are integrated with a high performance analog-to-digital (A/D) converter, universal serial communication interfaces (USCI), three 16-bit timers, real-time clock module with alarm capabilities, hardware multiplier, DMA and up to 87 I/O pins.

Applications includes analog and digital sensor systems,digital timers, digital motor control, thermostats, hand-held meters, remote controls, etc.

GSM MODEM (900/1800MHZ)

GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique mobile number. The advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications includes SMS Control, data transfer, remote control and logging can be developed easily.

This modem can either be connected to PC serial port directly or to any microcontroller through RS232. It can be used for sending and receiving SMS and calls. It can be used in GPRS mode to interface with internet and perform applications for data logging, decision making and control. In GPRS mode you can also connect to any remote FTP server and upload files for datalogging.

This modem is a plug and play highly flexible quad band SIM900A GSM modem for direct and easy integration to RS232 applications.

Applications

- SMS based Remote Control &Alerts
- SecurityApplications
- SensorMonitoring
- GPRS Mode Remote DataLogging

Features

- Status of Modem Indicated byLED
- Simple to Use &LowCost
- On board switching type power supplyregulator
- RS232output

MicroC/OS II (µCOSII)

µC/OS-II is a completely real-time, portable, preemptive, ROMable, scalable, multitasking kernel. µC/OS-II is written in ANSI C and contains a small portion of assembly language code to adapt it to different processor architectures. To date, µC/OS-II has been ported to different processor architectures.

µC/OS-II is based on µC/OS, The Real-Time Kernel that was first created. Millions of people around the world are using µC/OS and µC/OS-II in all kinds of applications, such as cameras, highway telephone call boxes, avionics, high-end audio equipment, medical instruments, musical instruments, network adapters, ATM machines, industrial robots, engine controls, and more. Numerous colleges and universities have also used µC/OS and µC/OS-II to teach students about real-time systems.

µC/OS-II is upward compatible with µC/OS v1.11 (the last released version of µC/OS) but provides many improvements. If you currently having an application that runs with µC/OS, it should run virtually on µC/OS-II. All of the services (i.e., function calls) provided by µC/OS have been saved for back . You may, however, have to change include files and product build files to point to the new filenames.

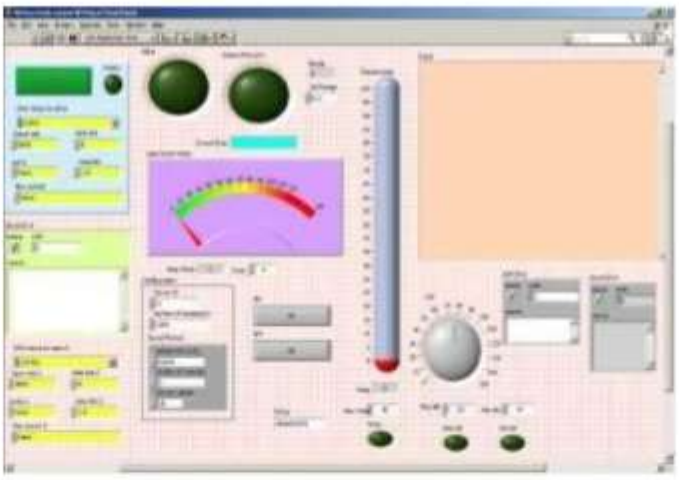
Features

- Portable
- ROMable
- Scalable
- Preemptive
- Multitasking
- Deterministic Executiontimes
- TaskStacks
- InterruptManagement
- Robust andReliable

PATIENT SIDECIRCUIT

PC SIDECIRCUIT

PC LABVIEWSNAP



CONCLUSION

The patient body monitoring system implemented with RTOS gives promising results than the other conventional methods. It works effectively in term of automated systems compared to the existing method. However, it has room for improvement in this project. In the future, the system will be intergratedwith WWW (World Wide Web). so, that patient data can be accessed over internet from any part of the world. As a result, medical prescriptions and precautions can be made easier. In a nutshell, this project is highly potential for application purposes in ICUmonitoring.

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PERFORMA FOR PROJECT COMPLETION REPORT

To,

Date: 25/11/2019

Head of Department

Name of Department: Computer Application

Name of College: KvScoS

Findings of the project: (Max-100 words): This Project body monitoring System implemented with RTOS give Promising result then the other Coventional methods. It work effectively in term of automated System compared to the existing method. However it has room for improvment in this Project.

External Support: Support financially Address Books.

Name of PI: Sanjeev Panwar

Name of the Department: Computer Application

Name of College: KvScoS

Title of the Project: Implementation of wireless Patient body monitoring System using RTOS.

Duration of the Project: 6 Month

Signature of the P.I.

Employee Code of PI:

Registrar
Swami Vivekanand
Subharti University
MEERUT

A

RESEARCH PROJECT

ENTITLED

"WIRELESS ELECTRONIC DISPLAY BOARD USING GSM TECHNOLOGY"

by

Mr. Himanshu Sirohi
ASSISTANT PROFESSOR
COMPUTER APPLICATION

KERAL VERMA SUBHARTI COLLEGE OF SCIENCE

SWAMI VIVEKANAND SUBHARTI UNIVERSITY, MEERUT

INTRODUCTION

This project deals with an innovative rather an interesting manner of intimating the message to the people using a wireless electronic display board which is synchronized using the GSM technology. This will help us in passing any message almost immediatelywithout anydelayjust bysendinga SMSwhichisbetter andmorereliablethantheoldtraditionalwayof pasting the message on notice board. This proposed technology can be used in many public places, malls or big buildings to enhancethesecuritysystemandalsomakeawarenessoftheemergencysituationsandavoidmanydangers.UsingvariousAT commandsisusedtodisplaythemessageontothedisplayboard.GSMtechnologyisusedtocontrolthe displayboardandfor conveying the information through a message sent from authenticateduser.

In this modern world Mobile Phones and the related technologies are becoming more and more prevalent. Various technical arenas in the field of Telecommunication and Embedded Systems are becoming omnipresent in the people. The use of cell phones has rapidly increased over the last decade and a half. Upgradation in networking technologies has encouragedthedevelopmentandgrowthofverydense networks. Now-a-days the general mass prefer communicating while on the move therefore landlines usage has been drastically reduced [1,2]. Notice boards are one of the widely used ones ranging from primary schools to major organizations to convey messages at large. A lot of paper is been used and which is later wasted by the organizations. This in turn leads to a lot of deforestation thus leading to global warming. Small innovative steps in makinguse of technology for regular purposes would have an adverse effect on the environment issues which we are presently concerned about. The main aim of this paper is to design a SMS driven automatic display Board which can replace the currently used programmable electronic display and conventional notice boards. It is proposed to design receive cum display toolkit which can be programmed and later be used from an authorized mobile phone. The whole process can be described from the block diagram in Figure 1. The GSM modem receives a message from the authorized mobile phone and the message is extracted by the microcontroller from the GSM modem and is displayed on the LED display board. Serial communication is used for the entire process from GSM module to Microcontroller and from microcontroller to the LED display. The three devices are powered by the same power supply [1-9]. This proposed system in this paper has manyupcoming

applications in educational institutions and organizations, crime prevention, traffic management, railways, advertisements etc. Been user friendly, long range and faster means of conveying information are major bolsters for this application. By using this proposed methodology we can enhance the security system and also make awareness of the emergency situations and avoid many dangers.

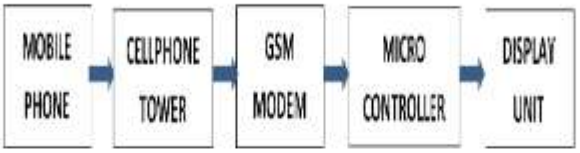

Figure 1: Block Diagram

LITERATURE REVIEW

With the development of cellular networks in the 1970's for increasing the lack of frequencies in the radiotelephone services which in turn lead to introduction of AMPS (Advanced Mobile Phone System) where the transmission was analog based. This was known to be the first generation in cellular networks. The second generation was based on digital transmission and was called with various abbreviations as GSM (Global System for Mobile communications), ERMES (European Radio Messaging System). Various Cordless telephone standards were also introduced during this time only. The third generation has risen with the unification of different technologies; some of them which are popularly known are FPLMTS (Future Public Land Mobile Telecommunications System), UMTS (Universal Mobile Telecommunication System), and IMT-2000(International Mobile telecommunication).

OVERVIEW

To realize the proposed wireless GSM Based Display unitthefollowingprototypemodelhasbeendeveloped in the laboratory. It consists of Micro controller, GSM Modem, One cellphone and LED display board. LED display board is used for testing the proposed methodology. The interfacing of a GSM modem with a normal PC is quite easy with help of the AT commandssenttoitfromtheHyperTerminalwindow. But we must take into fact that the modem requires a wired connection at one end and wireless at the other. As it is too expensive to use a dedicated general purpose computer at each and every site of the display boards,thepossibilityofperformingtheobjectivewith adedicatedcomputerisnotfeasiblepracticallyoncost factors. Hence we employ Atmel ATmega32 microcontroller with 1024 bytes EEROM storage memory. The complexity of coding

considerably intensifies as compared with PC, but once programmed the micro controller works at its best since it is a committed embedded system. The design procedure involves identifying the different components and assembling all of them and ensuring safe interfacing between all these components. Then coding process has to be done, which has to take care of the deferrals between two successive communications and most importantly the authentication of the sender's number. The number of authenticated mobile numbers can be more than one. This enables the multiple users can operate the digital display. The main limiting constraint is the RAM of themicrocontroller.

PROPOSED METHOD

A. Features and description of various hardware and software components

The AT89S52 is a low-power, high-performance CMOS 8-bit microcomputer with 4k bytes of flash programmable and erasable read only memory (EPROM).By combining a versatile 8-bit CPU with flash on a monolithic chip, the Atmel AT89S52 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications and pin out. In addition,theAT89S52isdesignedwithstaticlogicfor operation down to zero frequency and supports two software selectable power saving modes. The idle mode stops the CPU while allowing the ram, timer/counters, serial port and interrupt system to continue functioning. The power-down mode saves theramcontentsbutfreezestheoscillatordisablingall other chip functions[1-9].

We also are using SIM300 GSM module with following features

- TTL UART interface for connection to microcontroller
- RS232 interface for connection toPC/Laptop
- 12V power supplyoption
- 5V power supplyoption
- LED indicating networkstatus

In this project we have interfaced microcontroller with GSM Modem to decode the received message and do the required action. The protocol used for the communication between the two is AT command. RS-232 standards are used for the serial communication of binary bits. Various AT commands of call control, data card control, phone control, computer data interface, service, network communication parameter, SMS text mode and SMS PDU mode are used for the communication purpose from microcontroller to the GSM module.Raisonance 8051 Integrated Development Environment (RIDE) is the software used from editing to compiling, linking and debugging along with a simulator which conveniently

manages all aspects of the embedded systems development with a single user interface.

Operation

The unit can be operated with PS2 keyboard or serial port.

Operation with PS2keyboard:

Initially the PS2 keyboard is connected to the display unit and power is supplied to the display unit. Then five different options of creating a new message (F1), viewing a message (F3), formatting (F4), setting time anddate(F6)andexit(ESC)optionswillbedisplayed. (Corresponding keys are pressed to choose various options). On choosing F1 we are choosing to create a new message. The message looks in the following format: <M message><DEF 1><S 5><DL2>

The characters enclosed in brackets <> are parametric commands which control the display styles of the message. The parametric commands should be typed in capital letters only. These commands can be inserted only in specified areas only (some on beginning rest ending that also in specified order). The parametric commands are visible only when message is viewed or at the time of creating message. During the execution of messages these characters are notdisplayed

Parametric Command set:

<M> command for creating message.

<DEF 1>message number (1to99)

<S 5> command for defining speed.(1 to 9). 1 is slow, 9 is fast

<D L2/R2/U2/D2> Display beginsfrommentioned side that isfrom left/right/up or down and moves in opposite direction. Last digit defines number of times to display. (1 to99)

Illustration:

<M Hello world><DEF 1><S 4><D R2> enter.

In the above format <M defines that this is message, Hello world is the message<DEF 1> defines the messagenumber,<S4>definesthespeedis4,<DR2> defines the message should scroll from left to right 2 times. After pressing enter the message is saved in the memory.

F3 View is selected when there is a requirement to view the message saved in the memory. The message is displayed by choosing the number of message from 1 to 99 which is stored in the memory .Similarly, on choosing F4 it is designed so that all the messages in thememoryislostasitisusedforformatting.Thereis also an option to set the time and date according to its time zone which is accessed by choosing F6 access button.

Operation with serial port:

The unit is connected to the display and hyper terminal settings are configured. Shift# is typed to enter the menu mode where you will be asked to choose to view message (type 1), format (type 2), set time (type 3) and exit (type 4).

On choosing 1 the message is displayed on the board. The message has the following format:

<M message><DEF 1><S 5><D L2>

on choosing 2 the memory is formatted and 3 can be used to set the time and date accordingly.

Sending messages through serial port:

Connect the unit to serial port and configure hyper terminal to default settings and Press Shift * to feed the new messages. Then the display unit will print

********.

Illustration:

<M Hello world><DEF 1><S 4><D R2>

In the above format <M defines that this is message, Hello world is the message<DEF 1> defines the message number, <S 4> defines the speed is 4, <D R2> defines the message should scroll from left to right 2 times. After pressing enter the message saved in the memory.

The microcontroller, GSM module and display board are powered by AC to DC adapter with input 100-240V AC, 50/60Hz and Output 12V DC, 1A.

DESCRIPTION OF THE PROPOSED METHOD

Figure 2 shows the GSM module used in our paper; it consists of a SIM card of MIN "8686400268". The message transmitted by any number to this MIN is received and saved in the memory of the SIM card. This module works with the AT-Commands set as mentioned in earlier sections. The RxD and TxD pins of this GSM module are connected to the TxD and RxD of the microcontroller respectively so that the information (here message) is transmitted through aserial port[1-9]. The RxD and TxD pins of the microcontroller board are the 2nd and 3rd pins of the DB9 port given in the board (which are connected to the P3.0 and P3.1 ports of microcontroller). The message received by GSM module is retrieved by the microcontroller by using suitable AT-command. The display board is also connected to this board through serial port pins (P3.0 and P3.1). The message is transferred to the display board when the AT command "AT+CMGR" is executed.

Figure 2: GSMModule

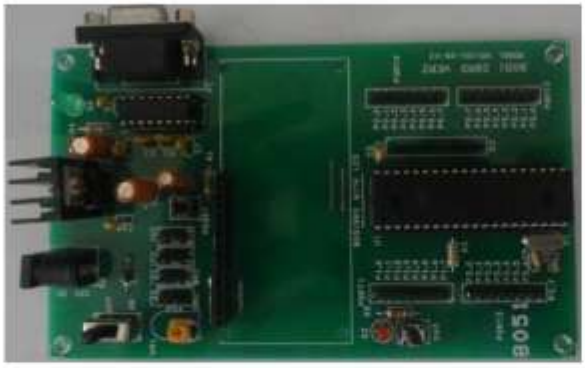

Figure 3: 8051 development board VER 2

Till the command AT+CMGR is executed the board displays the default message saved in it. When the AT+CMGR=1 command is executed, then the message is transferred to the Display board through serial communication and "=1" designates the message, storage location 1 in the board and then the message is displayed. Figure 4 shows the total hardware of the paper including the GSM module, 8051 development board, and the relay circuit (optional). All the connections are shown in this figure which is made as explained previously in the paper.

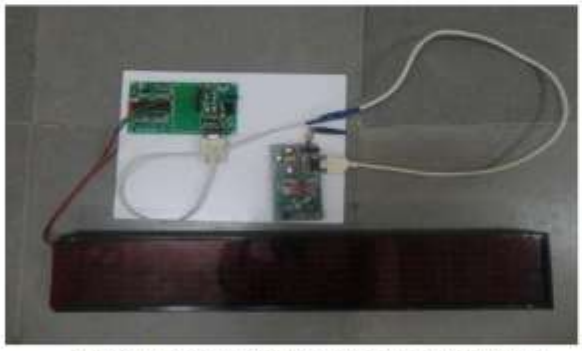

Figure 4: Hardware components connected together

SIMULATION RESULTS

Beforegoingontotheproposeddesignpractically,the results were verified in 8051 simulator. Using this simulator various modules of the project are constructed with the tools available in the simulator. And then by making the appropriate circuit connections as discussed earlier using the virtual wires and then writing the hex code onto the virtual microcontroller we can observe the results of the proposed method. The process of simulation of the project is asfollows.

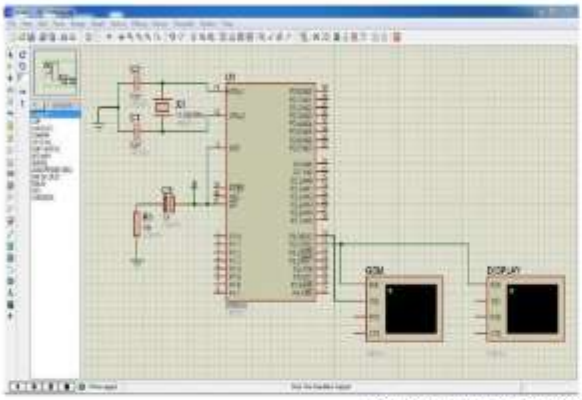

Figure 5: The schematic diagram or the virtual project

Figure 5 shows the schematic diagram built using the tools available in the simulator. It shows all the components of the project such as GSM module, Microcontroller and Display board and the connections between them.

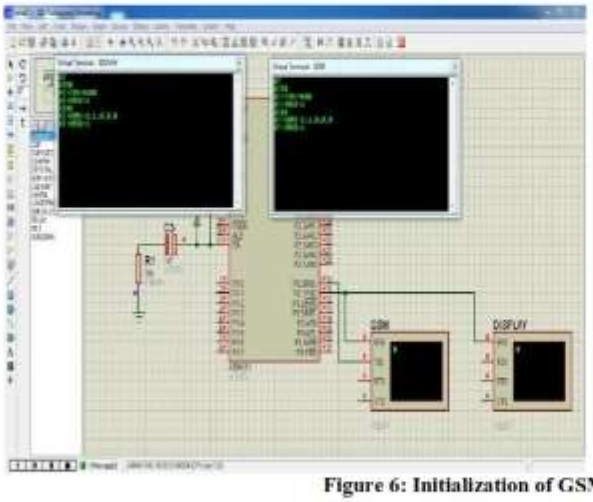

Figure 6: Initialization of GSM module and the Microcontroller

Figure 6 shows the initialization process of GSM module and microcontroller using AT commands. The two virtual terminal windows in above figure shows the commands executed in the GSM and the commands executed in the microcontroller that are passed onto the display board. Now the entire system waits for a new message to the providedMIN.

In figure 7 the GSM terminal shows a new message and notification as "+CMTI" and a command "AT+CMGR"isexecutedtoreadthemessagethrough microcontroller.

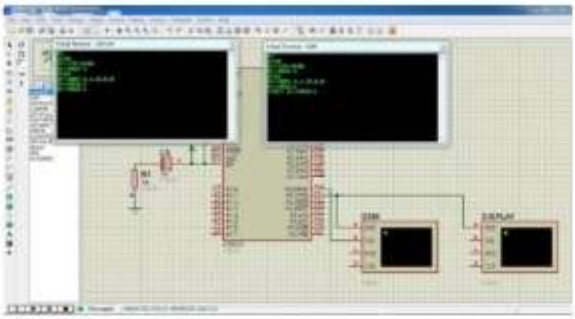

Figure 7: Displaying the notification of new message

Figure 8 shows the displaying of the message in the Display terminal immediately after the AT+ CMGR command is executed.

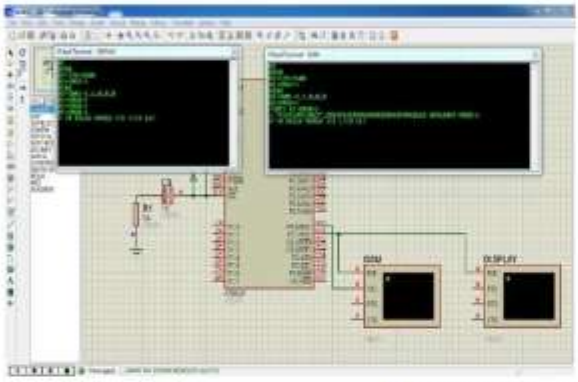

Figure 8: Terminals displaying the sent message

RESULTS

As shown in figure 9 the message is sent as "@hello cbit#" because when @ is received the message reading starts and when # is received the message reading stops so whatever the message we want to display is kept in between @ and #. The message is received by the GSM module and is passed onto the microcontroller using serial communication. The GSM module uses the AT commands presented in a propersyntax.TheGSMmodulereceivesthemessage and stores in the memory available in the SIM card. When the command AT+CMGR is executed in the microcontroller the message is transferred to the microcontroller. The GSM is connected to microcontroller board through serial communication using RS232 cable (DB9 pins). The LED display board is connected to microcontroller board by pins directly as shown in figure 4. The TxD and RxDof display board are connected to P3.0 and P3.1 of microcontrollerboard.

Initially when power is switched on and all the modules are kept ready, as there is no message is sent to the GSM module, the board displays the default message fed into it as shown in figure 10.

Figure 9: A mobile user sending the message in specified format

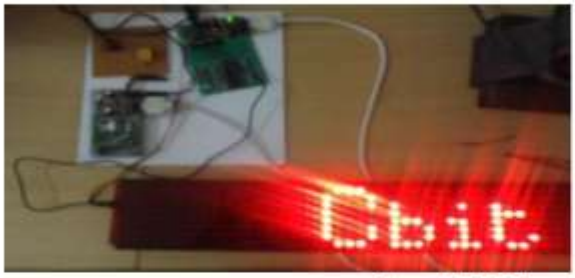

Figure 10: LED board displaying the default message

Then as in figure 9 when a message is sent in the specified format, then a series of commands are executed which can be seen in a HyperTerminal when the kit is connected to the COM PORT of PC as in figure 11.

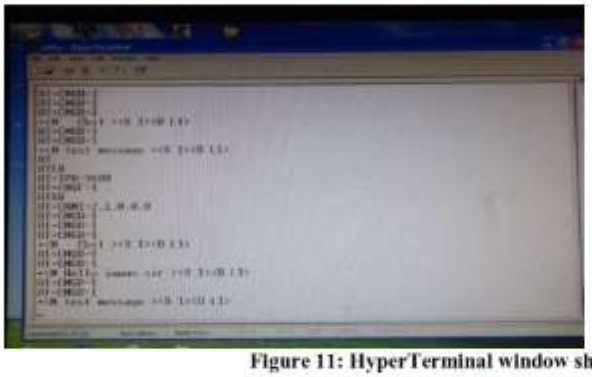

Figure 11: HyperTerminal window showing the sequence of commands executed

After these commands are executed the icrocontroller retrieves the message from GSM module and displays on the LED board as shown in figure 12.

Figure 12 LED board displaying the message sent

Thus from figure 12 we can see that the message sent is displayed on the LED board. Hence our papers aim is achieved successfully.

CONCLUSION

As the technology is advancing every day the display board systems are moving from Normal hand writing display to digital display. Further to Wireless display units. This paper develops a photo type laboratory modelwirelessnoticeboardsystemwithGSMmodem connected to it, which displays the desired message of the user through an SMS in a most populated or crowded places. This proposed system has many upcoming applications in educational institutions and organizations, crime prevention, traffic management, railways, advertisements etc. Been user friendly, long range and faster means of conveying information are major bolsters for this application. By using this proposed methodology we can enhance the security system and also make awareness of the emergency situations and avoid manydangers.

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PERFORMA FOR PROJECT COMPLETION REPORT

To,

Date: 11/09/2019

Head of Department

Name of Department: Computer Application

Name of College: KVSCOS

Findings of the project: (Max-100 words): As the Technology is advancing every day the display board system are moving from National hand writing display to digital display. This Project develops a Photo type laboratory model wireless notice board system with GSM modem. Connect to it, which display the desired message of the user through an SMS in most Populated or crowded places.

External Support: Support financially by Adesba Boore.

Name of PI: Himanshu Sirohi

Name of the Department: Computer Application

Signature of the P.I.

Name of College: KVSCOS

Title of the Project: Wireless Electronic Display Board using GSM Technolog Employee Code of PI:

Duration of the Project: 5 Month

Registrar
Swami Vivekanand
Subharti University
MEERUT

A

RESEARCH PROJECT

ENTITLED

"IoT based SMART FARMING SYSTEM"

by

Mr. HimanshuSirohi
ASSISTANT PROFESSOR
COMPUTER APPLICATION

KERAL VERMA SUBHARTI COLLEGE OF SCIENCE

SWAMI VIVEKANAND SUBHARTI UNIVERSITY, MEERUT

Introduction:

Internet of Things (IoT) technology has brought revolution to each and every field of common man's life by making everything smart and intelligent. IoT refers to a network of things which make a self- configuring network. The development of Intelligent Smart Farming IoT based devices is day by day turning the face of agriculture production by not only enhancing it but also making it cost-effective and reducing wastage. The aim / objective of this report is to propose IoT based Smart Farming System assisting farmers in getting Live Data (Temperature, Soil Moisture) for efficient environment monitoring which will enable them to increase their overall yield and quality of products. The IoT based Smart Farming System being proposed via this report is integrated with Arduino Technology mixed with different Sensors and a Wifi module producing live data feed that can be obtained online from Thingsspeak.com. The product being proposed is tested on Live Agriculture Fields giving high accuracy over 98% in data feeds.

Objective:

The objectives of this report is to proposed IoT based Smart Farming System which will enable farmers to have live data of soil moisture environment temperature at very low cost so that live monitoring can be done.

The structure of the report is as follows: chapter I will cover over of overview of IoT Technology and agriculture-concepts and definition, IOT enabling technologies, IOT application in agriculture, benefits of IOT in agriculture and IOT and agriculture current scenario and future forecasts. Chapter II will cover definition of IOT based smart farming system, the components and modules used in it and working principal of it. Chapter III will cover algorithm and flowchart of the overall process carried out in the system and its final graphical output .chapter IV consist of conclusion, future scope and references.

IOT TECHNOLOGY AND AGRICULTURE:

IOT: CONCEPT AND DEFINITION

Internet of things IOT consists of two words Internet and Things .The term things in IOT refers to various IOT devices having unique identities and have capabilities to perform remote sensing, actuating and live monitoring of certain sort of data.IOT devices are also enable to have live exchange of data with other connected devices and application either directly or indirectly, or collected data from other devices and process the data and send the data to various servers. The other term internet is define as Global communication Network connecting Trillions of computers across the planets enabling sharing of information .Thus the IOT can be define as :"A dynamic Global Network Infrusture with self-configuring capabilities based on standard and inter operable communication to protocol where physical and virtual things have identities, physical attributes ,and virtual personalities and use intelligent interfaces and are seamlessly integrated into the information network ,often communicate data associated with user and theirenvironment."

An ideal IoT device consists of various interfaces for making connectivity to other devices which can either be wired or wireless.

Any IoT based device consists of following components:

1. I/O interface forSensors.
2. Interface for connecting toInternet.
3. Interface for Memory andStorage.
4. Interface forAudio/Video.

IoT devices can be of various forms like wearable sensors, smart watches, IoT smart home etc.

IOT ENABLING TECHNOLOGIES

Internet of Things has a strong backbone of various enabling technologies- Wireless Sensor Networks, Cloud Computing, Big Data, Embedded Systems, Security Protocols and Architectures, Protocols enabling communication, web services, Internet and SearchEngines.

Wireless Sensor Network (WSN): It consists of various sensors/nodes which are integrated together to monitor various sorts of data.

Cloud Computing: Cloud Computing also known as on-demand computing is a type of Internet based computing which provides shared processing resources and data to computers and other devices on demand. It can be in various forms like IaaS, PaaS, SaaS, DaaS etc.

Big Data Analytics: Big data analytics is the process of examining large data sets containing various forms of data types—i.e. Big Data – to uncover hidden patterns, unknown correlations, market trends, customer preferences and other useful business information.

Communication Protocols: They form the backbone of IoT systems to enable connectivity and coupling to applications and these protocols facilitate exchange of data over the network as these protocols enable data exchange formats, data encoding and addressing.

Embedded Systems: It is a sort of computer system which consists of both hardware and software to perform specific tasks. It includes microprocessor/microcontroller, RAM/ROM, networking components, I/O units and storage devices.

IOT APPLICATIONS IN AGRICULTURE

With the adoption of IoT in various areas like Industry, Homes and even Cities, huge potential is seen to make everything Intelligent and Smart. Even the Agricultural sector is also adopting IoT technology these days and this in turn has led to the development of "*AGRICULTURAL Internet of Things(IoT)*"

Table 1.1 Various projects and applications are integrated in Agricultural fields leading to efficient management and controlling of various activities.

Application Name	Description
Crop Water Management	In order to perform agriculture activities in inefficient manner, adequate water is essential. Agriculture IoT is integrated with Web Map Service (WMS) and Sensor Observation Service (SOS) to ensure proper water management for irrigation and in turn reduces water wastage.

Precision Agriculture	High accuracy is required is required in terms of weather information which reduces the chances of crop damage. Agriculture IoT ensures timely delivery of real time data in terms of weather forecasting, quality of soil, cost of labour and much more to farmer.
Integrarattd Pest Management or Control (IPM/C)	Agriculture IoT systems assures farmers with accurate environmental data via proper live data monitoring oftemperature , moisture, plant growth and level of pests so that proper carecan be taken during production
Food Production & Safety	Agriculture IoT system accurately monitors various parameters like warehouse temperature, shipping transportation management system and also integrates cloud based recording systems.
Other Projects Implemented Till Date	1. The Phenonet Project by OpenIoT. 2. CLASS Equipment 3. Precisionhalk's UAV SensorPlatform 4. Cleangrow's Carbon NanotubeProbe 5. Temputech's Wireless Sensor Monitoring.

ADVANTAGES OF IOT IN AGRICULTURE

The following are the benefits of IoT in Agriculture:

1. IoT enables easy collection and management of tons of data collected from sensors and with integration of cloud computing services like Agriculture fields maps, cloud storage etc., data can be accessed live from anywhere and everywhere enabling live monitoring and end to end connectivity among all the partiesconcerned.

2. IoT is regarded as key component for Smart Farming as with accurate sensors and smart equipment's, farmers can increase the food production by 70% till year 2050 as depicted by experts.

With IoT productions costs can be reduced to a remarkable level which will in turn increase profitability andsustainability.

3. With IoT, efficiency level would be increased in terms of usage of Soil, Water, Fertilizers, and Pesticidesetc.

4. With IoT, various factors would also lead to the protection ofenvironment.

IOT AND AGRICULTURE CURRENT SCENARIO AND FUTURE FORECASTS

Shows the growth of IoT based adoption in Agriculture sector from Year 2000-2016 and Forecasts of year 2035-2050.

Year	Data Analysis
2000	**525 Million Farms connected to IoT**
2016	**540 Million Farms till Date are connected to IoT**
2035	**780 Million Farms would be connected to IoT**
2050	**2 Billion Farms are likely to be connected to IoT**

OVERVIEW OF THEPROJECT

DEFINITION IOT BASED SMART FARMINGSYSTEM

IoT based SMART FARMING SYSTEM is regarded as IoT gadget focusing on Live Monitoring of Environmental data in terms of Temperature, Moisture and other types depending on the sensors integrated with it. The system provides the concept of "Plug & Sense" in which farmers can directly implement smart farming by as such putting the System on the field and getting Live Data feeds on various devices like Smart Phones, Tablets etc. and the data generated via sensors can be easily shared and viewed by agriculture consultants anywhere remotely via Cloud Computing technology integration. The system also enables analysis of various sorts of data via Big Data Analytics from time to time.

COMPONENTS ANDMODULES

In this section, various components and Modules being used for **IoT based SMART FARMING SYSTEM** development is discussed:

ARDUINOUNO

The Arduino Uno is a microcontroller board based on the ATmega328(datasheet).It has 14 digital input/output pins(of which 6 can be used as PWM outputs),6 analog inputs, a 16 MHz crystal oscillator, a USB connection ,a power jack, an ICSP header , and a reset button.

WIFI MODULE-ESP 8266

ESP8266 Wi-Fi Module is SOC with TCP/IP protocol stack integrated which facilitates any microcontroller to access Wi-Fi network. ESP8266 module is cost effective module and supports APSD for VOIP Applications and Bluetooth co-existence interfaces. Technical Specifications: 802.11b/g/n; Wi-Fi Direct, 1MB Flash Memory, SDIO 1.1/2.0, SPI, UART, Standby Power Consumption of

<1.0mW.

SENSORS:

TEMPERATURESENSOR-DS18B20

The DS18B20 temperature sensor provides 9-bit to 12-bit Celsius temperature measurements and has alarm function with non-volatile user-programmable upper and lower trigger points. The DS18B20 has 64-bit serial code which allows multiple DS18B20s to function on same 1-wire bus.

Technical Specifications: Unique 1-Wire Interface; Measures Temperature from -55^{O}C TO +125^{O}C; Coverts temperature to 12-bit digital word in 750ms.

SOIL MOISTURE SENSOR-FC 28

Soil Moisture Sensor is used for measuring the moisture in soil and similar materials. The sensor has two large exposed pads which functions as probes for the sensor, together acting as a variable resistor. The moisture level of the soil is detected by this sensor. When the water level is low in the soil, the analog voltage will be low and this analog voltage keeps increasing as the conductivity between the electrodes in the soil changes. This sensor can be used for watering a flower plant or any other plants requiresautomation.

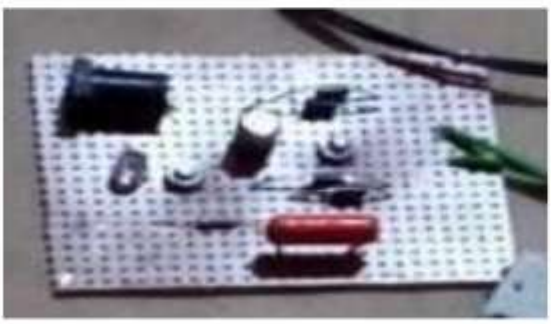
POWERSUPPLY

RECHARGEABLE BATTERY

The sealed lead-acid (SLA) 12V, 9Ah rechargeable battery is rated at a 5-hour (0.2) and 20-hour (0.05C) discharge. Longer discharge times produce higher capacity readings because of lower losses. The lead-acid performs well on high load currents. This battery act as an internal power supply for the whole circuit.

BATTERY CHARGING CIRCUIT WITHTRANSFORMER

The circuit acts as a 12 volt battery charger for Lead Acid battery. It gives 12 volt and 5 Amps current for quick charging of the battery. If the battery is partially discharged, full charge will be attained in one hour. The circuit is connected with a 0-14 volt 5 Ampere Step down transformer to convert AC to DC. Since pulsed DC is good for Lead Acid battery, a low value smoothing capacitor is used in the circuit .In the circuit, LED act as the Charger on status.

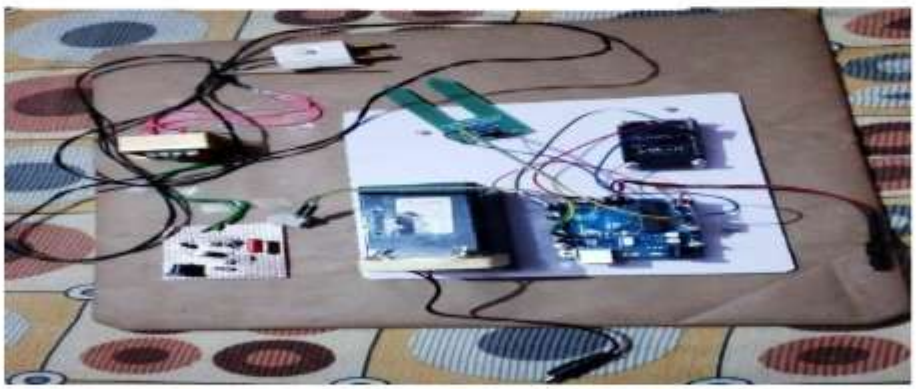


EXTERNAL ACADAPTER

A 12V AC adapter can also be considered as a component in the circuit for external power supply for the circuit which enabled the circuit to be switched 'ON' in case if the battery power is very low for use. The adapter can directly act as an AC/DC convertor to provide pure DC current externally to the circuit.

CIRCUIT DESCRIPTION & WORKINGPRINCIPAL

In this circuit there is a programmed ARDUINO which is connected with sensors(soil moisture and temperature)and a wifi module .The working principal of the model based on storing data from the sensors with the help of ARDUINO and passing it to wifi module .The wifi module gives the updates of data in a device through cloud computing. In the device the realtime data comes through wifi to the channel named SMART FARMING which we can access through the URL :https//:thingspeaks.com/channels/625454.In the channel the graph is plotted through mat lab technology .There is a chargeable battery which connected with the power supply of ARDUINO so that the circuit start working. There is also charging circuit with AC/DC converter for charging battery .In the case if the battery is not charged there further an adaptor which can explicitly give power to ARDUINOcircuits.



ALGORITHMS & FLOWCHART & OUTPUTGRAPHS

ALOGORITHM

THE ALGORITHM OF OVERALL PROCESS:-

STEP 1: START THE PROCESS STEP 2: CONNECTED

TO WIFI

STEP 3: READ TEMERATURE AND HUMIDITY

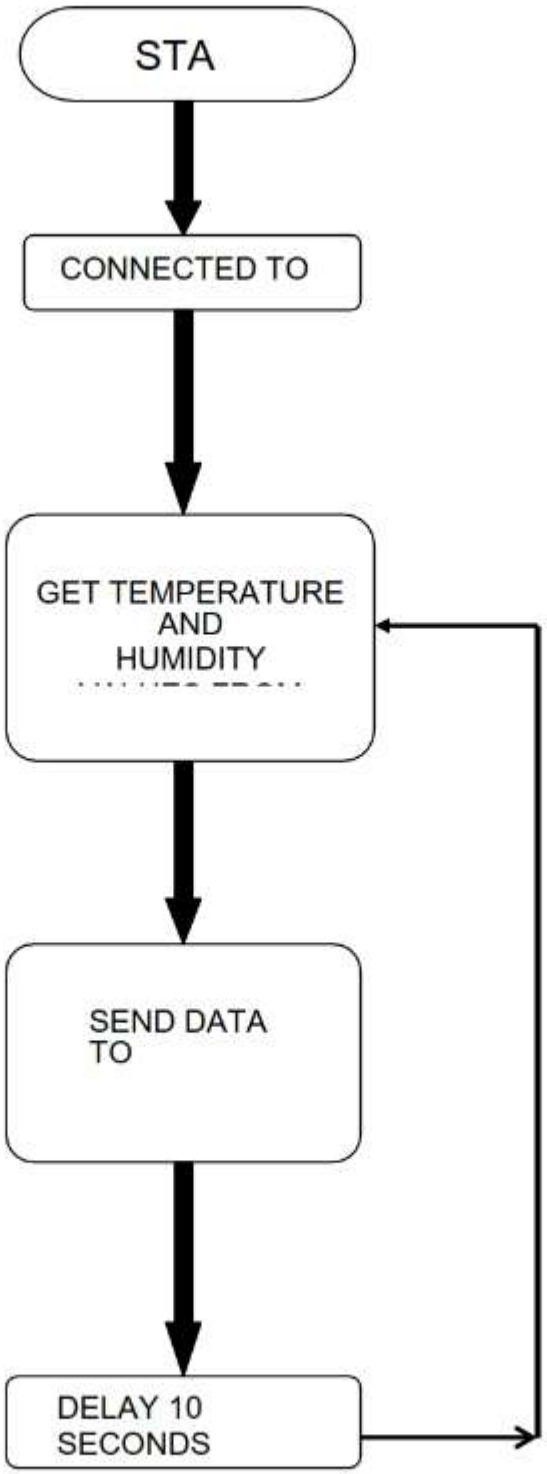
STEP 4: GET TEMPERATURE AND HUMIDITY VALUE S FROM ANOLOG PINS STEP 5: SEND DATA TO THINGSPEAK API

STEP 6: DELAY TO 10 SECONDS

STEP 7: REPEAT STEP 4, 5 & 6 UNTIL THE PROCESS END

STEP 8: END

FLOWCHART:


STA
CONNECTED TO
GET TEMPERATURE
AND
HUMIDITY
SEND DATA
TO
DELAY 10
SECONDS

OUTPUTGRAPHS:

Live Data of Temperature with Date and Time fromThingspeak.com

Live Data of Soil Moisture with Date and Time fromThingspeak.com

CONCLUSION:

IoT based SMART FARMING SYSTEM for Live Monitoring of Temperature and Soil Moisture has been proposed using Arduino and Cloud Computing. The System has high efficiency and accuracy in fetching the live data of temperature and soil moisture. The IoT based smart farming System being proposed via this report will assist farmers in increasing the agriculture yield and take efficient care of food production as the System will always provide helping hand to farmers for getting accurate live feed of environmental temperature and soil moisture with more than 99% accurate results.

FUTURESCOPE:

Future work would be focused more on increasing sensors on this system to fetch more data especially with regard to Pest Control and by also integrating GPS module in this system to enhance this Agriculture IoT Technology to full-fledged Agriculture Precision ready product.

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PERFORMA FOR PROJECT COMPLETION REPORT

To,

Date: 22.07.2020

Head of Department

Name of Department: Computer Application

Name of College: KvScoS

Findings of the project: (Max-100 words): IoT based smart farming System is used for Live monitoring of Temperature and Soil Moisture has been Proposed using Cloud computing. The System has high efficiency and accuracy in fetching the live data of temperature and soil moisture.

External Support: Adeeba books. Self printed

Name of PI: Himanshu Sirohi

Name of the Department: Computer Application

Name of College: KvScoS

Title of the Project: IoT based Smart Farming System

Duration of the Project: 4 Month

Himanshu

Signature of the P.I.

Employee Code of PI:

Registrar
Swami Vivekanand
Subharti University
MEERUT

A

RESEARCH PROJECT

ENTITLED

"Systematically Built-in Flow for Social Networking"

by

DR. NAVEEN CHANDRA
ASSISTANT PROFESSOR & HEAD
COMPUTER APPLICATION

KERAL VERMA SUBHARTI COLLEGE OF SCIENCE

SWAMI VIVEKANAND SUBHARTI UNIVERSITY, MEERUT

1. Introduction

In recent times 'sites like Facebook, myspace and Linkedin have created a real-life social networking site for its users which has led to rapid emergence in the social media industry. The user base of Facebook has recently been estimated at 700 million, which would mean that if Facebook were a country it would be the third most populous. However, site owners themselves agree that there may be a large number of fake users. These fraudulent users are only designed to spread spam or send offensive messages to other real users. However, true users who sometimes express their feelings on this form also commit this act. A simple emotional analyst who can understand words in the context in which the user was targeting and deleting messages that contain any offensive languages can directly delete these messages.
However, in the case of real life, offensive language can be used within some friends up to a certain level but not for work partners.

2. Objective

The purpose is to introduce a flammable real-time approach that addresses user performance and behavior on a social networking site. We introduce the concept of layers where flames can be better utilized using the Naive Bayesian theorem. We use this system to target user messages based on the different types of relationships they enjoy with the people they meet on social networking sites such as Facebook, Linkedin, etc.

3. Advantages

This approach will help to make flames easier for social networking sites and thus help to better develop these sites. As shown in our test cases this method helps to reduce users where the flame is not targeted making the message invisible to any minor / relative / legal member added to our friends list. This method adds a personality trait to maturity and thus can allow messages with certain friendly characters but only make them visible to my closest friends with whom I want to share the message.

4. Motivation

In recent times social networking sites have been working on algorithms to eliminate the tendency to burn out by blocking users or by removing flame statements. In social networks where everyone's work is visible to everyone, these statements are either cleared up or in some cases the user is blocked. However, the problem lies in a very fragile relationship as a friend or family member where a person's level of communication can be very different compared to each other. For example, a person could speak very casually to his superiors and his family but at the same time use abusive language in jokes with his friends. However, a person can delete these statements from his or her network, and if he or she regularly comes across those statements he or she may find himself or herself blocked on that site. Therefore, a different set of standards requires following traditional burning concepts, which simply analyzes the word or emotion attached to the words before deleting them. Therefore, the focus of this project is to develop a better and smarter combustion process.

5. Approach

Typically flaming has been divided into three categories.

Flamebait:- It (more commonly known as trolling) is a message posted to a public Internet discussion group, such as a forum, newsgroup or mailing list, with the intent of provoking an angry response (a "flame") or argument over a topic the poster often has no real interest in[9]. While flaming can occur because of legitimate debates or grievances, flamebait implies the intentional posting of inflammatory rhetoric or images.

Flame wars:- A flame war results when multiple users engage in provocative responses to the originally posted flamebait. Flame wars often draw in many users (including those trying to defuse the flame war) and can overshadow regular forum discussion if left unchecked.

Orthography and grammar:- Incorrect spelling and grammatical mistakes are also very frequently the subject of flames, particularly if a flame war has already started. In such a situation, the flamers may try to impugn their opponents' intelligence by highlighting any errors in their adversaries' grammar or spelling. This has given rise to the term spelling flame [10] for a flame that excoriates an earlier poster over their spelling errors.

Theory

Concept of circles was introduced by Google in their own version of social networking site Google+ which was aimed at bringing down the users of Facebook. In this paper, we try to introduce a similar concept but with modifications for better flaming. As on a social networking site a user can have many numbers of friends that can be his/her contacts from various spheres of lifes such as college friends, office friends, teachers, etc. In addition, for all these contacts a different level of flaming level is needed. One solution can be the Google approach of dividing peoples into circles and setting individual flaming levels for each one of them. The problem with this approach is that a person can overlap in multiple circles for ex- a person can be at the same time be my college friend as well as being my office buddy. So, when I want to share some office views/comments with my college friends I would like to omit this friend. Then how should we decide on classifying these kinds of friends? In addition, the level of closeness with one friend cannot be compared to another friend of the same circle and thus mean sharing the close messages with them. A more complex solution that is non-existent until now is creation of sub-circles to distinguish within the close friends of a circle and not so close ones. However, this approach will be tedious and long. A better approach will be to merge the circles to form layers.

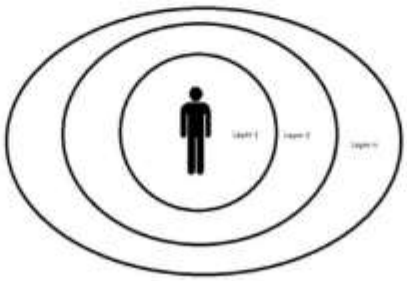

Figure 1: User at the centre of all layers

For sake of imagining, we could imagine ourselves at the centre of world surrounded by only our friends. Initially when we speak anything, it is audible to everybody. However, simultaneously we decide to censor some information i.e. in our case the flaming messages. For this, we speak the

flaming messages slowly and arrange all those peoples who we do not intend to hear these messages at the outer layers. This arrangement is ordered such as our close acquaintances are in the closest layers with whom the flaming threshold is high and we can discuss high level flaming messages with these peoples but as we traverse towards the outer layers, the threshold for flaming decreases so that high level flaming messages from us are not displayed to these peoples. In this kind of arrangement, we tend to arrange our parents, minors, teachers with whom we do not want to share the flaming messages at the outer layers. To disallow any misuse of this kind of freedom within close layered friend's people on both ends would have the option of disconnecting at any point of time. This option would make the act of close friendship a mutual thing thus not applicable to any kind of misuse from any of the person involved. We would also have to select the rate of increase in flaming threshold from the close layers to the outer layers. We could divide flaming words based on their intensity to create a heated environment.

Every Flaming word could be given some rating on a scale of 1 to 5, with lower rating words having low intensity of flaming and thus should be disclosed to as many layers as possible. We could assume to divide a users social network into k layers and thus the user can set the word rating for each layer. As the word, rating would not be exact and it could exist in decimals the k layers could have a gradual decrease in the ratings from lower to higher layers depending on the number of layers. The word rating could be decided using the context and emotion of the word in which state it was used. As there exist many algorithms for deciding whether a word lies in a particular class or not. We have used the Naive Bayesian algorithm for calculating the probability of a word lying in a class. We have classified all words into two classes:

1. Negative -This class of words is to be censored in some way or the other and should not be suitable for visibility of users of outer layers.
2. Positive-This class of words are suitable for users of every layers and thus a word having high probability for this class would mean it is suitable for every user. Naive Bayesian algorithm calculates the probability of a message belonging to a class by first calculating the probability of the words that constitute the message to belong to a particular class. For this probability to be calculated a certain amount of test cases are provided and from the P(c|w) is calculated as:

$$P(c|w)=(count(w \text{ in } c) +1)/(words(c)+ |V|)$$

Where,
|V|=Vocabulary of test cases,

words(c)=Total number of words in c,
count(w in c)=Number of occurrences of word w in c.

After the calculations of P(c|w) Bayesian theorem is applied to calculate the probability P(c|M).

$$P(c|M)=(P(c|w1)*P(c|w2)*...P(c))/(P(M))$$

Since, for P(c|M) to be maximum only the numerator part needs to be maximum and thus making the denominator part redundant. Thus, the Naive Bayesian Algorithm is reduced to the following formula:

$P(c|M)=P(c)*P(c|w1)*P(c|w2)...*P(c|wn)$

where,

$P(c|M)$=Probability of message M belonging to class c

$P(c)$=Probability of occurence of class c

Message M=w1+w2+w3+...wn

$P(c|w1)$=Probability of w1 in class c

$P(c|w2)$=Probability of w2 in class c

Figure 2: Naive Bayesian Formulae

These Probabilities are initially calculated through a test case that contains equal amount of test data for every kind of cases.

After calculation of these data from the test cases and the specific message we calculate the ratio of $P(-|M)/P(+|M)$ i.e. The ratio of probability of a message belonging to Negative class to that of the probability of a message belonging to the Positive class. If this ratio is below 1, the message will appear to users of every layers as the $P(+|M)>P(-|M)$ hence the chances that the message doesn't contain any censorable word is more and thus it would appear in every friends profile. For each inner layers we would have a particular corresponding threshold ratio and for a message to appear to the users of that layer the $P(-|M)/P(+|M)$ should be below the threshold and in case of innermost layer should be greater than a particular threshold ratio value. So, for example if we divide the threshold ratios as T1,T2,..and so on for layers 1,2,etc which form the innermost to outermost layer respectively.

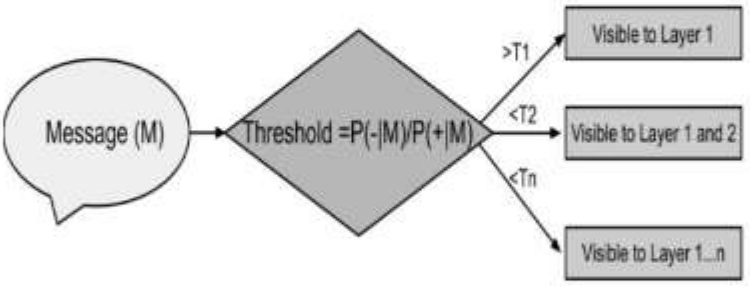

Figure 3: Architecture of the proposed model

Experimental Case

For an experimental case we would consider a case where a user has generated 4 layers of friends on his social networking site. We would insert the test case of following messages:

M1 – Got Admit into Caltech, yippee (+)

M2 – You Scumbag ,f****inga*****e (-)

M3 – Got New Phone tonight(+)

M4 – f***ing LAN not working today(-)

The signs in bracket at the end of message show the class to which the message belongs. From these test cases, following values can be computed.

Table 1: Experimental data

P(+)	P(-)	N(+)	N(-)	|V|
0.5	0.5	9	9	16

Similarly, for example a messages value will be calculated in the following way,

CASE 1

M:Phone F***ed up.
P(-|f***)=3/25
P(-|Phone)=1/25
P(-|up)=1/25
P(+|f***)=1/25
P(+|Phone)=2/25
P(+|up)=1/25
P(-|M)=1/2*(3/25)*(1/25)*(1/25)=0.0001
P(+|M)=1/2*(2/25)*(1/25)*(1/25)=0.00006

As, can be observed the probability comes out generally in powers of $10^{-1}$and as the number of words will increase this probability would vary. Thus a safer and more exact method would be to create a threshold according to the ratio of P(-|M)/P(+|M). For this case we had divided the four layers of groups having thresholds of:

Table 2: Individual layer probabilities

Layer 1	Layer 2	Layer 3	Layer 4
Ratio>2	1.5-2	1-1.5	<1

In This case our Threshold=P(-|M)/P(+|M) comes out to be 1.5.So,the message would be visible to users of Layer 1 and Layer 2.

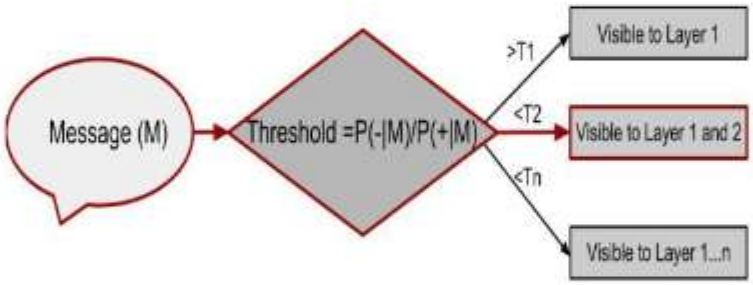

Figure 4: Model for medium threshold

CASE 2

Another example can be taken of another message,
M:F*** you A**h***
P(-|f***)=3/25
P(-|you)=2/25
P(-|A**h***)=2/25
P(-+|f***)=1/25
P(+|you)=1/25
P(+|a**h***)=1/25
P(-|M)=1/2*(3/25)*2/25*2/25
P(+|M)=1/2*1/25*1/25*1/25
Ratio=P(-|M)/P(+|M)=12

As the final ratio is 12, which is much higher than 2 the upper threshold value for the innermost layer. So, this message will only be visible to Layer1 friends who are very close and the user has indicated to broadcast any kind of messages to them.

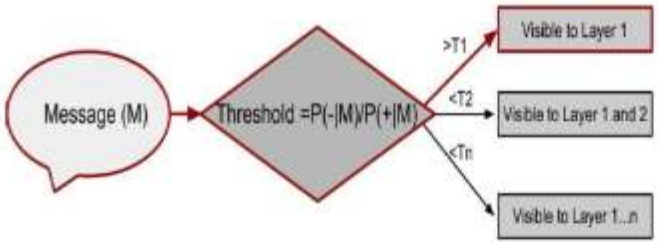

Figure 5: Model for high threshold

CASE 3

M :Football Match tonight at college campus
P(-|Football)=1/25
P(-|match)=1/25
P(-|tonight)=1/25
P(-|at) = 1/25
P(-|college) = 1/25
P(-|campus) = 1/25
P(+|Football)=1/25
P(+|match)=1/25
P(+|tonight)=2/25
P(+|at) = 1/25
P(+|college) = 1/25
P(+|campus) = 1/25
P(-|M)=1/2*(1/25)*1/25*1/25*1/25*1/25*1/25
P(+|M)=1/2*2/25*1/25*1/25*1/25*1/25*1/25
Ratio=P(-|M)/P(+|M)=1/2

As the ratio comes out to be less than 1 and as was discussed earlier cases like these depict that the chances of a message lying in the Negative class is less than being in Positive class. Therefore, these kinds of messages are safe for being shown to all layers of users. Visibility of these types of message is in all layers and does not require flaming at all.

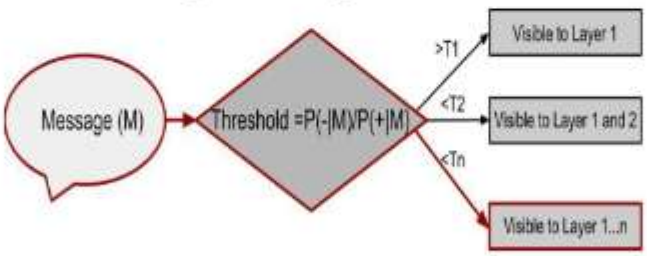

Figure 6: Model for low threshold

REAL TIME CASE SCENARIO

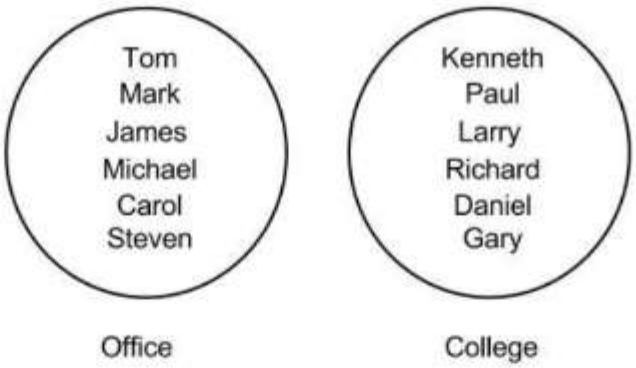

Figure 7: John's Circles of Friends

In previous test cases we saw how new messages are added to the test suite of the naïve Bayesian algorithm. The test suite can start with a few standard word cases which could be based on the location of the specific user and could vary with users per say. Then these suites could build themselves through the updation of statuses by the users. In this real time scenario friends of a user are divided in various layers

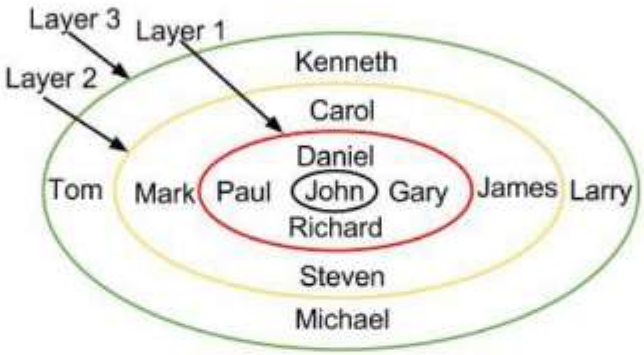

Figure 8: John's Friends distributed in Layers

Table 5: depicting the value of updated N(+) and N(-).

(+)	P(-)	N(+)	N(-)	|V|
0.5	0.5	15	15	20

M1:Watching football on internet
P (-|Watching) = 1/35
P(-|football) =1/35
P(-|on) =1/35
P(-|internet) =1/35
P(+|Watching) = 2/25
P(+|football) =2/25
P(+|on) = 1/15
P(+|internet) = 1/15
P(-|M) = (4/7)*1/35*1/35*1/35*1/35
P(+|M) = (3/7)*1/35*2/35*2/35*1/35
Ratio = P(-|M)/P(+|M)=1/3

Table 4: Threshold level for each layer

Layer 1	Layer 2	Layer 3
Ratio>2	1-2	<1

The values in the table depict the threshold levels for each layer of user in these cases.As the ratio value came out to be less than 1,the status message would be visible to all layers.
These status messages were randomly picked up from the social networking sites from a set of users thus making the results more releveant to the requirements.

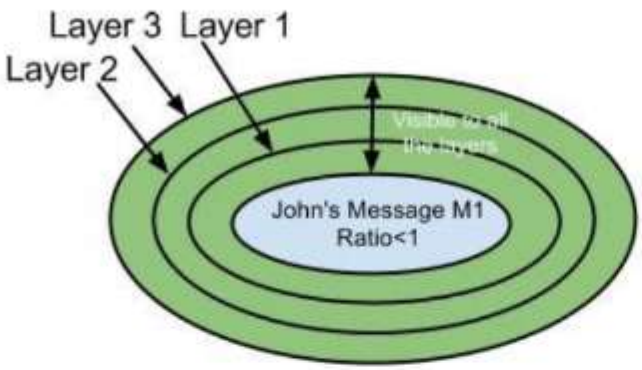

Figure 9: Visibility of message in John's friends

Similarly the friend circle's of Mark who is present in layer 2 of John's layers of friends is depicted below.

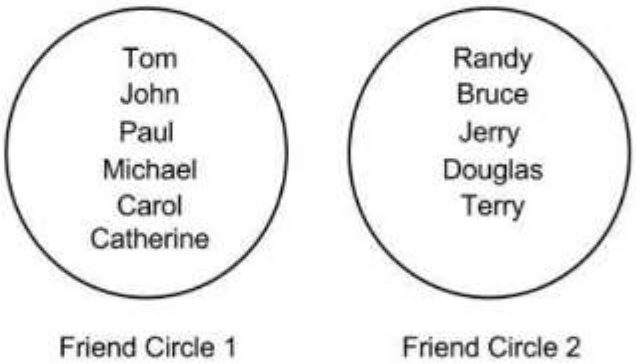

Figure 10: Mark's Circles of Friends

Different layers of friends present in Mark's list are thereby classified as follows:

Figure 11: Mark's Friends distributed in Layers

M1: F***ing assignments at caltech
P(-|F***ing) =5/35
P(-|assignments) = 1/35
P(-|at) = 1/35
P(-|Caltech) = 1/35
P(+|F***ing) = 1/35
P(+|assignments) = 1/35
P(+|at) = 2/35
P(+|Caltech) = 2/35
P(-|M) = 4/7*5/35
P(+|M) = 3/7*2/35*2/35
Ratio= P(-|M)/P(+|M) =5/3

So, the visibility would be till layer 2.

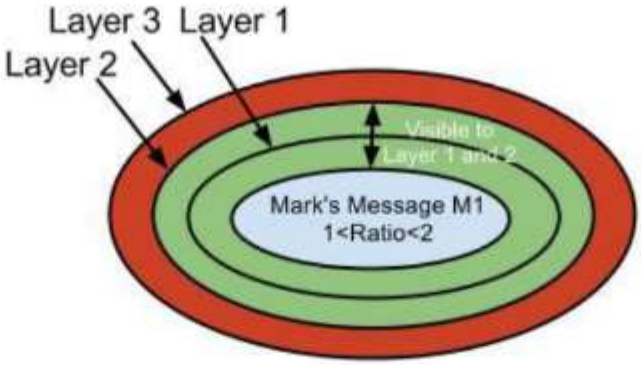

Figure 12: Visibility of message in Mark's friends

The visibility of different layers is dependent on the ratio which can be depicted using the following graph. We take

N_1- ∞= Threshold for Layer 1

N_1-N_2 = Threshold for Layer 2

N_2 – N_3 = Threshold for Layer 3 and so on for

N_{n-1} – N_n= Threshold for Layer n

1/ratio provides us the inverse of the ratio that has been found.

As can be seen from the graph all the layers including the layer which intersects can see the message for that particular ratio and for the remaining ones the message is not visible.

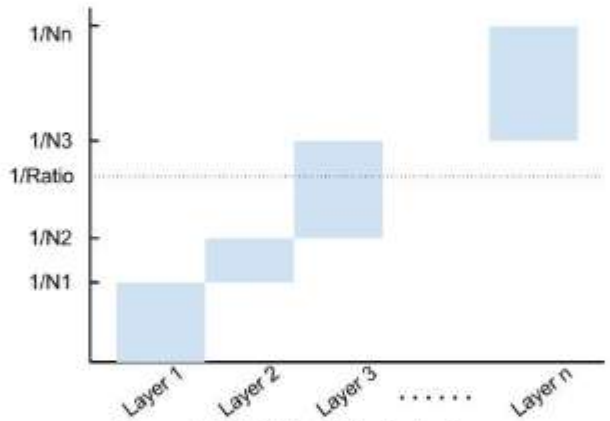

Figure 13: Visibility Criteria for Layers

6. Proposed Future work

The future works could see a practical implementation of this concept on any popular social networking medium for a testing phase. The data from the test phase could be used upon for any modifications or any improvements in the algorithm.

7. References

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PERFORMA FOR PROJECT COMPLITION REPORT

To,
Head of the Department
Name of the Department: Computer Applications.
Name of the College: KVSCOS

Date: 12.08.2020

Findings of the Project: (Max- 100 words): We have introduced a flammable real-time approach that addresses users Performance and behaviours on a social networking site. We introduced the concept of layers where flames can be better Utilized using the Naive Bayesian theorem. We use this System to target uses messages based on the different type of relationships. This approach will help to make flares easier for social networking sites and thus helps to better develop these sites. This method adds a Personality trait to maturity and thus can allow messages with certain friendly characters but only make them Visible to my closest friends with whom I want to share the messages.

External Support: Adeeba books.

Name of PI: Dr. NAVEEN CHANDRA
Name of Department: Computer Applications.
Name of the College: KVSCOS
Title of the project: Systematically Built in flame for Social Networking
Duration of the project:

Signature of the PI:

Employee code of PI:

Registrar
Swami Vivekanand
Subharti University
MEERUT

- **Latex**

  Strongly inhibits the watermelon mosaic virus.

- **Leaves**

  Leaf sap can be used to blow bubbles.

- **Sap**

  It stains linen. Sometimes used for marking

- **Shrub**

  Used for erosion control.

Use in developing world:

Currently the oil from *Jatropha curcas* seeds is used for making biodiesel fuel in Philippines, Pakistan and in Brazil, where it grows naturally and in plantations in the southeast, north, and northeast of Brazil. In the Gran Chaco of Paraguay, where a native variety (*Jatropha matacensis*) also grows, studies have shown the suitability of Jatropha cultivation[48][49] and agro producers are starting to consider planting in the region.In Africa, cultivation of *jatropha* is being promoted and it is grown successfully in countries such as Mali.

India

Jatropha oil is being promoted as an easily grown biofuel crop in hundreds of projects throughout India.Large plantings and nurseries have been undertaken in India by many research institutions, and by women's self-help groups who use a system of microcredit to ease poverty among semiliterate Indian women. The railway

line between Mumbai and Delhi is planted with *jatropha* and the train itself runs on 15–20% biodiesel.

Material Required:

Vegetable Oil♣

Antifreeze (Methanol)♣

Lye (NaOH)♣

Blender♣

Scales

Plastic Containers♣

Funnels♣

Plastic Bottle with lid♣

Duct Tape♣

Thermometer♣

Procedure For Analysis:

Measure out 200 ml of antifreeze and put it in one plastic container.

• Add in lye so that the antifreeze is absorbed.

• Cover container and mix well by shaking it. It is mixed when it starts to feel warm and is foamy.

• The mixture has now become sodium methoxide.

• Blend 1 liter of vegetable oil with the sodium methoxide in a blender for 20 minutes.

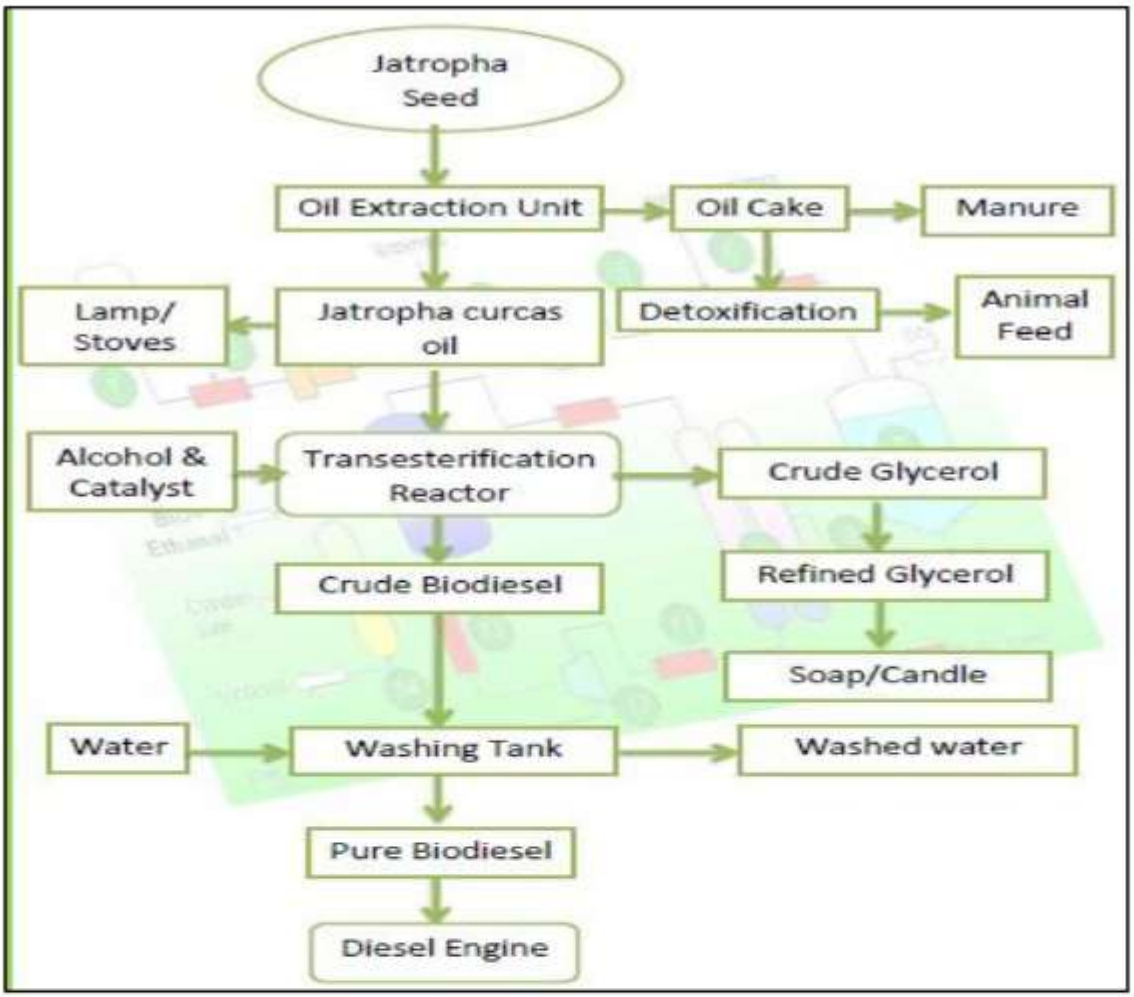
• Pour mixture into a bottle and wait 8 hours until the byproduct, glycerin, separates form the biodiesel. The glycerin will be on the solid on the bottom.

• Separate out the biodiesel by pouring into a glass bottle.

• Prepare a wash bottle by poking a small hole in the corner of the bottle and covering it with duct tape.

• Wash the biodiesel by pouring it into the wash bottle and adding in ½ a liter of water. Roll the bottle around to mix it and then remove the duct tape and drain the water.

• Repeat the washing process until the biodiesel is clear.This may need to be done numerous times over thecourse of a week to complete the process. Store the biodiesel in a glass container until ready to use.



Conclusion:

Biodiesel is currently about one and a half times more expensive than petroleum diesel fuel. Part of this cost is because the most common source of oil is the soybean, which only is only 20% oil. However, the costs of biodiesel can be reduced by making biodiesel from recycled cooking oils rather than from new soy beans, or by making it from plant matter with higher oil content.

EXTRACTION OF BIODIESEL FROM JATROPHA PLANT

It takes energy to produce biodiesel fuel from soy crops, including the¬ energy of sowing, fertilizing and harvesting.

Biodiesel fuel can damage rubber hoses in some engines, particularly in¬ cars built before 1994. You should check with the manufacturer before using biodiesel to see if you need to replace any hoses or rubber seals.

Biodiesel cleans the dirt from the engine. This dirt then collects in the¬ fuel filter, which can clog it. Clogging occurs most often when biodiesel is first used after a period of operation with petroleum diesel, so filters should be changed after the first several hours of biodiesel use.

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PERFORMA FOR PROJECT COMPLETION REPORT

To,

Head of Department

Date: 11/04/2020

Name of Department: chemistry

Name of College: KVSCOS

Findings of the project: (Max-100 words):

Biodiesel is currently one and half times more expensive than petroleum diesel fuel. However the costs of biodiesel can be reduced by making biodiesel from recycled cooking oils rather than from new soya beans or by making it from plant matter with higher oil content. Biodiesel cleans the dirt from the engine. This dirt then collects in the fuel filters which can clog it. filters must be changed in order to stop clogging.

External Support: Adeeba brothers

Name of PI: Pradhi Singhal

Name of the Department: Chemistry

Name of College: KVSCOS

Signature of the P.I. Pradhi

Title of the Project: Extraction of Biodiesel from Jatropha Plant

Employee Code of PI:

Duration of the Project: 04 months.

Registrar
Swami Vivekanand
Subharti University
MEERUT

Project Title: Machine Breakdown System for Volume Flexible Implication with Fuzzy and Multi Items

Name: Dr. NEHA SAXENA

Designation: Assistant Professor

Affiliation: Department of Mathematics, Keral Verma Subharti College of Science, Swami Vivekanad Subharti University, Meerut

Phone No.: 9152711055

Email ID: nancineha.saxena@gmail.com

Dated: 27.12.2019

Project title: Machine Breakdown System for Volume Flexible Implication with Fuzzy and Multi Items

Principal Investigator: Dr. Neha Saxena, Assistant Professor, Department of Mathematics, Keral Verma Subharti College of Science, Swami Vivekanad Subharti University, Meerut

Collaboration:

Objective of the project: This project investigated an Economic Manufacturing Quantity model for time dependent decaying items and selling price demand with volume flexible environment. Controlling market demand through the manipulation of selling price is an important strategy for increasing profit. We assumed that different machines 'A_i' (1,2….n) are dedicated to the production of different items 'i' with different production rates 'P_i'. The management of production in machine A_i is vested with the management unit 'B_i'. It is assumed that a machine may become out of order during its working time. As a result, there is a mean time for every machine between its failure/breakdowns. During a breakdown of a machine, there is demand although there is no production. In such a situation, the demand is met until the inventory level falls below the quantity demanded. When inventory level becomes less than the demand, the concerned management unit B_i is rendered fully idle. This project is alienated into two parts: (1) first one with constant deterioration and selling price dependent demand and (2) second one with the uniform distributed deterioration and time dependent demand. This is solved and analyzed theoretically.

Outcome of the project: For the first time EMQ model is developed in presence of fuzzy environment under random deterioration. In a competitive market, price of goods plays an important factor. Generally, a reduced price encourages a customer to buy more. For fitting in with realistic circumstances, the environment of the whole study has been taken as fuzzified. Model is developed in both the environment crisp and imprecise. The reason for adaptation of this model is-(1) the execution of fuzzy random variables as demand and production gives more realistic information where the variable values are indefinite. (2) Incorporation of imprecision and improbability in machine breakdown production process. (3) Capacity constraint is also a realistic situation.

From the analysis of the crisp model it has been observed that

1. The cost of ideal time of management units is indirectly proportional to the production rate and the profit.
2. Mean time of successive breakdowns is reversely proportional to the production rate and the profit.
3. The mean time to repair gives the reverse effect on the production rate and the profit.
4. The backlogging rate is indirectly proportional to the production rate and the profit.

We have many real life situations in which multi items inventories are required. For instance: a pharmacist keeps a number of medicines of different brands, readymade clothes shop keeps dresses of different things in different colors and in different size, shoe store stocks shoes of various models and sizes. The presented model is much more realistic and practical. The present model can be extended to include the delay in payments, inflation, and stochastic demand.

Machine Breakdown System for Volume Flexible Implication with Fuzzy and Multi Items

Abstract

This project investigated an Economic Manufacturing Quantity model for time dependent decaying items and selling price demand with volume flexible environment. Controlling market demand through the manipulation of selling price is an important strategy for increasing profit. We assumed that different machines 'A_i' (1,2….n) are dedicated to the production of different items 'i' with different production rates 'P_i'. The management of production in machine A_i is vested with the management unit 'B_i'. It is assumed that a machine may become out of order during its working time. As a result, there is a mean time for every machine between its failure/breakdowns. During a breakdown of a machine, there is demand although there is no production. In such a situation, the demand is met until the inventory level falls below the quantity demanded. When inventory level becomes less than the demand, the concerned management unit B_i is rendered fully idle. This project is alienated into two parts: (1) first one with constant deterioration and selling price dependent demand and (2) second one with the uniform distributed deterioration and time dependent demand. This is solved and analyzed theoretically.

1. Introduction

Production, quality and maintenance are the three major concerns of any manufacturing firm. In the competitive business environment, managers of manufacturing industries encounter the challenge everyday to produce quality products and to provide better services than before to customers. Due to technological innovations and scientific developments around the world, manufacturing infrastructure is also changing rapidly. Three important factors of the Economic Manufacturing Quantity (EMQ) model have been dealt with prior significance. First it is assumed that the production facility is not perfect reliable. Second, the production rate (greater than the demand rate) is not predetermined and fixed in advance. Third, the modern facilities are not free from deterioration due to epoch. As a result, random machine shifts from 'in-control' state to 'out-of-control' state frequently occur during production runs and some percentage of non-conforming items is produced. Further, the process deterioration after a machine shift may result in a machine breakdown in which

case the interrupted lot is usually aborted and then the basic EMQ model loses its usefulness. So, from theoretical as well as practical view points, the study of EMQ problem for unreliable manufacturing systems is quite significant and meaningful. There a major vacant space in the area of inventory modeling with machine breakdown. So, we have also taken a stride at the forefront to solve out the machine breakdown problem with flexible manufacturing system.

Chung (1997) discussed about the bound of machine breakdown problem. **Giri,** and **Dohi, (2005)** presented an exact formulation of EMQ model under a general framework in which the time to machine failure, corrective and preventive repair times all are assumed to follow arbitrary probability distributions. But they ignored the study of fuzzy**. Chakraborty** *et al.* **(2008)** presents a generalized economic manufacturing quantity model for an unreliable production system in which the production facility may shift from an 'in-control' state to an 'out-of-control' state at any random time and may ultimately break down afterwards. **Singh** and **Urvashi (2010)** discussed the effect of machine breakdown with fuzzy demand rate. They considered the volume flexibility with idle time of the inventory system**. Widyadana** and **Wee (2010)** develops deteriorating items production inventory models with random machine breakdown and stochastic repair time. The model assumes the machine repair time is independent of the machine breakdown rate.

Certainty eventually indicates that we assume the structures and parameters of the model to be definitely known, and that there are no doubts about their values or occurrence. If the model under consideration is a formal model, that is, if it does not pretend to model reality adequately, then the model assumptions are in a sense arbitrary. This means that the model builder can freely decide which model characteristics he chooses. If, however, the model or theory asserts factuality, that is, if the conclusions drawn from these models have a bearing on reality and are supposed to model reality adequately, then the modeling language has to be suited to model the characteristics of the situation under study appropriately.

Vojosevic *et al.* **(1996)** fuzzified the ordering cost into trapezoidal fuzzy number in the total cost of an inventory without backorder model and obtained the fuzzy total cost. They later used the centroid method and gained the total cost in the fuzzy sense. **Chen** and **Wang (1996)** fuzzified the ordering cost, inventory cost and backorder cost into trapezoidal fuzzy numbers and used the functional principle to obtain the estimate of the total cost in the fuzzy sense. **Roy** and **Maiti (1997)** rewrote the problem of classical economic order quantity by introducing fuzziness in both the objective function as well as the storage area. **Lee** and **Yao (1999)** discussed an inventory model without shortages by fuzzifying the order quantity into a triangular fuzzy number. **Yao** *et al.* **(2000)** explored an inventory

model without any backlogging for fuzzy order quantity and fuzzy total demand quantity. **Chang** *et al* **(2004)** considered the fuzzy problems for the mixture inventory model with backorders and lost sales. The total expected annual cost is obtained in the fuzzy sense. **Dey** *et al.* **(2005)** developed a realistic inventory model with imprecise demand and inventory costs and proposed an inventory policy to minimize the cost using man–machine interaction. **Chang** *et al.* **(2006)** considered the mixture inventory model involving a fuzzy random variable and obtained the total cost in the fuzzy sense. **Rong** *et al.* **(2008)** presented an optimization inventory policy for a deteriorating item with partially/fully backlogged shortages and price dependent demand. **Singh, S.R.** and **Singh, C. (2008)** considered the fuzzy inventory model for finite rate of replenishment using signed distance method. **Singh S.R.** and **Urvashi (2010)** also discussed on fuzzy inventory model with different conditions. In this project manufacturing system considered with capacity constraints.

In conventional studies of inventory models, it is normally assumed that the lifetime of an item is infinite while in storage. In reality, it is not always true. Due to the unsatisfactory preservation conditions, some portions of the items like food grains, vegetables, fruits, radioactive substances, fashion goods, blood, high- tech products, drugs, etc., are damaged or decayed due to spoilage, obsolescence, evaporation, pilferage, etc. and are not in a condition to satisfy the customer's demand. **Nahmias (1982)** classified the deteriorating inventory problems into two categories: fixed lifetime and random lifetime. Many researchers, like **Mandal** and **Phaujder (1989), Ting** and **Chung (1994), Hariga (1994), Mandal** and **Maiti (1999)**, etc. considered the inventory models for deteriorating items assuming fixed life cycle. **Roy** *et al.* **(2010)** develops an inventory model of a volume flexible manufacturing system for a deteriorating item with randomly distributed shelf life, continuous time-varying demand, and shortages over a finite time horizon. Total cost is derived for the system and minimized.

Many of the researchers have considered single item inventory models with crisp parameter only. In the past, researchers pay less attention towards the coordination of the factor of machine breakdown, volume flexibility and fuzzy environment with multi items which proves a major hindrance to a researcher in this field. It is very much realistic condition for business environment. Produced units deteriorate over time. But most of researchers consider certainty in deterioration. In reality items deteriorate with uncertainty that follows different distributions. Therefore, we have developed this entire concept simultaneously in our model with uniform distribution of deterioration.

This project investigated an Economic Manufacturing Quantity model for time dependent decaying items and selling price demand with volume flexible environment. Controlling market demand through the manipulation of selling price is an important strategy for increasing profit. We assumed that different machines 'A_i' (1,2….n) are dedicated to the production of different items 'i' with different production rates 'P_i'. The management of production in machine A_i is vested with the management unit 'B_i'. It is assumed that a machine may become out of order during its working time. As a result, there is a mean time for every machine between its failure/breakdowns. During a breakdown of a machine, there is demand although there is no production. In such a situation, the demand is met until the inventory level falls below the quantity demanded. When inventory level becomes less than the demand, the concerned management unit B_i is rendered fully idle. This situation occurs when the customer is a wholesaler having the demand of a big lot size and the concerned management unit can't meet this demand because the stock size is less than the quantity demanded. Therefore, we considered the idle time of each management unit; this idle time leads to an additional cost for the last man hours. We have considered the capital available for manufacturing the items is limited. In the present study, demand of multi items involved in the study is represented by fuzzy numbers. As a result the total cost function is ultimately obtained as fuzzy. Later on this cost function is defuzzified to obtain a crisp cost function with allowed variations. This project is alienated into two parts: (1) first one with constant deterioration and selling price dependent demand and (2) second one with the uniform distributed deterioration and time dependent demand. This is solved and analyzed theoretically.

2. Assumptions and Nomenclature:

The proposed inventory model is developed under the following assumptions and notations:

2.1 Assumptions:

The following assumptions are made for development of mathematical model:

- Model is developed for multiple items.
- Demand rate is selling price dependent for each item for first model and time dependent for the second one model.
- Production rate is considered as a decision variable.
- Machine breakdown is considered during the production period.
- Idle time is considered for management of units.

- Crisp and fuzzy both the cases are considered.

2.2 Nomenclature:

The following notations are made for development of mathematical model:

$Q_i(t)$: On- hand inventory of i-th item at time t

P_i: Production rate per unit time for the i-th item

$\theta(t)$: Deterioration rate

μ_i: Mean time between successive breakdown of the machine

m_i: Mean time of repair of i-th machine

τ_i: Mean duration of a breakdown of machine

$\psi_i(t_i)$: Probability density function of t_i

$\phi_i(\tau_i)$: Probability density function of τ_i

C_h^i: Cost of carrying one unit of i-th item in inventory per unit time

C_s^i: Shortage Cost per unit time of the i-th item

S_p^i: Selling price per unit of i-th item

$\eta_i(P_i)$: Cost for production of a unit of i-th item

D_i: Demand rate for the i-th item per unit time

W_i: Cost of idle time of management unit Bi

CAP: Total capital available for production of all the items

3. Model I: Formulation of the model with selling price dependent demand:

The production cycle begins with zero stock. Production starts at time t=0 and stocks reaches at the highest level $Q_i(t_i)$ at time t_i. After time t_i machine becomes out of order, then repairing of machines starts and takes time to come back into working state. During the repairing period two cases may arise.

Differential Equations of the inventory system are

$$Q_i'(t)+\theta Q_i(t)=P_i-D_i(s) \qquad \text{with } Q_i(0)=0 \qquad \ldots. (1)$$

$$Q_i'(t)+\theta Q_i(t)=-D_i(s) \qquad \text{with } Q_i(x)=0 \qquad \ldots.(2)$$

Solutions of the above equations are

$$Q_i(t)=\frac{(P_i-D_i(s))}{\theta}(1-e^{-\theta t}) \qquad \ldots. (3)$$

$$Q_i(t)=-\frac{D_i(s)}{\theta}(1-e^{\theta(x-t)}) \qquad \ldots. (4)$$

Scenario (a):

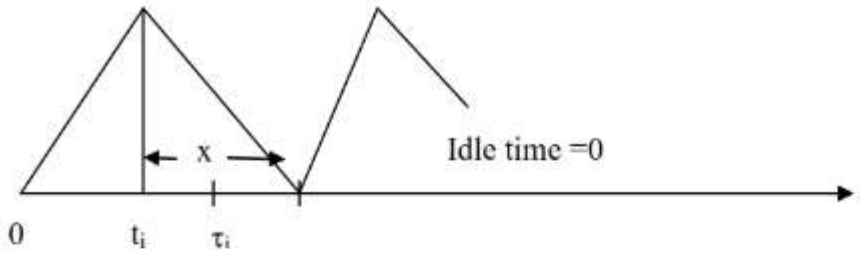

Figure 1: Graphical representation of inventory system without shortages

Scenario (b):

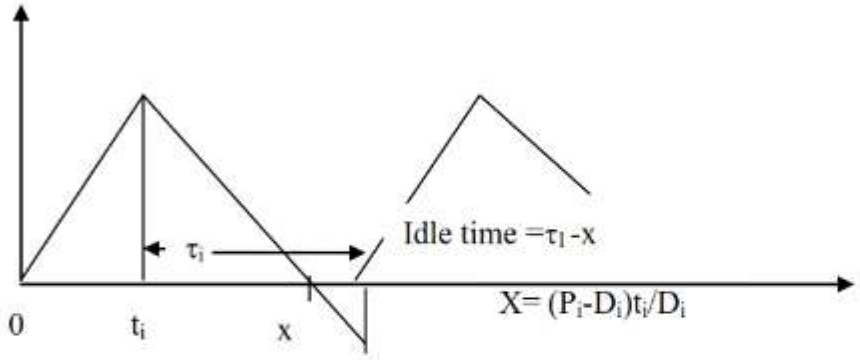

Figure 2: Graphical representation of inventory system with shortages

One can conclude that the idle times of the management units {Bi, i= 1, 2, 3…..}due to breakdown of the machines {Ai, i=1, 2,3…..} are

$$u_i = \begin{cases} 0, & \text{if } \dfrac{Q_i(t_i)}{D_i(s)} \geq \tau_i \\ \tau_i - \dfrac{Q_i(t_i)}{D_i(s)} & \text{if } \dfrac{Q_i(t_i)}{D_i(s)} < \tau_i \end{cases}$$

3.1 Expected cost per breakdown

The expected cost per breakdown of the machine {Ai, i= 1, 2, 3……} during idle time, is

$$E_{ic}^{\ i} = W_i \int_0^{\infty} \{ \int_{\frac{Q_i(t_i)}{D_i(s)}}^{\infty} (\tau_i - \frac{Q_i(t_i)}{D_i(s)}) \phi_i(\tau_i) d\tau_i \} \psi_i(t_i) dt_i \qquad \text{.... (3.5)}$$

3.2 Expected shortage cost during ideal time

The expected shortage cost for i-th item, during idle item, is

$$E_{sc}^{\ i} = C_S^{\ i} D_i(s) \int_0^{\infty} \{ \int_{\frac{Q_i(t_i)}{D_i(s)}}^{\infty} (\tau_i - \frac{Q_i(t_i)}{D_i(s)}) \phi_i(\tau_i) d\tau_i \} \psi_i(t_i) dt_i \qquad \text{.... (3.6)}$$

Now the total inventory of i-th item is

$Inv_i(t_i)$ = Inventory during$[0, t_i]$ + Inventory during $[0, x]$

$$=\frac{(P_i-D_i(s))}{\theta}\int_0^{t_i}(1-e^{-\theta t})dt-\frac{D_i(s)}{\theta}\int_0^{x}(1-e^{\theta(x-t)})dt$$

$$=\frac{(P_i-D_i(s))}{\theta}[t_i+\frac{e^{-\theta t_i}}{\theta}-\frac{1}{\theta}]+\frac{D_i(s)}{\theta}[\frac{e^{(\frac{(P_i-D_i(s))t_i}{D_i(s)})}}{\theta}-\frac{1}{\theta}-\frac{(P_i-D_i(s))t_i}{\theta}] \quad \ldots. (3.7)$$

3.3 Expected inventory cost for i-th item

$$E_{ic}^{\ i}=C_h^i\int_0^{\infty}Inv_i(t_i)\psi_i(t_i)dt_i$$

$$=C_h^i[\frac{(P_i-D_i(s))}{\theta}\int_0^{\infty}(t_i+\frac{e^{-\theta t_i}}{\theta}-\frac{1}{\theta})\psi_i(t_i)dt_i+\frac{D_i(s)}{\theta}\int_0^{\infty}(\frac{e^{(\frac{(P_i-D_i(s))t_i}{D_i(s)})}}{\theta}-\frac{1}{\theta}-\frac{(P_i-D_i(s))t_i}{\theta})\psi_i(t_i)dt_i]$$

$\ldots. (3.8)$

3.4 Production cost per unit of the item

$$\eta_i(P_i)=(R_i+\frac{G_i}{P_i^{\alpha}}+k_iP_i^{r}) \quad \ldots. (3.9)$$

Here one can consider the density functions are

$$\psi_i(t_i)=\frac{1}{\mu_i}e^{-t_i/\mu_i}, \qquad \phi_i(\tau_i)=\frac{1}{m_i}e^{-\tau_i/m_i}$$

3.5 Expected total cost

Expected total cost breakdown, including the inventory and shortages cost is,

ETC (P_1, P_2, P_3, ...) = Expected holding cost + Expected cost for idle item + Expected shortage cost =

$$\sum_{i=1}^{n}\frac{D_i(s)}{\theta}C_h^{\ i}\int_0^{\infty}(\frac{e^{\theta(\frac{P_i-D_i(s)}{D_i(s)})t}}{\theta}-\frac{1}{\theta})(\frac{1}{\mu_i}e^{-t_i/\mu_i})dt_i+\sum_{i=1}^{n}W_i\int_0^{\infty}\{\int_{\frac{Q_i(t_i)}{D_i(s)}}^{\infty}(\tau_i-\frac{Q_i(t_i)}{D_i(s)})\phi_i(\tau_i)d\tau_i\}\psi_i(t_i)dt_i$$

$$+\sum_{i=1}^{n}D_i(s)C_s^{\ i}\int_0^{\infty}\{\int_{\frac{Q_i(t_i)}{D_i(s)}}^{\infty}(\tau_i-\frac{Q_i(t_i)}{D_i(s)})\phi_i(\tau_i)d\tau_i\}\psi_i(t_i)dt_i \quad \ldots. (3.10)$$

ETC (P_1, P_2, P_3.....) = $=f(P_i)D_i+g(P_i)$ $\ldots. (3.11)$

Where $f(P_i)=\sum_{i=1}^{n}\frac{(C_s^iD_i(s)+W_i)m_i^{\,2}}{\mu_i(P_i-D_i(s))+m_iD_i(s)}+\sum_{i=1}^{n}C_h^i[\frac{P_i-D_i(s)}{D_i(s)}\left(\mu_i+\frac{\mu_i}{\theta}+1-\frac{1}{\theta}-\frac{\mu_iD_i(s)}{\theta}\right)-\frac{1}{\theta}(\frac{D_i(s)}{\theta(D_i(s)-\theta\mu_i(P_i-D_i(s)))}-\frac{1}{\theta})]$

And $g(P_i)=\sum_{i=1}^{n}\eta_i(P_i)\,P_i\mu_i$

3.6 Expected Production cost of the item

$E_{prc} = \sum_{i=1}^{n} \int_0^{\infty} \eta_i(P_i) P_i t_i \ \psi_i(t_i) dt_i$ .... (3.12)

As the capital for manufacturing the item is limited, the constraints

$\sum_{i=1}^{n} \eta_i(P_i) P_i \mu_i \leq CAP$ must be satisfied.

3.7 Mathematical formulation of the fuzzy model:

When the demand rate becomes fuzzy, the objective function can be redefined as

ETC (P_1, P_2, P_3.....) = $= f(P_i)\tilde{D}_i(s) + g(P_i)$

Wavy bar denotes the fuzzification of the parameters. We express the fuzzy demand rate $\widetilde{D_i}$as the triangular fuzzy number $(D_i(s) - \delta_1, D_i(s), D_i(s) + \delta_2)$. Suppose, the membership function of the fuzzy demand rate $\widetilde{D_i}$ is as follows:

$$\mu_{\widetilde{D_i}}(D_i) = \begin{cases} \dfrac{D - D_i + \delta_1}{\delta_1} & D_i - \delta_1 \leq D \leq D_i \\ \dfrac{D_i + \delta_2 - D}{\delta_2} & D_i \leq D \leq D_i + \delta_2 \\ 0 & elsewhere \end{cases}$$

Here, 0< δ_1 <D_i, 0< δ_2 and D_i are given fixed numbers δ_1 and δ_2 are determined by the decision maker based on the given uncertainty. From equation (11), for each P_i , let

$G_{P_i}(D_i) = f(P_i)D_i + g(P_i)$

and y= $G_{P_i}(D_i)$ then we have $D_i = \dfrac{G_{P_i}(D_i) - g(P_i)}{f(P_i)}$

By the extension Principle, one can have the following

$$\mu_{G_{P_i}(D_i)}(y) = \sup_{D_i = G_{P_i}(D_i)} \mu_{\widetilde{D_i}}(D_i) = \mu_{\widetilde{D_i}}\left(\frac{G_{P_i}(D_i) - g(P_i)}{f(P_i)}\right)$$

$$= \begin{cases} \dfrac{G_{P_i}(D_i) - g(P_i) - (D_i - \delta_1) f(P_i)}{f(P_i)\delta_1} & (D_i - \delta_1) f(P_i) + g(P_i) \leq G_{P_i}(D_i) \leq D_i f(P_i) + g(P_i) \\ \dfrac{(D_i + \delta_2) f(P_i) - G_{P_i}(D_i) + g(P_i)}{f(P_i)\delta_2} & D_i f(P_i) + g(P_i) \leq G_{P_i}(D_i) \leq (D_i + \delta_2) f(P_i) + g(P_i) \\ 0 & elsewhere \end{cases}$$

Now, one can find the centroid of $\mu_{G_{P_i}(D_i)}(y)$ as

$$\int_{-\infty}^{\infty} \mu_{G_{P_i}(D_i)}(y) dy = \int_{(D_i - \delta_1) f(P_i) + g(P_i)}^{D_i f(P_i) + g(P_i)} \frac{y - g(P_i) - (D_i - \delta_1) f(P_i)}{f(P_i)\delta_1} dy + \int_{D_i f(P_i) + g(P_i)}^{(D_i + \delta_2) f(P_i) + g(P_i)} \frac{(D_i + \delta_2) f(P_i) - y + g(P_i)}{f(P_i)\delta_2} dy = \frac{\delta_1 + \delta_2}{2} f(P_i)$$

=P(say) and

$$\int_{-\infty}^{\infty} y\mu_{G_{P_i}(D_i)}(y)dy = \int_{(D_i-\delta_1)f(P_i)+g(P_i)}^{D_i f(P_i)+g(P_i)} y\frac{y-g(P_i)-(D_i-\delta_1)f(P_i)}{f(P_i)\delta_1}dy$$

$$+\int_{D_i f(P_i)+g(P_i)}^{(D_i+\delta_2)f(P_i)+g(P_i)} y\frac{(D_i+\delta_2)f(P_i)-y+g(P_i)}{f(P_i)\delta_2}dy = \left(D_i f(P_i)-g(P_i)-\frac{f(P_i)(\delta_1-\delta_2)}{3}\right)(\delta_1+\delta_2)f(P_i) = R(say)$$

The centroid of $\mu_{G_{P_i}(D_i)}(y)$ is

$$M(P_i,\delta_1,\delta_2)=R/P=D_0 f(P_i)-g(P_i)-\frac{f(P_i)(\delta_1-\delta_2)}{3} \quad \ldots. (3.13)$$

where, $0<\delta_1<D_0$, $0<\delta_2$.

$M(P_i,\delta_1,\delta_2)$ is the estimate of total cost in fuzzy sense.

If $\delta_1=\delta_2$, then equation (11) reduces to (12).

Equation (13) gives an estimate of cost function. For minimization of cost function, differentiating equations (13) with respect to P_1, P_2. The software **Mathematica 8.0** is used to derive the optimal solution.

4. Numerical Illustration

The model has been explored numerically as well. We have considered the following data for the study which based on the previous study. The common input parameters are:

Items no.(i)	W_i	μ_i	m_i	R_i	k_i	G_i	D_i	C_h^1	C_s^1	S_p^1	θ
1	40	8	0.6	0.8	0.02	6.25	200	0.07	3	5	0.03
2	35	8.5	0.5	1.2	0.015	7.50	300	0.08	3.5	6	0.03

Solving the problem numerically with the help of computer software **MATHEMATICA 8.0**, we find that the optimum solution is P_1^*=204.9272, P_2^*=305.9327, ETP= 359.534.

5. Sensitivity Analysis

Table 5.1: Variation in the cost of ideal time (W_i):

Change in %	P_1^*	P_2^*	ETP
-50%	-0.264	0.0	-3.801
-25%	-0.131	0.0	-2.908
+25%	+0.131	0.0	+1.895
+50%	+0.260	0.0	+3.785

Table 5.2: Variation in the various parameters:

Parameter	% Change	-30%	-20%	-10%	10%	20%	30%
W_1&W_2	P_1	+0.96	+0.64	+0.32	-0.33	-0.67	-1.01
	P_2	+0.52	+0.35	+0.18	-0.18	-0.36	-0.54
	ETP	+7.16	+4.76	+3.27	-2.36	-4.70	-7.02
μ_1& μ_2	P_1	+13.02	+7.48	+3.29	-2.66	-4.86	-6.7
	P_2	+14.62	+8.53	+3.79	-3.10	-5.69	-7.89
	ETP	+158.09	+93.6	+41.45	-32.27	-56.77	-74.78
m_1&m_2	P_1	-1.61	-0.92	-0.40	+0.32	+0.59	+0.81
	P_2	-0.84	-0.49	-0.21	+0.17	+0.32	+0.44
	ETP	-12.01	-7.05	-3.15	+2.59	+4.76	+6.61
S_p&S_{2p}	P1	**+26.2**	+16.2	+6.0	-6.0	-16.2	-26.2
	P2	**+40.28**	+29.45	+16.08	-16.08	-29.45	-40.28
	ETP	**+42.24**	+38.35	+32.04	-32.04	-38.35	-42.24

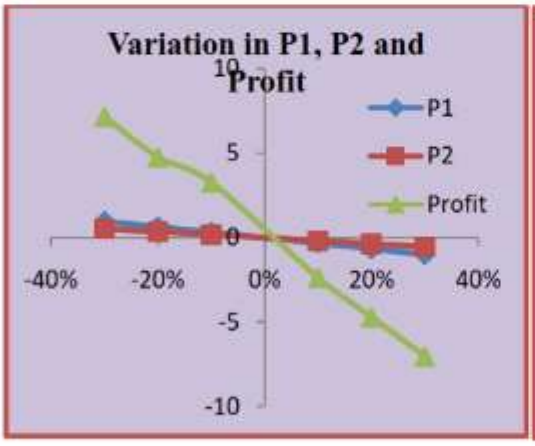

Fig 3: Graphical representation of sensitivity of the P_1, P_2 and Profit w.r.t W_1&W_2

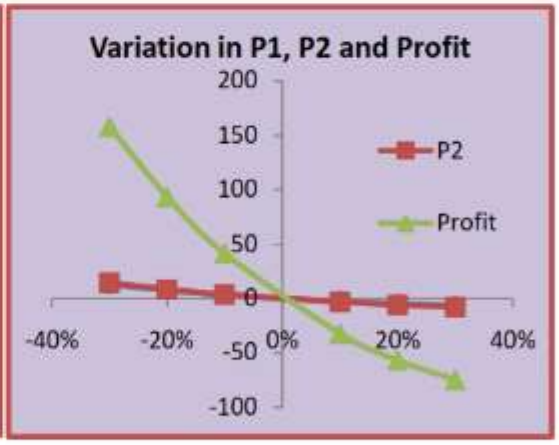

Fig 4: Graphical representation of sensitivity of the P_1, P_2 and Profit w.r.t μ_1& μ_2

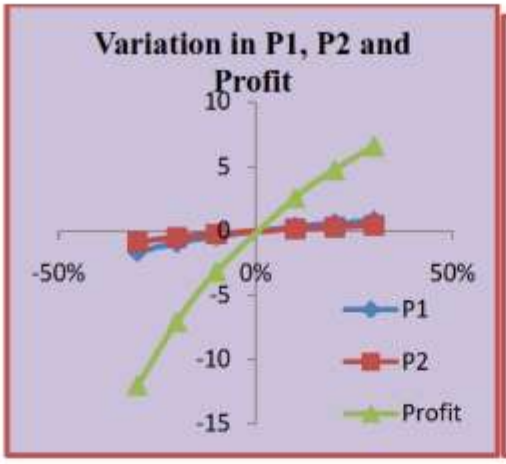

Fig 5: Graphical representation of sensitivity of the P_1, P_2 and Profit w.r.t m_1&m_2

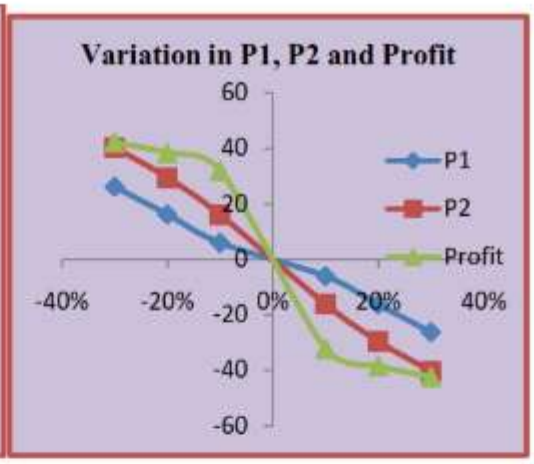

Fig 6: Graphical representation of sensitivity of the P_1, P_2 and Profit w.r.t S_p&S_{2p}

1. P_i (i=1,2) is less sensitive and the profit is moderately sensitive to change in the parameter W_i (i=1,2). If the cost of ideal time of management unit is increases then the production rate and the profit are decreases and if the cost of ideal time of management unit is decreases then the production rate and the profit are increases. The variation of the P_i (i=1,2) and the profit w.r.t. W_i (i=1,2) has been represented graphically in figure 1.
2. P_i (i=1,2) is little sensitive and the profit is highly sensitive to change in the parameter μ_i (i=1,2). The production rate and the profit are increases with the decreases of the mean time of successive breakdowns and the production rate and the profit are decreases with the increases of the mean time of successive breakdowns. The figure 2 shows the variation of the P_i (i=1,2) and the profit.
3. P_i (i=1,2) is slightly sensitive and the profit is somewhat sensitive to change in the parameter m_i (i=1,2). If the mean time to repair of a machine is increases, then the production rate and the profit are decreases and if the mean time to repair of a machine is decreases then the production rate and the profit are increases. This fact can be easily understood by figure 3.
4. P_i (i=1,2) and the profit are moderately sensitive to change in the parameter S_p& S_{2p}. When the selling price is increases, the production rate of machine and the profit are decreases and when the selling price is decreases, the production rate of machine and the profit are increases. The graphical representations of the P_i (i=1,2) and the profit are shown by the figure 5.

6. Model II: Formulation of Model with Uniform Distribution Deterioration and Time Dependent Demand:

The production cycle begins with zero stock. Production starts at time $t=T_{i-1}$ and stocks reaches at the highest level $Q_i(t_{i1})$ at time t_{i1}. After time t_{i1} machine becomes out of order, then repairing of machines starts and takes time to come back into working state. During the repairing period shortages comes in the system which is very common in manufacturing firms. After that cycle again starts and shortages come in the system because of no inventory. Hence, our main object is to analyze scenario.

Differential Equations of the inventory system are

$$Q_i'(t)+\frac{1}{b-t}Q_i(t)=P_i-D_i(t) \qquad T_{i-1}<t<t_{i1} \qquad \ldots. (6.1)$$

$$Q_i'(t)+\frac{1}{b-t}Q_i(t)=-D_i(t) \qquad t_{i1}<t<t_{i2} \qquad \ldots. (6.2)$$

$$Q_i'(t)+\frac{1}{b-t}Q_i(t)=P_i-D_i(t) \qquad t_{i2}<t<t_{i3} \qquad \ldots. (6.3)$$

$$Q_i'(t)+\frac{1}{b-t}Q_i(t)=-D_i(t) \qquad t_{i3}<t<t_{i4} \qquad \ldots. (6.4)$$

$$Q_i'(t)=-D_i(t) \qquad t_{i4}<t<t_{i5} \qquad \ldots. (6.5)$$

$$Q_i'(t)=P_i-D_i(t) \qquad t_{i5}<t<T_i \qquad \ldots. (6.6)$$

Where $D_i(t)=\alpha_i+\beta_i t$

With boundary conditions $Qi(T_{i-1})=0$, $Q_i(t_{i2})=0$, $Q_i(t_{i3})=0$, $Q_i(t_{i5})=0$ and $Q_i(T_i)=0$

Solutions of the above equations are

$$Q_i(t)=(b-t)[(P_i-\alpha_i-\beta_i b)\log\left|\frac{b-T_{i-1}}{b-t}\right|+\beta_i(t-T_{i-1})] \qquad T_{i-1}<t<t_{i1} \qquad \ldots. (6.7)$$

$$Q_i(t)=-(b-t)[(-\alpha_i-\beta_i b)\log\left|\frac{b-t}{b-t_{i2}}\right|+\beta_i(t_{i2}-t)] \qquad t_{i1}<t<t_{i2} \qquad \ldots. (6.8)$$

$$Q_i(t)=(b-t)[(P_i-\alpha_i-\beta_i b)\log\left|\frac{b-t_{i3}}{b-t}\right|+\beta_i(t-t_{i3})] \qquad t_{i2}<t<t_{i3} \qquad \ldots. (6.9)$$

$$Q_i(t)=-(b-t)[(-\alpha_i-\beta_i b)\log\left|\frac{b-t}{b-t_{i5}}\right|+\beta_i(t_{i5}-t)] \qquad t_{i3}<t<t_{i4} \qquad \ldots. (6.10)$$

$$Q_i(t)=\alpha_i t_{i5}+\frac{\beta_i}{2}t_{i5}^{\,2}-(\alpha_i t+\frac{\beta_i}{2}t^2) \qquad t_{i4}<t<t_{i5} \qquad \ldots. (6.11)$$

$$Q_i(t) = (P_i - \alpha_i)(T_i - t_i) - \frac{\beta_i}{2}(T_i - t_i^2) \qquad t_{i5} < t < T_i \qquad \ldots. (6.12)$$

Using the above equations, we have

$$t_{i1} = b - e^{\left[\frac{\{(P_i - \alpha_i - \beta_i b)\log|(b - T_i - 1)| + (\alpha_i + \beta_i b)\log|(b - t_i 2)| + \beta_i(t_i 2 - T_i - 1)\}}{P_i}\right]} \qquad \ldots. (6.13)$$

$$t_{i4} = b - e^{\left[\frac{\{(P_i - \alpha_i - \beta_i b)\log|(b - t_{i3})| + (\alpha_i + \beta_i b)\log|(b - t_{i5})| + \beta_i(t_{i5} - t_{i3})\}}{P_i}\right]} \qquad \ldots. (6.14)$$

$$t_{i6} = \frac{(P_i - \alpha_i)T_i - \frac{\beta_i}{2}T_i^2 + \alpha_i t_{i5} + \frac{\beta_i}{2}t_{i5}^2}{P_i} \qquad \ldots. (6.15)$$

Scenario:

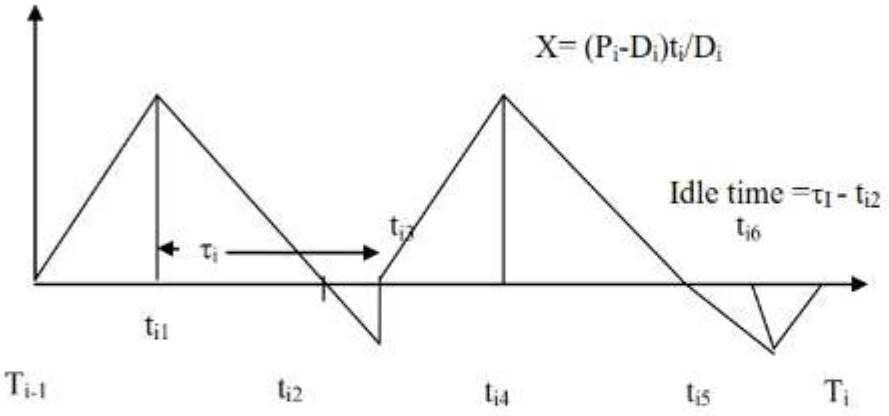

Figure 3: Graphical representation of inventory system

We conclude that the idle times of the management units {B_i, i= 1, 2, 3…..}due to breakdown of the machines {Ai, i=1, 2,3…..} are

$$u_i = \begin{cases} 0, & \text{if } \frac{Q_i(t_i)}{D_i(t_i)} \geq \tau_i \\ \tau_i - \frac{Q_i(t_i)}{D_i(t_i)} & \text{if } \frac{Q_i(t_i)}{D_i(t_i)} < \tau_i \end{cases}$$

6.1 Expected cost per breakdown

The expected cost per breakdown of the machine {A_i, i= 1, 2, 3……} during idle time, is

$$E_{ic}^{\ i} = W_i \int_0^{\infty} \{ \int_{\frac{Q_i(t_i)}{D_i}}^{\infty} (\tau_i - \frac{Q_i(t_i)}{D_i(t_i)})\phi_i(\tau_i)d\tau_i \}\psi_i(t_i)dt_i \qquad \ldots. (6.16)$$

6.2 Expected Shortage cost during idle item

The expected shortage cost for i-th item, during idle item, is

$$E_{sc}^{\ i} = C_S^{\ i} D_i \int_0^{\infty} \{ \int_{\frac{Q_i(t_i)}{D_i}}^{\infty} (\tau_i - \frac{Q_i(t_i)}{D_i(t_i)}) \phi_i(\tau_i) d\tau_i \} \psi_i(t_i) dt_i \quad \ldots. (6.17)$$

Now the total inventory of i-th item is

Inv_i = Inventory during $[T_{i-1}, t_{i1}]$ + Inventory during $[t_{i1}, t_{i2}]$ + Inventory during $[t_{i3}, t_{i4}]$ +Inventory during $[t_{i4}, t_{i5}]$

$$Inv_i = [(P_i - \alpha_i - \beta_i b) \log|b - T_{i-1}| \{ bt_{i1} - \frac{t_{i1}^{\ 2}}{2} - bT_{i-1} - \frac{T_{i-1}^{\ 2}}{2} \} + \frac{(P_i - \alpha_i - \beta_i b)}{2} \{ (b - t_{i1})^2 \log|b - t_{i1}| -$$

$$\frac{(b - t_{i1})^2}{2} (b - T_{i-1})^2 \log|b - T_{i-1}| + \frac{(b - T_{i-1})^2}{2} \} + \beta_i \{ \frac{bt_{i1}^{\ 2}}{2} - bT_{i-1}t_{i1} - \frac{t_{i1}^{\ 3}}{3} + T_{i-1}\frac{t_{i1}^{\ 2}}{2} + \frac{bT_{i-1}^{\ 2}}{2} - \frac{T_{i-1}^{\ 3}}{6} \}]$$

$$+[(\alpha_i + \beta_i b) \log|b - t_{i2}| \{ bt_{i1} - \frac{t_{i1}^{\ 2}}{2} - bt_{i2} - \frac{t_{i2}^{\ 2}}{2} \} + \frac{(\alpha_i + \beta_i b)}{2} \{ (b - t_{i1})^2 \log|b - t_{i1}| - \frac{(b - t_{i1})^2}{2}$$

$$(b - t_{i2})^2 \log|b - t_{i2}| + \frac{(b - t_{i2})^2}{2} \} - \beta_i \{ \frac{bt_{i1}^{\ 2}}{2} - bt_{i2}t_{i1} - \frac{t_{i1}^{\ 3}}{3} + t_{i2}\frac{t_{i1}^{\ 2}}{2} + \frac{bt_{i2}^{\ 2}}{2} - \frac{t_{i2}^{\ 3}}{6} \}]$$

$$+[(P_i - \alpha_i - \beta_i b) \log|b - t_{i3}| \{ bt_{i1} - \frac{t_{i4}^{\ 2}}{2} - bt_{i3} - \frac{t_{i3}^{\ 2}}{2} \} + \frac{(P_i - \alpha_i - \beta_i b)}{2} \{ (b - t_{i4})^2 \log|b - t_{i4}|$$

$$-\frac{(b - t_{i4})^2}{2} (b - t_{i3})^2 \log|b - t_{i3}| + \frac{(b - t_{i3})^2}{2} \} + \beta_i \{ \frac{bt_{i4}^{\ 2}}{2} - bt_{i3}t_{i4} - \frac{t_{i4}^{\ 3}}{3} + t_{i3}\frac{t_{i4}^{\ 2}}{2} + \frac{bt_{i3}^{\ 2}}{2} - \frac{t_{i3}^{\ 3}}{6} \}]$$

$$+[(\alpha_i + \beta_i b) \log|b - t_{i5}| \{ bt_{i4} - \frac{t_{i4}^{\ 2}}{2} - bt_{i5} - \frac{t_{i5}^{\ 2}}{2} \} + \frac{(\alpha_i + \beta_i b)}{2} \{ (b - t_{i4})^2 \log|b - t_{i4}| - \frac{(b - t_{i4})^2}{2}$$

$$(b - t_{i5})^2 \log|b - t_{i5}| + \frac{(b - t_{i5})^2}{2} \} - \beta_i \{ \frac{bt_{i4}^{\ 2}}{2} - bt_{i5}t_{i4} - \frac{t_{i4}^{\ 3}}{3} + t_{i5}\frac{t_{i4}^{\ 2}}{2} + \frac{bt_{i5}^{\ 2}}{2} - \frac{t_{i5}^{\ 3}}{6} \}]$$

…. (9.6.18)

6.3 Expected inventory cost for i-th item

$$E_{ic}^{\ i} = C_h^i \int_0^{\infty} Inv_i(t_i) \psi_i(t_i) dt_i \quad \ldots. (6.19)$$

Now the total shortages of i-th item is

$Short_i$ = Shortages item during $[t_{i5}, t_{i6}]$ + Shortages item during $[t_{i6}, T_i]$

$$= \{ \frac{\alpha_i}{2}(t_{i6}^2 - t_{i5}^2) + \frac{\beta_i}{6}(t_{i6}^3 - t_{i5}^3) - (\alpha_i t_{i5} + \frac{\beta_i}{2} t_{i5}^2)(t_{i5} - t_{i6}) \} + \frac{(P_i - \alpha_i)}{2}(T_i - t_{i6})^2$$

$$-\frac{\beta_i}{2}(\frac{2}{3}T_i^3 - T_i^2 t_{i6} + \frac{t_{i6}^3}{3})$$

…. (6.20)

6.4 Expected Shortages cost during stock out condition

$$E_{Sc}^{\ i} = C_S^{\ i} \int_0^{\infty} short_i(t_i) \psi_i(t_i) dt_i \quad \ldots. (6.21)$$

6.5 Expected production cost

Expected production cost per unit of the item is

$$E_{Pc}^{'} = \int_0^{\infty} P_i(R_i + \frac{G_i}{P_i^{\alpha}} + k_i P_i^{\gamma})\{(t_{i1} - T_{i-1}) + (t_{i4} - t_{i3}) + (T_i - t_{i6})\}\psi_i(t_i)dt_i \quad \ldots. (6.22)$$

Here we consider the density functions are

$$\psi_i(t_i) = \frac{1}{\mu_i} e^{-t_i/\mu_i}, \qquad \phi_i(\tau_i) = \frac{1}{m_i} e^{-\tau_i/m_i}$$

6.6 Expected Total cost

Expected total cost breakdown, including the inventory and shortages cost is,

ETC (P_1, P_2, P_3, ...) = Expected holding cost + Expected cost for idle item + Expected shortage cost + Expected production cost .... (6.23)

For minimization of cost function, differentiating equations (6.23) with respect to P_1,P_2..... The software Mathematica5.2 is used to derive the optimal solution.

When we fuzzify the cost goal, holding cost, production cost, cost for idle item and the shortage cost, we arrive at the following fuzzified net cost function:

7. Fuzzy Modeling

We define a fuzzy non-linear programming problem as:

$$\bar{\text{Max}}\ f\left(x, \bar{C}_0\right) \quad \ldots. (6.24)$$

Subject to

$$f_k\left(x, \tilde{C}_k\right) \le \tilde{b}_k, k = 1,2,.....,m$$

$$x \ge 0 \text{ where } x = (x_1, x_2, ..., x_n)^T \ge 0$$

And $\tilde{C}_0 = \left(\tilde{C}_{01}, \tilde{C}_{02}, ..., \tilde{C}_{0l_0}\right)^T$, $\tilde{C}_r = \left(\tilde{C}_{r1}, \tilde{C}_{r2}, ..., \tilde{C}_{rl_r}\right)^T$

are fuzzy coefficient vectors of f_0 and $f_r\,(r = 1,2,.....,m)$ respectively.

When a parameter is fuzzified, it is represented by a membership function which may be triangular, trapezoidal, parabolic, gauss etc. A membership function (MF) is a curve that defines how each point in the input space is mapped to a membership value (or degree of membership) between 0 and 1. The only condition a membership function must really satisfy is that it must vary between 0 and 1. The

function itself can be an arbitrary curve whose shape we can define as a function that suits us from the point of view of simplicity, convenience, speed, and efficiency.

In our study we have used parabolic MF for the objective function and the constraints.

$$\mu_0\left(f_0(x)\right)=1 \qquad \text{for } f_0(x)\geq b_0$$

$$=1-\left(\frac{b_0-f_0(x)}{a_0}\right)^n \qquad \text{for } b_0-a_0\leq f_0(x)\leq b_0$$

$$=0 \qquad \text{for } f_0(x)\leq b_0-a_0 \qquad \ldots. (6.25)$$

and $\mu_k\left(f_k(x)\right)=1 \qquad \text{for } f_k(x)\leq b_k$

$$=1-\left(\frac{b_k-f_k(x)}{a_k}\right)^n \qquad \text{for } b_k\leq f_k(x)\leq b_k+a_k$$

$$=0 \qquad \text{for } f_k(x)\geq b_k+a_k \qquad \ldots. (6.26)$$

$\bar{C_0}$ is the fuzzy coefficient vector of the objective function f_0. The MF of these fuzzy coefficients $\mu_{C_0}(x)=\left(\mu_{C_{01}}(x),\mu_{C_{02}}(x),.....,\mu_{C_{0j_0}}(x)\right)$, is given by:

$$\mu_{C_{0j}}(x)=1 \qquad \text{for } x\leq A_{0j}$$

$$=1-\left(\frac{x-A_{0j}}{P_{0j}}\right)^n \qquad \text{for } A_{0j}\leq x\leq A_{0j}+P_{0j}$$

$$=0 \qquad \text{for } x\geq A_{0j}+P_{0j} \qquad \ldots. (6.27)$$

The membership function of fuzzy coefficient vector $\bar{C_k}$ of the constraint function $f_k\left(k=1,2,.....,m\right)$ are $\mu_{C_k}(x)=\left(\mu_{C_{k1}}(x),\mu_{C_{k2}}(x),.....,\mu_{C_{kj_k}}(x)\right)$, is

$$\mu_{C_{kj}}(x)=1 \qquad \text{for } x\geq A_{kj}$$

$$=1-\left(\frac{A_{kj}-x}{P_{kj}}\right)^n \qquad \text{for } A_{kj}-P_{kj}\leq x\leq A_{kj}$$

$$=0 \qquad \text{for } x\leq A_{kj}-P_{kj} \qquad \ldots. (6.28)$$

Here 'n' is a natural number whose value may change from one MF to another.

Max α $\ldots. (6.29)$

Subject to

$f_0\left(x,\mu_{C_0}^{-1}(\alpha)\right)\geq\mu_0^{-1}(\alpha),$

$$f_k\left(x,\mu_{C_k}^{-1}(\alpha)\right)\le\mu_k^{-1}(\alpha)\quad(k=1,2,.....,m),\text{ with the conditions, }x\ge 0,\quad\alpha\in[0,1]$$

Where, $\mu_{C_k}^{-1}(x)=\left(\mu_{C_{k1}}^{-1}(x),\mu_{C_{k2}}^{-1}(x),.....,\mu_{C_{kk}}^{-1}(x)\right),\ k=0,1,2,.....,m$

For our fuzzified model defined by equation (6.24), we define MF for different parameters involved as follows, by using $Z,\eta(P_i),C_h^i,C_s^i$ and W_i as the fuzzy goals and z_0,η_0,c_{h0},c_{s0} and w_0 as the tolerances respectively for all MFs:

$$\mu_0(ENP)=1 \qquad \text{for } ENP\ge Z$$

$$=1-\left(\frac{Z-ENP}{z_0}\right)^{n_0} \qquad \text{for } Z-z_0\le ENP\le Z$$

$$=0 \qquad \text{for } ENP\le Z-z_0 \qquad \ldots. (6.30)$$

$$\mu_0(\eta)=1 \qquad \text{for } \eta\ge\eta(P_i)$$

$$=1-\left(\frac{\eta(P_i)-\eta}{\eta_0}\right)^{n_\eta} \qquad \text{for } \eta(P_i)-\eta_0\le\eta\le\eta(P_i)$$

$$=0 \qquad \text{for } \eta\le\eta(P_i)-\eta_0 \qquad \ldots. (6.31)$$

$$\mu_0(C_h^i)=1 \qquad \text{for } c_h\le C_h^i$$

$$=1-\left(\frac{c_h-C_h^i}{c_{h_0}}\right)^{n_h} \qquad \text{for } C_h^i\le c_h\le C_h^i+c_{h0}$$

$$=0 \qquad \text{for } c_h\ge C_h^i+c_{h0} \qquad \ldots. (6.32)$$

$$\mu_0(c_s)=1 \qquad \text{for } c_s\le C_s^i$$

$$=1-\left(\frac{c_s-C_s^i}{c_{s_0}}\right)^{n_s} \qquad \text{for } C_s^i\le c_s\le C_s^i+c_{s0}$$

$$=0 \qquad \text{for } c_s\ge C_s^i+c_{s0} \qquad \ldots. (6.33)$$

$$\mu_0(w)=1 \qquad \text{for } w\le W_i$$

$$=1-\left(\frac{w-W_i}{w_0}\right)^{n_w} \qquad \text{for } W_i\le w\le W_i+w_0$$

$$=0 \qquad \text{for } w\ge W_i+w_0 \qquad \ldots. (6.34)$$

Here, n_0, n_s, n_p, n_l and n_a are positive real numbers. So, now our fuzzy model reduces to the crisp model according as:

Max α .... (6.35)

Subject to

$$ETC(P,\alpha) \geq Z - z_0(1-\alpha)^{1/n_0},$$

where $P \geq 0, \quad \alpha \in [0,1]$

Here, we have:

$$ETC(P,\alpha) = \frac{1}{T_i}\Big[SR(T_2)\left(S - s_0(1-\alpha)^{1/n_s}\right) - PC(T_1)\left(C_p + c_{p0}(1-\alpha)^{1/n_p}\right)$$

$$-HC(T_2)\left(C_l + c_{l0}(1-\alpha)^{1/n_l}\right) - \left(A + a_0(1-\alpha)^{1/n_a}\right)\Big]$$

This is the equivalent crisp problem of our fuzzified system and solving it we may arrive at the optimal solution.

8. Numerical Illustration

The model has been explored numerically as well. There are following data which are used to explain the model, based on the studies in proper unit. We have studied for two items. The following numerical study has been used to find the optimal solution of the multi items production model.

Table 8.1: Values of parameters:

Items no.(i)	W_i	μ_i	m_i	R_i	k_i	G_i	D_i	C_h^i	C_s^i	S_p^i	θ
1	40	8	0.6	0.8	0.02	6.25	200	0.07	3	5	0.03
2	35	8.5	0.5	1.2	0.015	7.50	300	0.08	3.5	6	0.03

We solved the problem numerically with the help of computer software **MATHEMATICA 8.0**

9. Sensitivity Analysis for Model:

In order to study how the parameters effect on the optimal solution of production and the profit, the sensitivity analysis for all parameters has been conducted.

Table 9.1: Variation in Backordering parameter:

N	P	δ	TC	δ	TC	δ	TC	δ	TC	δ	TC
1	25	0.3	5394.65	0.4	5325.76	0.5	5246.32	0.6	5321.96	0.7	5384.46
1	27	0.3	5355.62	0.4	5301.65	0.5	5230.72	0.6	5306.38	0.7	5357.36

1	29	0.3	5326.51	0.4	5279.73	0.5	5216.31	0.6	5285.49	0.7	5317.52
1	31	0.3	5371.44	0.4	5299.29	0.5	5216.31	0.6	5305.73	0.7	5343.62
1	33	0.3	5409.49	0.4	5347.29	0.5	5232.56	0.6	5342.82	0.7	5374.63
2	25	0.3	5221.34	0.4	5145.75	0.5	5112.76	0.6	5189.45	0.7	5264.48
2	27	0.3	5277.45	0.4	5189.65	0.5	5062.34	0.6	5205.55	0.7	5222.44
2	29	0.3	5299.55	0.4	5089.33	0.5	5020.45	0.6	5153.77	0.7	5196.31
2	31	0.3	5333.65	0.4	5147.94	0.5	5072.54	0.6	5199.87	0.7	5240.21
2	33	0.3	5387.39	0.4	5202.66	0.5	5112.43	0.6	5242.66	0.7	5288.66
3	25	0.3	5294.62	0.4	5267.59	0.5	5232.83	0.6	5267.98	0.7	5290.55
3	27	0.3	5288.41	0.4	5234.55	0.5	5199.34	0.6	5226.84	0.7	5259.52
3	29	0.3	5242.02	0.4	5192.52	0.5	5163.55	0.6	5193.97	0.7	5217.11
3	31	0.3	5287.99	0.4	5270.11	0.5	5201.45	0.6	5232.52	0.7	5259.21
3	33	0.3	5344.81	0.4	5316.22	0.5	5234.59	0.6	5272.96	0.7	5299.66
4	25	0.3	5439.62	0.4	5396.53	0.5	5367.89	0.6	5399.88	0.7	5481.65
4	27	0.3	5399.64	0.4	5356.34	0.5	5311.56	0.6	5365.49	0.7	5411.41
4	29	0.3	5367.43	0.4	5309.42	0.5	5264.75	0.6	5304.57	0.7	5375.68
4	31	0.3	5409.89	0.4	5389.52	0.5	5321.33	0.6	5366.99	0.7	5409.98
4	33	0.3	5442.91	0.4	5412.95	0.5	5365.36	0.6	5412.66	0.7	5477.46

9. Observations:

(1) As we increases the value of the backlogging parameter then the total cost firstly decreases and then increases gradually.

(2) On increases the value of number of item the total cost is decreases because as we produced more items in same time that effect the total cost.

(3) As both the parameter increases at the same time total cost is decreases rapidly.

10. Conclusion:

For the first time EMQ model is developed in presence of fuzzy environment under random deterioration. In a competitive market, price of goods plays an important factor. Generally, a

reduced price encourages a customer to buy more. For fitting in with realistic circumstances, the environment of the whole study has been taken as fuzzified. Model is developed in both the environment crisp and imprecise. The reason for adaptation of this model is-(1) the execution of fuzzy random variables as demand and production gives more realistic information where the variable values are indefinite. (2) Incorporation of imprecision and improbability in machine breakdown production process. (3) Capacity constraint is also a realistic situation.

From the analysis of the crisp model it has been observed that

5. The cost of ideal time of management units is indirectly proportional to the production rate and the profit.
6. Mean time of successive breakdowns is reversely proportional to the production rate and the profit.
7. The mean time to repair gives the reverse effect on the production rate and the profit.
8. The backlogging rate is indirectly proportional to the production rate and the profit.

We have many real life situations in which multi items inventories are required. For instance: a pharmacist keeps a number of medicines of different brands, readymade clothes shop keeps dresses of different things in different colors and in different size, shoe store stocks shoes of various models and sizes. The presented model is much more realistic and practical. The present model can be extended to include the delay in payments, inflation, and stochastic demand.

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PERFORMA FOR PROJECT COMPLETION REPORT

To,

Head of Department

Date: 25.08.2020

Name of Department: Mathematics

Name of College: KVSCOS

Findings of the project: (Max-100 words):

From the analysis of the crisp model it has been observed that the cost of idel time of management units is indirectly proportional to the production rate and the profit. and mean time of successive breakdown is reversely proportional to the production rate and the profit.

External Support: By Gyan Vijan Sansthan

Name of PI: Dr. Neha Sarena

Name of the Department: Mathematics

Name of College: KVSCOS

Signature of the P.I.

Title of the Project: Machine breakdown with volume flexibility.

Employee Code of PI:

Duration of the Project:

Registrar
Swami Vivekanand
Subharti University
MEERUT

STUDY OF MENSTRUAL PATTERN CHANGES IN PATIENTS ACCEPTING INJECTION DMPA VERSUS LNG-IUS FOR VARIOUS GYNAECOLOGICAL INDICATIONS

Research Proposal Submitted

By

DR. MAMTA TYAGI

Department of Obstetrics & Gynaecology

INTRODUCTION

The current population of India is 1.3 billion as of 2017, based on the latest United Nations estimates[1]. India population is equivalent to 17.86% of the total world population. India ranks number 2 in the list of countries (and dependencies) by population.The population density in India is 452 per Km^2.The total land area is 2,972,892 Km^2.32.8 % of the population is urban (439,801,466 people in 2017)

The median age in India is 27 years[2].India is projected to be the world's most populous country by 2022[3].It is expected to become the first political entity in history to be home to more than 1.5 billion people by 2030, and its population is set to reach 1.7 billion by 2050[4][5].India adds up to 1,000,000 people to its population every 20 days[6][7][8][9][10]

There are various types of contraceptive methods available in today's world. The common ones are hormonal methods like OCPs, minipills, progesterone only pills, etc. Then there are barrier methods like male & female condoms, etc. We also have injectables like DMPA injection. Then we have emergency contraceptive methods. We also have Intra uterine devices; copper containing and hormonal like LNG IUS. There are permanent methods also like vasectomy & tubectomy.

In 1952, India became the first country in the world to initiate a family planning program[11].The LNG IUS was first approved for medical use in 1990 in Finland and in the United States in 2000[12].It is on the World Health Organization's List of Essential Medicines, the most effective and safe medicines needed in a health system[13].More than 120 countries have approved the device and it is used by more than 10 million women[12][14].

India adopted LNG IUS as contraception in the year 2015.LNG IUS is a T-shaped device with body containing Levonorgestrel (a potent progestin of 19-nortestosterone) 52mg; with a release rate of 20 mcg/24 hours. It lasts for atleast 5 and upto 7 years[15][16].

AIMS & OBJECTIVES

To study the acceptability, efficacy and safety of LNG IUS as a contraceptive method.

MATERIAL AND METHOD

- This is a prospective study which will be conducted in the department of Obstetrics & Gynaecology, Subharti Medical College, Meerut; over a period of two years from 1st September 2017 to 31st August 2019.
- All women along with their relatives coming to department of Obstetrics & gynaecology and willing to know about contraceptive methods for spacing or limiting family size will be offered counselling for contraception. Counselling will be done by cafeteria approach and GATHER method.
- Any woman who will opt for some specific method or brought by her relatives will be again counselled about various available contraceptives. Subjects opting for LNG-IUS as contraceptive method will be enrolled in present study after evaluating them for inclusion & exclusion criteria.
- A didactic approach will be adopted and the women and her family members will be allowed to ask questions and discuss their concerns.
- Patient will be followed for 1 month, 3 month and 6 month interval.

Inclusion criteria:

All women of reproductive age group opting for LNG IUS as contraceptive method.

Exclusion criteria:

	WHO MEC Category
• Pregnancy	4
• Postpartum 48 hours to <4 weeks	3
• Unexplained vaginal bleeding	4
• HIV infection	3
• Cervical cancer	4
• Current breast cancer	4
• Liver tumour	3
• Acute venous thrombosis	3
• Current PID	4
• Sepsis	4

The LNG-IUS will be inserted into the uterine cavity according to the insertion instructions given in annexure 4.

ANNEXURE III

CASE PROFORMA

Subharti Medical College Meerut

Safety, efficacy and acceptability of LNG IUS as contraception

1. Reg No. Name Age Religion
2. Husband's / Father's Name
3. Address
4. Education Wife Husband
5. Occupation Wife Husband
6. Phone: Landline Mobile Email id
5. Menstrual History
   - LMP
   - Duration
   - Interval
   - Flow
   - Pain
   - Passage of Clots

6. Obstetrics History
   - Age at marriage
   - Contraception used between marriage and 1st pregnancy
   - Previous use of any contraceptive: Y/N
   - If yes then specify- Barrier/ IUCD/ OCP
   - H/O of previous abortion - If yes then no. of abortion_____
     Date of last abortion _____
   - Ectopic pregnancy
   - Number of living issues

7. Past history of
   - Any bleeding disorder
   - Jaundice

8. Systemic Examination CNS CVS RS P/A

9. General & Local Examination

	1st visit (1 month)	2nd visit (3 month)	3rd visit (6 month)
H/o expulsion			
G/E			
P/S			
P/V			
Any complaint			
Menstrual history			
Investigation:			
Hb			
USG (if strings not visible)			
UPT (if overdue)			

ANNEXURE IV

LNG IUS insertion technique:

STEP 1: Put new/ clean examination or high-level disinfected surgical gloves on both hands.
STEP 2: Prepare the client
STEP 3: Gently grasp the tenaculum and apply gentle traction.
STEP 4: Carefully insert the loaded IUS.
STEP 5: Gently advance the loaded IUS into the uterine cavity, and stop when the blue depth-gauge comes in contact with the cervix or slight resistance is felt.
STEP 6: Hold the tenaculum and white plunger rod stationary, while partially withdrawing the insertion tube.
STEP 7: Remove the white plunger rod, while holding the insertion tube stationary.
STEP 8: Gently push insertion tube until you feel a slight resistance.
STEP 9: Use high-level disinfected (or sterile) sharp Mayo scissors to cut the IUS strings at 3 to 4 cm.
STEP 10: Gently remove the tenaculum.
STEP 11: Examine the woman's cervix for bleeding.
STEP 12: Gently remove the speculum.
STEP 13: Allow the woman to rest.

PERFORMA FOR PROJECT COMPLETION REPORT

To,

Date: 11/11/2021

Head of Department Dr. Mamta Tyagi

Name of Department: Department of Obstetrics & gynaecology

Name of College: Subharti Medical College

Findings of the project: (Max-100 words): In women with heavy menstrual bleeding the LNG-IUS results in greater reduction in menstrual blood loss & a higher likelihood of treatment success than with Medroxyprogesterone acetate. Once all complications were reported more in LNG-IUS was compared to group with injectable DMPA.

External Support: Younker Buddhist Society and Research Foundation —

Name of PI: Dr. Mamta Tyagi

Name of the Department: Department of Obstetrics & gynaecology

Name of College: Subharti Medical College

Title of the Project: Study of menstrual pattern changes in patients accepting Injection DMPA versus LNG-IUS for various gynaecological indications.

Duration of the Project: 2 years.

Employee Code

Signature of P.I.

Registrar
Swami Vivekanand
Subharti University
MEERUT

CLINICAL UTILITY OF BREAST ULTRASOUND AS AN ADJUNCT TO MAMMOGRAPHY IN SCREENING AND DIAGNOSTIC IMAGING

Research Proposal Submitted

By

Dr. MUKTA MITAL

Dept of Radio diagnosis & Imaging

INTRODUCTION

: _— . _:aphy (also called mastography) is the process of using low-energy X-rays (usually _r a 1 kVp) to examine the human breast for diagnosis and screening. The goal of ruur. _ graphy is the early detection of breast cancer, typically through detection of -.ajrarer.src masses or microcalcifications which cannot be delineated by clinical a _L— ir on or other imaging modalities

_ - - : graphy is the most sensitive mode of breast imaging.

т. igraphy has been proven in randomized controlled trials to be a sensitive screening the detection of early breast cancer [1, 2]. The reported sensitivity of screening t: graph)' varies from 65% [3] to 91% [4], One of the various factors leading to false. _. . findings on mammography is the effect of breast density [5, 6], Furthermore, breast

- i ' t r on mammography is also associated with increased risk of breast cancer [7,- • larmography is an imperfect tool and is not equally effective in all women, overall -jtu-.it>- of mammography for detection of breast cancer is 85%.However in women with ti* f r rreast tissue sensitivity of mammography is reduced to 47.8-64.4%. [9]

Frees: ultrasound (US) has been suggested to supplement mammography screening of rer with dense breasts, because of its improved ability to detect cancer in dense breast — us. .ack of associated ionizing radiation exposure, and its wide availability. Currently, > is used primarily in the diagnostic setting to evaluate specific findings identified by

- - , examination or mammography. It is less widely used as a screening test in women

Jr a: high-risk for developing breast cancer and cannot tolerate an MRI, and to date is

- Tru _=r.f y used to screen women at average risk. [10].

- - -leaky, use of breast ultrasound was limited to differentiating cysts from solid masses

■ oman with a palpable lump corresponding to a clearly benign finding at targeted u raj :ri such as simple cyst, nonpathologic lymph node, lipoma, sebaceous cyst, clustered

- rr -. rj. or duct ectasia, can safely undergo clinical follow-up without short-interval

- . fallow-up, needle aspiration, or biopsy. Most palpable masses associated with ._ - and lactation are benign. Fibroadenomas are the most common solid masses in . amen and can grow in response to increased estrogen levels during pregnancy.-mm . : r.s such as galactoceles and lactating adenomas may occur in lactating women,

me rreast abscesses are also potential complications of breast-feeding [34],

mu breast cancer, defined as malignancy occurring during pregnancy, lactation, or ear postpartum, occurs in approximately 1 in every 3000 pregnancies [35]. A : mass is the most common presenting symptom in women with gestational breast u m . m J-r.37]. Thus, pregnant and lactating women with a palpable lump should be * yured promptly.

7 _ru; : _ ultrasound should be the primary imaging study and has been reported to have high : 100%) in the detection of symptomatic gestational breast cancer. Mammographic i~iu .. vsity reporting is an important national issue. As of February 2014, 14 states have -u mms requiring that women be directly notified if they have dense breast tissue on a u mammogram, and similar federal legislation has been proposed.[1 l-13]Proponents - density reporting legislation note that many women do not know their breast density ***m*** ur_: uense breasts are associated with an increased risk of breast cancer, and that dense :ssue can mask breast cancers resulting in false negative mammographic r _n_nu:ions.[14]

-: graphic breast density is categorized into one of four density categories according to eh can College of Radiology (ACR) Breast Imaging Reporting and Data System (BI- i almost entirely fatty, scattered areas of fibroglandular density, heterogeneously um . ur.d extremely dense; [15] Arrrr: \ innately 47% of women undergoing screening mammography have : graphically dense breasts. [16] As more women begin to receive density notification many will be turning to their healthcare providers for additional information to guide fee dec mens regarding supplemental breast cancer, screening.

Er uernm:logical studies have identified many risk factors that increase the chance for a develop breast cancer. Important risk factors for female breast cancer include early _. . : met of menarche, late age at onset of menopause, a first full-term pregnancy after the : 1 years, a history of premenopausal breast cancer for a mother and a sister, and a history' of breast cancer or benign proliferative breast disease. Obesity, nulliparity, a' _ m:m residence. There are 2 types of mammography examinations: screening and _ _ur Screening mammography is done in asymptomatic women. Early detection of cancers by screening mammography greatly improves a woman's chances for :i' _ ireatment. Screening mammography is recommended every 1-2 years for women reach 40 years of age and every year once they reach 50 years of age. In some a.- physicians may recommend beginning screening mammography before age 40 if - m has a strong family history of breast cancer. Studies have shown that regular : crams may decrease the risk of late-stage breast cancer in women 80 years of age and _ f'. Diagnostic mammography is performed in symptomatic women, when a breast ample discharge is found during self-examination or an abnormality is found during _ mammography. Diagnostic mammography is more involved and time-consuming : men mg mammography and is used to determine exact size and location of breast malkies and to image the surrounding tissue and lymph nodes. Mammography is known

n . - _ ; a certain false-negative rates. According to data from the Breast Cancer Detection l —: vs'.ration Project, the false-negative rate of mammography is approximately 8-10%. Arrr: ximately 1-3% of women wdth a clinically suspicious abnormality, a negative - a—: gram, and a negative sonogram may still have breast cancer. Possible causes for

■ —a breast cancers include dense parenchyma obscuring a lesion, poor positioning or e. perception error, incorrect interpretation of a suspect finding, subtle features of

~.a gnancy. and slow growth of a lesion. [19], Ultrasonography has been playing an rcreasingly important role in the evaluation of breast cancer. Breast ultrasound is the • . -,e method in

the case of a symptomatic patient, after clinical examination. In the case

_ Tztient without symptoms, breast ultrasound is ascribed a higher sensitivity for detecting rr-eas: .ancer in women with dense breast tissue, women under the age of 50 and high-risk r.er Many specific indications for breast US have been enumerated, including: evaluation

■ : r _ gable mass incompletely evaluated at mammography; differentiation of a cyst from a - a: a ale: evaluation of palpable lesions wdth associated mammographic asymmetry, no

--ET— graphic findings, the presence of implants, or a history of lumpectomy or -nr: erneetomy. M ammo graphically occult cancers can be detected by ultrasound in 10 to 40 : me cases depending on the patient's breast density and age [20-22].

AIMS AND OBJECTIVE

- . : determine the value of ultrasonography as an adjunct to mammography for maracterising breast lesions (palpable and non palpable)
- Comparative accuracy in monitoring existing benign breast lumps ,assessing symptoms such as breast pain, redness, swelling, skin changes ,axillary

mphadenopathy and their follow up.

- To assess the comparative effectiveness of mammography in combination with breast ultrasonography versus mammography alone for breast cancer screening for women at average risk of breast cancer.
- To determine which is more accurate imaging test mammography or ultrasound for diagnosis of breast cancer based on the women's age and breast density.
- To determine the contribution of mammography followed by sonography for detection of non palpable breast cancers.

MATERIALS AND METHODS

- To each patient, detailed history was taken including: Age at first childbearing, age at menarche, age at menopause, history of breastfeeding, number of children, history of hormone therapy, a history of pre-menopausal breast cancer for a mother and a sister, a personal history of breast cancer or benign proliferative breast disease, radiation, chemical exposure and smoking.

Analysis in detail

- The protocol of diagnosis consisted of clinical breast examination, ultrasound, mammography and histopathological examination.fnac/biopsy(if required)
- Physical examination

- Clinical breast examination of the whole breasts and axillary's regions was performed with the patient in the sitting position with arms both lowered and raised. In an upright position, we visually inspects the breasts, noting asymmetry, nipple discharge, obvious masses, and skin changes, such as dimpling, inflammation, rashes, and unilateral nipple retraction or inversion. With the patient supine and one arm raised, we thoroughly palpate breast tissue, axillary's region and supraclavicular area, assessing the size, texture, and location of any masses. After the patient history is obtained and the clinical breast examination is performed, the next diagnostic step was mammography, ultrasound and biopsy.

Inclusion **criteria -**

- Patients aged 30-75 years
- Asymptomatic patient come for breast screening.
- Symptomatic patient with breast lump.
- Patient aged 30-75 years with symptoms as pain heaviness , nipple discharge ,skin changes, risk factors like early age of menarche ,late menopause, history of radiation :c the chest in childhood.

- Patient with positive personal and family history of benign and malignant breast c..-eases (mother and 1st degree relatives),Asymptomatic women with dense breast [BI-RADS] DENSITY CATEGORY 3 OR 4
- Women with breast implants.

Exclusion criteria-

- Patient <30 years of age
- Pregnant females
- Patient not willing for investigation
- Male breast

Mammography

Conventional film-screen mammography was performed with at least two views per breast, medio-lateral oblique and cranio-caudal views. Additional views or spot compression views were obtained where appropriate. Mammograms were obtained with dedicated mammography units.Patient younger than 30 years were excluded because mammography' was not performed in this age group. Mammograms were interpreted according to the Breast Imaging Reporting and Data system (Bl-RADS)diagnostic categories on a five-point scale, with BI-RADS 1 (negative), 2 (benign finding), 3 (probably benign), 4 (suspicious abnormality), and 5 (highly suggestive of malignancy). Breast density grades were also determined according to the BI-RADS on a scale of 1-4, with 4 corresponding to a dense breast, 3 to a heterogeneous breast, 2 to scattered fibro glandular densities and 1 to an almost entirely fat breast.

- Breast Ultrasound

Ultrasound examinations were performed using a high-resolution unit (Saamsung Medison Diagnostic Ultrasound System HS-50 AND HS 70) with a linear array probe centred at 7, 5 MHz. All ultrasound examinations were performed with the patient in a supine position for the medial parts of the breast and in a contra lateral posterior oblique position with arms raised for

the lateral parts of the breast. The whole breasts were scanned. Diagnoses were scored on a five-point scale identical to the mammographic B 1-RADS categories .

- Histopathological examination /FNAC/BIOPSY if required Therapy

Treatment of patient with breast cancer was based on a multimodality approach combining surgery, radiation therapy hormonal therapy and/or chemotherapy. Treatment is tailored for an individual patient based on tumor size, axillary lymph node involvement, estrogens and progesterone status, histo-logic tumour type, standardized pathologic grade, and menopausal status. Lumpectomy or wide local excision was performed for patient with benign tumour.

Statistical analysis

x2 test, and student t-test were used for statistical data processing. The significance of differences observed was assessed using Pearson's chi-square test, with $p<0,01$ considering to be statistically significant.

PERFORMA FOR PROJECT COMPLETION REPORT

To,

Date: 11/11/2024

Head of Department

Name of Department: Department of Radio-diagnosis

Name of College: Subharti Medical College, Meerut

Findings of the project: (Max-100 words): USG found more sensitive in identifying smaller lesions particularly benign lesions & infection, Abscesses. Mammography found to be more sensitive in identifying larger lesions. USG more sensitive for heterogeneously dense breast (category C & D) in younger patients. Mammography more sensitive in older patients with fatty breast. USG more sensitive in identifying axillary lymph nodes.

External Support: Younker Buddhist Society and Research foundation

Name of PI: Dr. Mukta Mittal

Name of the Department: Department of Radio-diagnosis

Name of College: Subharti Medical College Meerut.

Title of the Project: Clinical utility of Breast ultrasound As an adjunct Imaging to Screening & Diagnostic Imaging.

Duration of the Project: 1 year

Registrar
Swami Vivekanand
Subharti University
MEERUT

An Imperfect Production Process with Variable holding Cost and Stochastic demand for Imprecise System

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Dated: 24.10.2019

Project title: An Imperfect Production Process with Variable holding Cost and Stochastic demand for Imprecise System

Principal Investigator: Dr. Neha Saxena, Assistant Professor, Department of Mathematics, Keral Verma Subharti College of Science, Swami Vivekanad Subharti University, Meerut

Collaboration:

Objective of the project: In this project, we have fabricated a supply chain inventory system for deteriorating items with stochastic demand and multi items. In affluent countries, people are more interested about the quality of an item irrespective to its price structure. Taking this fact into consideration, we have considered the imperfectness in production process. Budget constraint is taken to be stochastic and imprecise in nature. We developed model with variable holding cost and shortage cost and production are fuzzified. The model has also been exemplified numerically with sensitivity analysis and it has proved itself financially viable also.

Outcome of the project: In real world, defective products cannot be avoided in some production processes. This project highlights the situation of imperfect production process with crisp and fuzzy environment under stochastic constraint. Numerical illustration is given to show the optimality of the model. From the sensitivity analysis we can say that as the numbers of deliveries amplify, the profit also increases. The profit is highly sensitive towards total number of units which are produce. Managers can control the situation of excess of stock and no stock by using the volume flexibility in their production process. Manufacturing firms also controlled their material cost and selling price because they are highly sensitive. Inspection is an essential part of the production process they cannot ignore it. We investigated the model with variable holding cost whose idiom is depending on time.

An Imperfect Production Process with Variable holding Cost and Stochastic demand for Imprecise System

Abstract

In this project, we have fabricated a supply chain inventory system for deteriorating items with stochastic demand and multi items. In affluent countries, people are more interested about the quality of an item irrespective to its price structure. Taking this fact into consideration, we have considered the imperfectness in production process. Budget constraint is taken to be stochastic and imprecise in nature. We developed model with variable holding cost and shortage cost and production are fuzzified. The model has also been exemplified numerically with sensitivity analysis and it has proved itself financially viable also.

1. Introduction:

Most of the models have been originated in static environment making an allowance for demand rates which were constant. This kind of a demand rate had the simple and the only advantage to provide plainness to the study. But in reality demand is uncertain; we can't find the exact demand. So, stochastic demand rate is a better choice and very in close proximity to reality. Keeping an inventory for future sale or use is very common phenomenon in business. Generally, retail firms, wholesalers, manufacturing companies and even blood banks have a stock of goods on hand. But because of uncertain demand stock being insufficient, the customer may prefer some other brands as a result; the shortages will fetch loss to the producer. Stock out becomes an inevitable aspect in certain situations and businessmen have to seldom face the unwanted situation of customer dissatisfaction. This situation motivates the researchers to study about it. On one hand it is considered as a negative aspect if a businessman runs out of stock and cannot fulfill the demand of the customers but on the other hand as a matter of fact in most of the cases this stock out situation may prove profitable for the businessman. This is because, even the unavailability of the stock puts a lost sale cost on the businessman, the backlogging of demand allows him to order a larger lot size and hence allows for a larger cycle inventory and reduces cost for him. Hence, we developed the inventory model with stochastic demand and shortages.

Many researchers have developed a series of theories to find the optimal order policy so that the relevant total cost (or profit) has a minimum (or maximum) value in the classical (crisp) inventory

models. However, most of the earlier proposed methods had assumed that all the associated cost parameters and relevant data are exactly known and fixed. Furthermore, in practice, those assumptions are unrealistic and are generally vague and imprecise. Thus, there are uncertainties in real world such as inventory costs usually exist with imprecise components. When uncertainty become a matter of debate, conventional approaches to treating uncertainty in inventory control focuses on probability theory. In this case, customer demand as one of the key parameters and source of uncertainty has been most often treated by a probability distribution. However, the probability-based approaches may not be sufficient enough to reflect all uncertainties that may arise in a real world inventory system. Modelers may face some difficulties while trying to build a valid model of an inventory system in which the related costs cannot be determined precisely. For example, costs may be dependent on some foreign monetary unit. In such a case, due to the change in the exchange rates, the costs are often not known precisely. Another source of uncertainty may arise because of the difficulty of determining exact cost components. In some cases trying to determine the precise values of such cost components may be very difficult and costly, if not impossible.

In 1965, the first publication in fuzzy set theory by **Zadeh (1965)** showed the intention to accommodate uncertainty in the non-stochastic sense. **Zimmermann (1985)** developed a tolerance approach to transform a fuzzy decision making problem to a regular crisp optimization problem and showed that it can be solved to obtain a unique exact optimal solution with highest membership degree using classical optimization algorithms. **Padmanabhan** and **Vrat (1990)** formulated an inventory problem of deteriorating items with two objectives: minimization of total average cost and wastage cost in crisp environment. **Goyal (1991)** discussed a procedure for determining the economic manufacturing policy for a product and the economic ordering policy for the raw materials required by the product. The demand for the product was constant over time and shortages were not permitted. **Srinivasan** and **Lee (1996)** developed a manufacturing model when the demand rate was taken as variable, processing time follows an arbitrary probability distribution. **Roy** and **Maiti (1998)** formulated an inventory problem of deteriorating items with two objectives, namely, maximizing total average profit and minimizing total cost in fuzzy model. **Yao** and **Wu (1999)** and **Dey** *et al.* **(2005)** have considered the production model with fuzzy environment. **Goyal** and **Giri (2003)** developed the production–inventory problem in which the demand, production and deterioration rates of a product were assumed to vary with time. **Singh** and **Diksha (2008)** developed an inventory model for decaying items with variable demand and variable holding cost. They have considered the crisp environment. **Maity** and **Maiti (2008)** developed the optimal production policy for an inventory control system of deteriorating items in fuzzy environment. Here, the deterioration of the items and depreciation of sales were at a constant rate. **Singh** and **Singh (2008)** considered the fuzzy

inventory model for finite rate of replenishment using signed distance method. **Chakraborty, Giri** and **Chaudhuri (2008)** presented a generalized economic manufacturing quantity model for an unreliable production system in which the production facility may shift from an 'in-control' state to an 'out-of-control' state at any random time and may ultimately break down afterwards. **Chakraborty, Giri,** and **Chaudhuri (2009)** developed a production inventory system for deteriorating items in which the production facility may not only shift from an 'in-control' state to an 'out-of-control' state. **Singh** and **Urvashi (2009)** developed an integrated production model with imperfect production process with stochastic demand rate. They considered the manufacturing system of stochastically imperfect items with continuous stochastic demand under budget and shortage constraints.

Most of the researchers have considered either single item inventory model with crisp parameter or single item inventory model with fuzzy parameter and capacity constraints. In the past researchers pay no or less attention towards the coordination of the factor of imperfect production, stochastic demand, capacity constraints, volume flexibility and fuzzy environment with multi items in supply chain environment. It is very much realistic condition for business environment. Therefore, this entire concept has been developed simultaneously in our model.

2. Assumptions and Notations:

The proposed inventory model is developed under the following assumptions and notations:

2.1 Assumptions:

Assumptions used in model are shown below:

(i) The inventory system is an imperfect production system.

(ii) This is a single period inventory model.

(iii) Production rate is finite and flexible.

(iv) Production cost is taken to be a function of production rate.

(v) Total demand over the period of cycle is stochastic and uniform over time.

(vi) Percentage of imperfectness is stochastic.

(vii) Shortages are permitted and partially back-logged.

(viii) Fuzzification of budget constraint is considered.

2.2 Notations:

The inventory system involves n items and for i-th item (i= 1, 2…, n) following notations are used:

(i) A_i's, B_i's and R_i's are constants in the density function $f_i(x_i)$ where

$$f_i(x_i) = A_i + B_i x_i, \qquad 0 \le x_i \le R_i$$

$$0; \qquad \text{elsewhere}$$

(ii) b_i's and d_i's are constants in the density function $g_i(e_i)$ where

$$g_i(e_i) = \begin{cases} d_i, & 0 \le e_i \le b_i \\ 0; & \text{elsewhere:} \end{cases}$$

(iii) B, $\hat{B}$ are maximum budget (total production cost and screening cost) which are considered as stochastic and fuzzy respectively.

(iv) C_{1i} is holding cost per unit item per unit time for producer.

(v) C_{pi} is production cost per unit; $\hat{C}_{pi}$ being the fuzzy value of C_{pi}.

(vi) C_{si} is shortage cost per unit item; $\hat{C}_{si}$ being the fuzzy value of Csi.

(vii) e_i is rate of imperfect units.

(viii) $EAP_m(Q_1, Q_2, \ldots\ldots, Q_n, t_{3i})$ is total expected average profit of producer.

(ix) E (B), $E(S_M)$ is expectations of the random variables B, S_M, respectively.

(x) EP_{mi} is the Expected profit for i-th item of producer.

(xi) $f_i(x_i)$ is probability density function of the demand x_i $(0 < x_i < \infty)$.

(xii) $g_i(e_i)$ is probability density function for the rate of defective units e_i.

(xiii) K_i is selling price per unit item of imperfect quality.

(xiv) L_i is salvage value per unit.

(xv) P_i is production rate per unit time.

(xvi) P_{ii} is production rate of good (perfect) units which satisfies the relation $P_{ii} = (1 - e_i) P_i$

(xvii) $q_i(t)$ is on hand inventory at time $t \ge 0$.

(xviii) Q_i is total production.

(xix) Q_{ii} is total production of good units which satisfies the relation $Q_{ii} = (1 - e_i) Q_i$.

(xx) Q_{si} is the shortage amount.

(xxi) r_i's are probabilities, i = 1,. . . ,k.

(xxii) S_c is screening cost per unit item.

(xxiii) S_i is selling price per unit item of good quality.

(xxiv) S_M, $\hat{S}_M$ are maximum shortage cost allowed which are considered as stochastic and fuzzy respectively.

(xxv) t_{1i} is the production time.

(xxvi) t_{2i} is the time after which shortages occur in the retailer's model.

(xxvii) T_i is fixed duration of the cycle.

(xxviii) x_i is total demand over time period $(0, T_i)$, which is stochastic.

(xxix) $\phi(r_i)$ is a real number, where $\int_{\phi(r_i)}^{\infty} \phi(t)dt = r_i, \phi(t)$ being the standard normal density function, i = 1,. . . ,k.

(xxx) η_1 is possibility/necessity of the budget constraint; same notation is being used in different models with different values in general.

(xxxi) η_2 is possibility/necessity of the shortage constraint, same notation is being used in different models with different values in general.

(xxxii) $\sigma(B)$, $\sigma(S_M)$ are standard deviation of the random variables B, S_M respectively.

(xxxiii) C_{2i} is holding cost per unit item per unit time for producer.

(xxxiv) C_{lsi} is lost sale cost per unit item.

3. Mathematical Formulation and Analysis:-

3.1. Producer model:

The production cycle begins with zero-inventory and starts at $t = 0$. Production is stopped at time $t = t_{i1}$. In the interval $(0, t_{i1})$, the inventories of perfect quality items and imperfect quality items pile up separately after meeting their demands. The inventories of perfect quality items and imperfect quality items fall to the zero level at the end $t = T_i$. Therefore, the governing equations of this model are

$$Q_i'(t) + \theta Q_i(t) = (1-e_i)P_i - \frac{x_i}{T_i}, \quad 0 \le t \le t_{1i} \qquad \ldots (1)$$

$$Q_i'(t) + \theta Q_i(t) = -\frac{x_i}{T_i}, \quad t_{1i} \le t \le T_i \qquad \ldots (2)$$

With boundary conditions $Q_i(0) = 0$, $Q_i(T_i) = 0$

Solution of the above equations are given below

$$Q_i(t) = \frac{1}{\theta}(P_{ii} - \frac{x_i}{T_i})(1 - e^{-\theta t}), \quad 0 \le t \le t_{1i} \qquad \ldots (3)$$

$$Q_i(t) = \frac{P_{ii}t_{1i}e^{\theta(T_i - t)}}{\theta T_i} - \frac{x_i}{\theta T_i}, \quad t_{1i} \le t \le T_i \qquad \ldots (4)$$

Where $P_{ii} = (1-e_i)\, P_i$

Since shortages do not occur, we must have $Q_i(T_i) \ge 0$

$$\frac{P_{ii}t_{1i}e^{\theta(T_i - t)}}{\theta T_i} - \frac{x_i}{\theta T_i} \ge 0$$

$x_i \leq P_{ii} t_{1i}$ ... (5)

Now by the notations $Q_i = P_i t_{1i}$ and $Q_{ii} = P_{ii}\, t_{1i}$

3.2. Expected holding cost for non-defective units of i-th item:-

$$\text{H.C.} = \int_0^1 [\int_0^{Q_{ii}} \{\int_0^{t_{1i}} (C_1 + \alpha t)\{\frac{1}{\theta}(P_{ii} - \frac{x_i}{T_i})(1 - e^{-\theta t})\} dt$$

$$+ \int_{t_{1i}}^{T_i} \left(\frac{P_{ii} t_{1i} e^{\theta(T_i - t)}}{\theta T_i} - \frac{x_i}{T_i} \right) (C_1 + \alpha t)\ dt\} f_i(x_i) dx_i\ ] g_i(e_i) de_i$$

$$\text{H.C.} = C_{1i} \int_0^1 [\int_0^{Q_{ii}} \{\tfrac{1}{\theta}(P_{ii} - \frac{x_i}{T_i})(\frac{e^{-\theta t_{1i}} - 1}{\theta} + t_{1i}) + (\frac{P_{ii} t_{1i}}{\theta T_i})(\frac{e^{-\theta T_i} - 1}{\theta})$$

$$- \frac{x_i}{\theta T_i}(T_i - t_{1i})\} f_i(x_i) dx_i] g_i(e_i) de_i + \alpha \int_0^1 \int_0^{Q_{ii}} [\{\frac{1}{\theta}(P_{ii} - \frac{x_i}{\theta T_i}) \frac{t_{1i} e^{-\theta t_{1i}}}{\theta} (\frac{t_{1i}^2}{2}$$

$$+ \frac{e^{-\theta t_{1i}} - 1}{\theta^2}) + \frac{P_{ii} t_{1i}}{\theta T_i}(-\frac{Ti}{\theta} + \frac{t_{1i} e^{-\theta(Ti - t_{1i})}}{\theta} + \frac{e^{-\theta(Ti - t_{1i})} - 1}{\theta^2})\} f_i(x_i) dx_i\ ] g_i(e_i) de_i$$

... (6)

3.3. Expected holding cost for defective units of i-th item:-

$$\text{H.C.} = \int_0^1 \int_0^{t_{1i}} [(C_{1i} + \alpha t) e_i P_i] g_i(e_i) de_i$$

$$= C_{1i} \int_0^1 \frac{e_i Q_i^2}{2P_i} g_i(e_i) de_i + \alpha \int_0^1 \frac{e_i Q_i^3}{3P_i} g_i(e_i) de_i \quad \ldots (7)$$

Where $Q_i = P_i\, t_{1i}$

3.4. Salvage value of the system:-

$$\text{S.V.} = L_i \int_0^1 \{\int_0^{Q_{ii}} (Q_{ii} - x_i) f_i(x_i) dx_i\} g_i(e_i) de_i \quad \ldots (8)$$

3.5. Screening cost of the system:-

$$\text{S.C.} = S_c\, P_i\, t_{1i} = S_c\, Q_i \quad \ldots . (9)$$

3.6. Production cost of the system:-

$$\text{P.C.} = C_{pi}\, P_i \quad \ldots (10)$$

3.7. Revenue from the sales of perfect units:-

$$\text{S.R.} = S_i \int_0^1 \{ \int_0^{Q_i} x_i f_i(x_i) dx_i \} g_i(e_i) de_i \qquad \ldots. (11)$$

3.8. Revenue from the sales of imperfect units:-

$$\text{S.R.} = k_i Q_i \int_0^1 \{ e_i g_i(e_i) de_i \} \qquad \ldots. (12)$$

Expected Profit for i-th item (E P_{mi}) = Revenue from the sales of perfect units+ Revenue from the sales of imperfect units- holding cost for non-defective units - holding cost for defective units- Screening cost-Production cost

$$\ldots. (13)$$

3.9. Total expected average profit for all items:-

$$EAP_m (Q_1, Q_2, \ldots\ldots, Q_n) = \sum_{i=1}^{n} \frac{1}{T_i} EP_{mi} \qquad \ldots. (14)$$

3.10. Retailer's model:

3.10.1. Case1: When shortages do not occur:

The inventory level $q_i(t)$ governed by the differential equations, i = 1,2, . . . ,n.

$$Q_i'(t) + \theta Q_i(t) = -\frac{x_i}{T_i}, \qquad 0 \le t \le \frac{T_i}{k} \qquad \ldots. (15)$$

With boundary condition $Q_i(\frac{T_i}{k}) = 0$

Solution of the above equation is

$$Q_i(t) = \frac{x_i}{\theta T_i}(e^{\theta(\frac{T_i}{k} - t)} - 1), \qquad \ldots (16)$$

Expected holding cost for the system is given as

$$\text{H.C.} = \int_0^1 [\int_0^{Q_i} \{ \int_0^{T_i/k} (C_{2i} + \alpha t) Q_i(t) dt \} f_i(x_i) dx_i] g_i(e_i) de_i \qquad \ldots. (17)$$

3.10.2. Case-II: When shortages occur:

The governing differential equations are

$$Q_i'(t) + \theta Q_i(t) = -\frac{x_i}{T_i}, \qquad 0 \le t \le t_{2i} \qquad \ldots. (18)$$

$$Q_i'(t) = -\frac{e^{-\delta t} x_i}{T_i}, \qquad t_{2i} \le t \le \frac{Ti}{k} \qquad \ldots. (19)$$

With boundary condition $Q_i(t_{2i}) = 0$

Solution of the above equations are given as

$$Q_i(t) = \frac{x_i}{\theta T_i}(e^{\theta(t_{2i}-t)} - 1), \qquad 0 \le t \le t_{2i} \qquad \ldots. (20)$$

$$Q_i(t) = \frac{x_i}{\delta T_i}(e^{-\delta t} - e^{-\delta t_{2i}}), \qquad t_{2i} \le t \le \frac{Ti}{k} \qquad \ldots. (21)$$

3.11. Expected holding cost for the system:-

$$H.C. = \int_0^1 [\int_{Q_{ii}}^{\infty} \{\int_0^{t_{2i}} (C_{2i} + \alpha t) Q_i(t) dt\} f_i(x_i) dx_i] g_i(e_i) de_i \qquad \ldots. (22)$$

3.12. Expected Shortage cost for the i-th item:-

$$S.C. = C_{si}\, Q_{si}$$

$$S.C. = C_{si} \int_0^1 [\int_{Q_{ii}}^{\infty} \int_{t_{2i}}^{\frac{Ti}{k}} \{-Q_i(t)\} f_i(x_i) dx_i] g_i(e_i) de_i \qquad \ldots. (23)$$

$$\text{Where } Q_{si} = \int_0^1 [\int_{Q_{ii}}^{\infty} \int_{t_{2i}}^{\frac{Ti}{k}} \{-Q_i(t)\} f_i(x_i) dx_i] g_i(e_i) de_i$$

3.13. Expected lost sale cost for the i-th item:-

$$L.S.C. = C_{Lsi} \int_0^1 [\int_{Q_{ii}}^{\infty} \int_{t_{2i}}^{\frac{Ti}{k}} \frac{x_i}{T_i} \{1 - e^{-\delta t}\} f_i(x_i) dx_i] g_i(e_i) de_i \qquad \ldots. (24)$$

3.14. Sales Revenue for the i-th item:-

$$S.R. = S_i \int_0^1 \{\int_0^{Q_{ii}} x_i f_i(x_i) dx_i + Q_{ii} \int_{Q_{ii}}^{\infty} f_i(x_i) dx_i\} g_i(e_i) de_i \qquad \ldots. (25)$$

3.15. Expected Profit for i-th item of the retailer:-

$(E\ P_{ri})$ =Sales Revenue - holding cost – shortage cost- lost sale cost …. (26)

Hence for all items total expected average profit is given as

$$EAP_r(Q_1, Q_2, \ldots\ldots, Q_n, t_{2i}) = \sum_{i=1}^{n} \frac{1}{T_i} EP_{ri} \qquad \ldots. (27)$$

3.16. Total expected average profit for the whole supply chain system:-

$$EAP(Q_1, Q_2, \ldots\ldots, Q_n, t_{2i}) = \sum_{i=1}^{n} \frac{1}{T_i}(EP_{ri} + EP_{mi}) \qquad \ldots.(28)$$

Now, we have to maximize the profit function:

Max EAP ($Q_1, Q_2, \ldots\ldots, Q_n, t_{2i}$)

Subject to

$$\sum_{i=1}^{n}(C_{pi}+S_c)Q_i \le B$$

And $$\sum_{i=1}^{n} C_{si}Q_{si} \le S_M \qquad \ldots. (29)$$

We now study the general problem by considering linear density functions for the demand 'x'and for e_i, the percentage of defective units in item Q_i.

We consider the density functions for demand as linear i.e.

$$f_i(x_i) = A_i + B_i x_i, \qquad 0 \le x_i \le R_i$$

$$0; \qquad \text{elsewhere} \qquad \ldots. (30)$$

Where Ai's and Bi's are constants.

From the property of probability density function [i.e. $\int_{-\infty}^{\infty} f(x)dx = 1$

Simplifying we get the following conditions

$$A_i R_i + \frac{B_i R_i^2}{2} = 1$$

We consider the density functions for e_i's as

$$g_i(e_i) = \begin{cases} d_i, & 0 \le e_i \le b_i \\ 0; & \text{elsewhere} \end{cases} \qquad \ldots. (31)$$

Where b_i $d_i = 1$, i=1,2,3…..,n

Under these considerations from equation (11.29), we have

EAP ($Q_1, Q_2, \ldots\ldots, Q_n, t_{2i}$)

$$= \sum_{i=1}^{n} \frac{d_i}{T_i}[S_i\{(b_i - \frac{b_i^2}{2})(A_i R_i + \frac{B_i R_i^2}{2})Q_i - \frac{B_i Q_i^3}{12}(1-(1-b_i)^4)\} L_i Q_i^2 \{\frac{A_i}{6}(1-(1-b_i)^3)$$

$$+ \frac{B_i Q_i}{24}(1-(1-b_i)^4) - \frac{(S_C + C_{Pi})Q_i}{d_i} - \{\{\frac{C_{2i}}{\partial T_i}(\frac{e^{\theta \frac{T_i}{k}} - 1}{\theta} - \frac{T_i}{k}) - \frac{\alpha}{\theta T_i}(-\frac{T_i}{\theta k} - \frac{T_i^2}{2k^2} + \frac{e^{\theta \frac{T_i}{k}} - 1}{2\theta^2})\}$$

$$(\frac{A_iQ_i^2}{6}(1-(1-b_i)^3)+\frac{B_iQ_i^3}{24}(1-(1-b_i)^4))\}\frac{C_{xi}}{\delta T_i}\{\{e^{-\delta t_{3i}}(\frac{T_i}{k}-t_{3i})$$

$$+\frac{1}{\delta}(e^{-\delta\frac{T_i}{k}}-e^{-\delta t_{3i}})\}\{(\frac{A_iR_i^2}{2}+\frac{B_iR_i^3}{3})b_i-\frac{A_iQ_i^2}{6}(1-(1-b_i)^3)-\frac{B_iQ_i^3}{12}(1-(1-b_i)^4)\}\}$$

$$-C_{Lxi}\{\{\frac{T_i}{k}-t_{3i}-\frac{B_iQ_i^3}{12}(1-(1-b_i)^4)\}\}-(\frac{C_{1i}Q_i^2}{2P_i}+\frac{\alpha Q_i^3}{2P_i^2})\frac{b_i^2}{2}+\frac{1}{2}k_iQ_ib_i^2$$

$$-C_{1i}\{\frac{1}{\theta}\{\frac{A_iQ_i^2}{3}(1-(1-b_i)^3)-\frac{A_iP_i}{3\theta}(\frac{P_i}{\theta}-\frac{Pe^{-\theta\frac{Q_i}{P_i}}}{\theta}-Q_i)(1-(1-b_i)^3)$$

$$-\frac{A_iQ_i^2}{6\theta T_i}(1-(1-b_i)^3)-\frac{(1-(1-b_i)^3)}{3\theta T_i}(\frac{A_iQ_iPe^{-\theta\frac{Q_i}{P_i}}}{-\theta}+\frac{A_iP_i^2}{\theta^2}-\frac{A_iP_i^2e^{-\theta\frac{Q_i}{P_i}}}{\theta^2})$$

$$+\frac{B_iQ_i^3}{6}(1-(1-b_i)^3)+\frac{PB_iQ_i^3}{8\theta}(1-(1-b_i)^4)-\frac{PB_i}{4\theta}(1-(1-b_i)^4)$$

$$(\frac{Q_iPe^{-\theta\frac{Q_i}{P_i}}}{-\theta}+\frac{P_i^2}{\theta^2}-\frac{P_i^2e^{-\theta\frac{Q_i}{P_i}}}{\theta^2})-\frac{B_iQ_i^4}{16P_iT_i}(1-(1-b_i)^4)+\frac{B_iQ_i^3}{12\theta T_i}(1-(1-b_i)^4)$$

$$+\frac{B_iQ_iPe^{-\theta\frac{Q_i}{P_i}}}{3\theta^2T_i}(1-(1-b_i)^3)+\frac{B_iQ_iP_i^2e^{-\theta\frac{Q_i}{P_i}}}{2\theta^3T_i}(1-(1-b_i)^4)$$

$$+\frac{B_iP_i^3(1-(1-b_i)^4)}{2\theta^4T_i}=(e^{-\theta\frac{Q_i}{P_i}}-1)\}+\frac{A_iQ_i(1-(1-b_i)^3)}{3\theta T_i}(\frac{e^{-\theta P_i}-1}{\theta})$$

$$-\frac{A_iQ_i^2(1-(1-b_i)^3)}{6\theta}+\frac{A_iQ_i^3(1-(1-b_i)^4)}{12\theta T_iP_i}-\frac{B_iQ_i^3(1-(1-b_i)^4)}{12\theta}$$

$$\frac{B_iQ_i^3(1-(1-b_i)^4)}{8\theta T_i}(\frac{e^{-\theta P_i}-1}{\theta})+\frac{B_iQ_i^4(1-(1-b_i)^4)}{16\theta T_iP_i}\}-\frac{\alpha}{\theta}\{\frac{(1-(1-b_i)^3)}{3}$$

$$\{\frac{A_iQ_i}{4P_i}-\frac{A_iQ_iP_i}{\theta^2}e^{-\theta\frac{Q_i}{P_i}}+\frac{A_iQ_iP_i}{\theta^2}+\frac{A_iP_i}{\theta^2}(\frac{Pe^{-\theta\frac{Q_i}{P_i}}}{\theta}-\frac{P_i}{\theta}-Q_i)\}$$

$$-\frac{A_iQ_i^4(1-(1-b_i)^4)}{32\theta T_iP_i}+\frac{A_iQ_i^2e^{-\theta\frac{Q_i}{P_i}}}{\theta^3T_iP}(b_i-\frac{b_i^2}{2})+\frac{(1-(1-b_i)^3)}{3}\{\frac{2A_iQ_iPe^{-\theta\frac{Q_i}{P_i}}}{\theta^4T_i}$$

$$+\frac{2A_iP_i^2e^{-\theta\frac{Q_i}{P_i}}}{\theta^5T_i}+\frac{Q_iPe^{-\theta\frac{Q_i}{P_i}}}{\theta^4T_i}+\frac{P_i^2e^{-\theta\frac{Q_i}{P_i}}}{\theta^5T_i}-\frac{P_i^2}{\theta^5T_i}+\frac{Q_i^2}{2\theta^3T_i}\}$$

$$+\frac{(1-(1-b_i)^4)}{4}\{\frac{B_iQ_i^4}{6P_i}-\frac{B_iP_iQ_i^2e^{-\theta\frac{Q_i}{P_i}}}{\theta^2}-\frac{2B_iQ_iP_i^2e^{-\theta\frac{Q_i}{P_i}}}{\theta^3}+\frac{B_iQ_iP_i^2}{\theta^3}$$

$$-\frac{B_i P Q_i^2}{2\theta^2}-\frac{B_i Q_i^5}{10\theta P_i^2 T_i}+\frac{B_i Q_i^3 e^{-\theta\frac{Q_i}{P_i}}}{\theta^3 T_i}+\frac{3B_i P Q_i^3 e^{-\theta\frac{Q_i}{P_i}}}{\theta^4 T_i}+\frac{6B_i Q_i P_i^2 e^{-\theta\frac{Q_i}{P_i}}}{\theta^5 T_i}$$

$$+\frac{B_i Q_i^3}{3\theta^3 T_i}+\frac{B_i P Q_i^2 e^{-\theta\frac{Q_i}{P_i}}}{\theta^4 T_i}+\frac{2B_i Q_i P_i^2 e^{-\theta\frac{Q_i}{P_i}}}{\theta^5 T_i}-\frac{2B_i Q_i^3}{\theta^6 T_i}+\frac{2B_i P_i^3 e^{-\theta\frac{Q_i}{P_i}}}{\theta^6 T_i}\}$$

$$-\frac{2B_i P_i}{3\theta^4}(1-(1-b_i)^3)\}\}] \qquad \ldots. (32)$$

Here $Q_{si} = \frac{1}{\delta T_i}\{\{e^{-\delta t_{3i}}(\frac{T_i}{k}-t_{3i})+\frac{1}{\delta}(e^{-\delta\frac{T_i}{k}}-e^{-\delta t_{3i}})\}\{(\frac{A_i R_i^2}{2}+\frac{B_i R_i^3}{3})b_i$

$$-\frac{A_i Q_i^2}{6}(1-(1-b_i)^3)-\frac{B_i Q_i^3}{12}(1-(1-b_i)^4)\}\}$$

Our problem is maximized the expected average profit subjected to fuzzy/ probabilistic restrictions on total production cost along with inspection cost under budget and shortage constraint . Hence the problem, given by (29), is reduced to

Max EAP ($Q_1, Q_2, \ldots\ldots, Q_n, t_{2i}$)

Subject to

$$\sum_{i=1}^{n}(C_{pi}+S_c)Q_i \le B$$

And

$$\sum_{i=1}^{n} C_{si}Q_{si} \le S_M \quad , Q_i>0, i=1, 2, 3\ldots, n \qquad \ldots. (33)$$

Now we shall consider different cases for the constraints i.e.,

(a) Both the constraints as stochastic,

(b) One constraint as stochastic and another constraint as fuzzy,

(c) Both the constraints as fuzzy.

3.17. Probabilistic constraint:

(1)When limitations on total production cost and inspection cost is probabilistic then

$$\text{Prob}\,[\sum_{i=1}^{n}(C_{pi}+S_c)Q_i \le B\,] \ge r_1,\ 0<r_1<1$$

(2)When limitation on shortages becomes probabilistic, the constraint becomes

$$\text{Prob}\left[\sum_{i=1}^{n} C_{si} Q_{si} \le S_M\right] \ge r_2,\ 0 < r_2 < 1$$

3.18. Fuzzy (Possibility/necessity) constraints:

If $\hat{B}, \hat{C}_{pi}, \hat{C}_{si}, \hat{S}_M$ are imprecise in nature, then the above constraints are of the following form:

$$\sum_{i=1}^{n} (\hat{C}_{pi} + S_c) Q_i \le \hat{B} \text{ and } \sum_{i=1}^{n} \hat{C}_{si} Q_{si} \le \hat{S}_M$$

(Here wavy cap^ denotes fuzzyfication of the parameters).

Hence the problem (33) is reduced to the below form and we have to maximize the profit function by the given equation.

Max EAP ($Q_1, Q_2 \ldots\ldots, Q_n, t_{2i}$)

Subject to $\sum_{i=1}^{n} (\hat{C}_{pi} + S_c) Q_i \le \hat{B}$ and $\sum_{i=1}^{n} \hat{C}_{si} Q_{si} \le \hat{S}_M$, $Q_i > 0$, i =1, 2, 3…, n .... (34)

3.19. Chance constrained programming technique

A stochastic non-linear programming problem with some linear chance constraints can be expressed as

Max $Z(x_1, x_2 \ldots, x_n)$ .... (35)

s.t.:

$$\text{Prob}\left[\sum_{j=1}^{n} a_{ij} x_j \le b_i\right] \ge r_i \quad \text{.... (36)}$$

$$x_j \ge 0, \quad j=1,2\ldots..,n \quad , r_i \in (0,1), \quad i=1,2\ldots.,k \quad \text{.... (37)}$$

Where a_{ij}, b_i are normal random variables and r_i are specified probabilities. For simplicity, we assume that the decision variables x_j are deterministic. Here we consider the case: only b_i's are normally distributed random variables with known means and variances.

Let E (b_i) and Var (b_i) denote the mean and variance of the normal random variable b_i.

The constraints (20) can be written as

$$\text{Prob}\left[\frac{b_i - E(b_i)}{\sqrt{\text{Var}(b_i)}} \ge \frac{\sum_{j=1}^{n} a_{ij} x_j - E(b_i)}{\sqrt{\text{Var}(b_i)}}\right] \ge r_i \quad \text{.... (38)}$$

Where $\frac{b_i - E(b_i)}{\sqrt{Var(b_i)}}$ is a standard normal variation? Considering $\phi(r_i)$, where $\int_{\phi(r_i)}^{\infty} \phi(t)dt = r_i$, $\phi(t)$ being the standard normal density function, we have $\frac{\sum_{j=1}^{n} a_{ij}x_j - E(b_i)}{\sqrt{Var(b_i)}} \leq \phi(r_i)$ which can be written as

$$\sum_{j=1}^{n} a_{ij}x_j \leq E(b_i) + \sqrt{Var(b_i)}\ \phi(r_i) \quad \ldots. (39)$$

Thus the probabilistic non-linear programming problem stated in Eqs. (11.35)– (11.39) is equivalent to the following deterministic non-linear programming problem. Here profit function is maximized also:

Max $Z(x_1, x_2 \ldots, x_n)$ …. (40)

s.t.: $\sum_{j=1}^{n} a_{ij}x_j \leq E(b_i) + \sqrt{Var(b_i)}\ \phi(r_i)$ $x_j \geq 0$, $j=1, 2\ldots..., n$, $0<r_i<1$, $i=1,2\ldots.,k$

3.20 Possibility/necessity programming technique

Possibility/necessity in fuzzy environment

If $\tilde{A}$ and $\tilde{B}$ be two fuzzy subsets of real numbers $\Re$ with membership functions $\mu_{\tilde{A}}$ and $\mu_{\tilde{B}}$ respectively, then taking degree of uncertainty as the semantics of fuzzy number, according to Liu and Iwamura (1998), Dubois Prade (1980, 1983):

$$Pos(\tilde{A} * \tilde{B}) = \sup\{\min(\mu_{\tilde{A}}(x), \mu_{\tilde{B}}(y)), x, y \in \Re, (x * y)\} \quad \ldots. (41)$$

Where the abbreviation Pos represent possibility and * is any one of the relations >, <, =, ≤, ≥. On the other hand necessity measure of an event $\tilde{A} * \tilde{B}$ is a dual of possibility measure. The grade of necessity of an event is the grade of impossibility of the opposite event and is defined as:

$$Nes(\tilde{A} * \tilde{B}) = 1 - Pos(\overline{\tilde{A} * \tilde{B}}) \quad \ldots. (42)$$

Where the abbreviation Nes represents necessity measure and $\overline{\tilde{A} * \tilde{B}}$ represents complement of the event $\tilde{A} * \tilde{B}$. Also necessity measures satisfy the condition

$$\min(Nes(\tilde{A} * \tilde{B}), Nes(\overline{\tilde{A} * \tilde{B}})) = 0$$

The relationships between possibility and necessity measures satisfy also the following conditions (cf. Dubois and Prade (1978)):

Pos ($\tilde{A} * \tilde{B}$) $\geq$ Nes ($\tilde{A} * \tilde{B}$), Nes ($\tilde{A} * \tilde{B} > 0$) $\Rightarrow$ Pos ($\tilde{A} * \tilde{B}$) = 1and

Pos ($\tilde{A} * \tilde{B}$) <1 $\Rightarrow$ Nes ($\tilde{A} * \tilde{B}$) =0.

If $\tilde{A}, \tilde{B} \in \Re$ and $\tilde{C} = f(\tilde{A}, \tilde{B})$ where f: be a binary operation then membership function $\mu_{\tilde{C}}$ of $\tilde{C}$ is defined as $\mu_{\tilde{C}}(v)$ =sup {min ($\mu_{\tilde{A}}$ (x), $\mu_{\tilde{B}}$ (y)), x, y$\in\Re$ and v= f(x, y) $\forall$ v$\in\Re$}

3.21 Triangular fuzzy number

In particular if $\tilde{A}$ be a Triangular Fuzzy Number (TFN) then $\mu_{\tilde{A}}$ (x) is defined as follows

$$\mu_{\tilde{A}}(x) = \begin{cases} \dfrac{x - a_1}{a_2 - a_1}, for a_1 \leq x \leq a_2 \\ \dfrac{a_3 - x}{a_3 - a_2}, for a_2 \leq x \leq a_3 \\ 0, otherwise \end{cases}$$

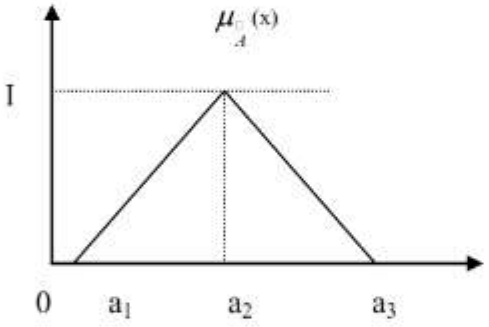

Fig 1. Membership function of TFN $\tilde{A}$

Where a_1, a_2 and a_3 are real numbers. Also this type of triangular fuzzy number is denoted as $\tilde{A} = (a_1, a_2, a_3)$.

3.22 η Cut of a fuzzy number:

An η Cut of a fuzzy number, $\tilde{A}$ is defined as a crisp set

$A_\eta = \{x : \mu_{\tilde{A}}(x) \geq \eta, x, \in \Re\}$, where $\eta \in [0, 1]$

3.23 Imprecise constraints

Let us consider the constraint $\tilde{A} \geq \tilde{B}$. This can be represented in necessity and possibility sense as Nes($\tilde{A} \geq \tilde{B}$) and Pos ($\tilde{A} \geq \tilde{B}$). Nes ($\tilde{A} \geq \tilde{B}$) Pos ($\tilde{A} \geq \tilde{B}$) estimates that an event " $\tilde{A} \geq \tilde{B}$ " will occur with the minimum (maximum) chance at least g ((say) by DM). Hence the said constraint can be

represented as Nes ($\tilde{A} \geq \tilde{B}$)> η(Pos ($\tilde{A} \geq \tilde{B}$) >η). Let $\tilde{A}$ = (a_1, a_2, a_3) and $\tilde{B}$ = (b_1, b_2, b_3) be two triangular fuzzy numbers. Then for these fuzzy numbers, following Wang and Shu [2005] and Inuiguchi et al. [1994], Lemmas 1, 2 can be derived.

Lemma1: Nes ($\tilde{A} \geq \tilde{B}$)> η iff $\frac{b_3 - a_1}{a_2 - a_1 + b_3 - b_2} < 1 - \eta$.

Proof: Let, we have Nes ($\tilde{A} \geq \tilde{B}$)>η. From Fig2, it is clear that

$$\text{Pos}\left(\tilde{A} \leq \tilde{B}\right) = \begin{cases} 1, for a_2 \leq b_2 \\ \zeta_1 = \dfrac{b_3 - a_1}{a_2 - a_1 + b_3 - b_2}, for a_2 > b_2, b_3 < a_1 \\ 0, for a_1 \geq b_3 \end{cases}$$

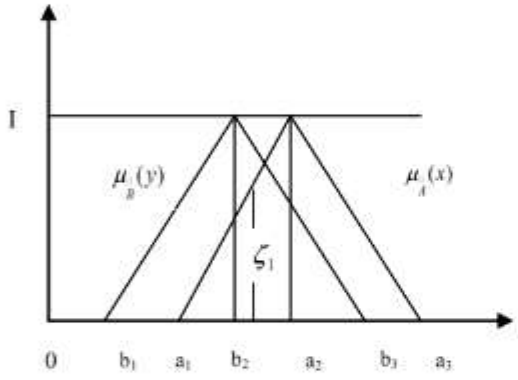

Figure 2 Two TFN $\tilde{A}$ and $\tilde{B}$ and Pos ($\tilde{A} \leq \tilde{B}$)

Hence, Nes ($\tilde{A} \geq \tilde{B}$)> η⇒(1- Pos ($\tilde{A} \geq \tilde{B}$))> η.

Therefore, Nes ($\tilde{A} \geq \tilde{B}$)> η iff $\zeta_1 = \frac{b_3 - a_1}{a_2 - a_1 + b_3 - b_2} < 1 - \eta$, $(a_2 > b_2, b_3 > a_1)$.

Lemma 2: Pos ($\tilde{A} \geq \tilde{B}$)> η iff $\frac{a_3 - b_1}{b_2 - b_1 + a_3 - a_2} < 1 - \eta$, $a_2 < b_2, a_3 > b_1$.

Proof: Let us consider Pos ($\tilde{A} \geq \tilde{B}$)>η.

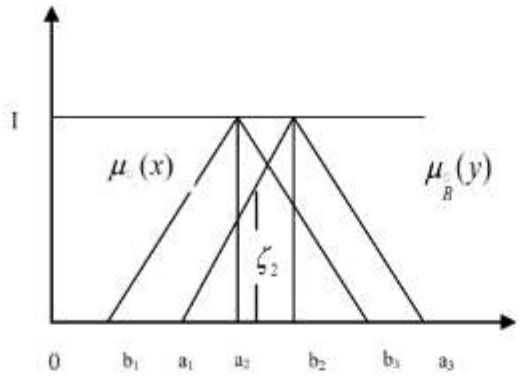

Figure 3 Two TFN $\tilde{A}$, $\tilde{B}$ and Pos ($\tilde{A} > \tilde{B}$)

$$\text{Pos}(\tilde{A} \le \tilde{B}) = \begin{cases} 1, for a_2 \ge b_2 \\ \zeta_2 = \dfrac{a_3 - b_1}{b_2 - b_1 + a_3 - a_2}, for a_2 < b_2, b_3 > a_1 \\ 0, for a_1 \le b_3 \end{cases}$$

Pos ($\tilde{A} \ge \tilde{B}$)> η iff $\dfrac{a_3 - b_1}{b_2 - b_1 + a_3 - a_2} < 1 - \eta$, ($a_2 < b_2, a_3 > b_1$).

3.24: Different models:

3.24.1. Both constraints are stochastic

In this case our problem is

Max EAP (Q_1, Q_2……, Q_n, t_{2i})

Subject to:

Prob [$\sum_{i=1}^{n} (C_{pi} + S_c) Q_i \le B$] ≥r_1,

Prob [$\sum_{i=1}^{n} C_{si} Q_{si} \le S_M$] ≥r_2, **Q_i >0, i =1, 2, 3…, n, 0< r_1<1, 0< r_2<1** …. (43)

Hence according to chance constraint programming technique, the optimizing problem (35) is restated as:

Max EAP (Q_1, Q_2……, Q_n, t_{2i}) …. (44)

Subject to:

$$\sum_{i=1}^{n} (C_{pi} + S_c) Q_i - E(B) - \sqrt{Var(B)}\phi(r_1) \le 0 \quad \text{…. (45)}$$

$$\sum_{i=1}^{n} C_{si}Q_{si} - E(S_M) - \sqrt{Var(S_M)}\phi(r_2) \le 0 \quad \text{.... (46)}$$

$Q_i > 0$, $Q_{si} > 0$, i =1, 2, 3..., n, $0 < r_1 < 1$, $0 < r_2 < 1$

3.24.2. One constraint is stochastic and other one is fuzzy

In this case there are four sub cases. We consider the model under the different cases of the constraints.

Model-3.24.2.1 Budget constraint as stochastic and shortage constraint Necessity type.

In this case the problem is

Max EAP_1 (Q_1, Q_2... Q_n, t_{2i})

Subject to: Prob $[\sum_{i=1}^{n}(C_{pi} + S_c)Q_i \le B] \ge r_1$,

Nes $[\sum_{i=1}^{n} \hat{C}_{si} Q_{si} \le \hat{S}_M] > \eta_2$

Equivalent crisp representation of the above problem is given by

Max EAP_1 (Q_1, Q_2... Q_n, t_{2i})

Subject to:

$$\sum_{i=1}^{n}(C_{pi} + S_c)Q_i - E(B) - \sqrt{Var(B)}\phi(r_1) \le 0$$

$$\frac{\sum_{i=1}^{n} C_{si}Q_{si} - S_{M1}}{(S_{M2} - S_{M1}) + \sum_{i=1}^{n}(C_{si3} - C_{si2})Q_{si}} < 1 - \eta_2$$

i. e. Max EAP_1 (Q_1, Q_2... Q_n, t_{2i}) .... (47)

Subject to:

$$\sum_{i=1}^{n}(C_{pi} + S_c)Q_i - E(B) - \sqrt{Var(B)}\phi(r_1) \le 0$$

$$\text{and} \sum_{i=1}^{n}\{\eta_2 C_{si3} + (1-\eta_2)C_{si2}\}Q_{si} \le \eta_2 S_{M1} - (1-\eta_2)S_{M2} \quad \text{.... (48)}$$

$Q_i > 0$, $Q_{si} > 0$, i =1, 2, 3..., n, $0 < r_1 < 1$, $0 < \eta_2 < 1$

Procceeding as before, the objective and constraints for other models are as follows.

Model- 3.24.2.3 Budget constraint as stochastic and shortage constraint is of possibility type.

Max EAP_1 ($Q_1, Q_2 \ldots Q_n, t_{2i}$) .... (49)

Subject to: constraint (38)

and $\sum_{i=1}^{n} \{\eta_2 C_{si2} + (1-\eta_2) C_{si1}\} Q_{si} \le \eta_2 S_{M2} - (1-\eta_2) S_{M3}$ .... (50)

$Q_i > 0$, $Q_{si} > 0$, i =1, 2, 3..., n, $0 < r_1 < 1$, $0 < \eta_2 < 1$

Model-3.24.2.4. Budget constraint is possibility type and shortage constraint is stochastic.

Max EAP_1 ($Q_1, Q_2 \ldots Q_n, t_{2i}$) .... (51)

Subject to:

$$\sum_{i=1}^{n} \{\eta_1 (C_{Pi2} + S_C) + (1-\eta_1)(C_{Pi1} + S_C)\} Q_i \le \eta_1 B_2 - (1-\eta_1) B_3 \quad \text{.... (52)}$$

and constraint (38)

where EAP_1 = EAP with $(C_{Pi} + S_C) = \eta_1 (C_{Pi2} + S_C) - (1-\eta_1)(C_{Pi1} + S_C)$

$Q_i > 0$; i =1, 2, 3..., n, $0 < r_2 < 1$, $0 < \eta_1 < 1$

3.25. Both constraints are fuzzy

Here also we have four sub-cases.

Model-3.25.1: Budget constraint is Nes type and shortage constraint is also Nes type.

Max EAP_1 ($Q_1, Q_2 \ldots Q_n, t_{2i}$) .... (53)

Subject to: $\sum_{i=1}^{n} \{\eta_1 (C_{Pi2} + S_C) + (1-\eta_1)(C_{Pi1} + S_C)\} Q_i \le \eta_1 B_2 - (1-\eta_1) B_3$ .... (54)

constraint equation (38)

where EAP_1 = EAP with $(C_{Pi} + S_C) = \eta_1 (C_{Pi3} + S_C) - (1-\eta_1)(C_{Pi2} + S_C)$

and $C_{si} = \eta_2 C_{si2} - (1-\eta_2) C_{si1}$, **$Q_i > 0$; i =1, 2, 3..., n, $0 < \eta_2 < 1$, $0 < \eta_1 < 1$**

Model-3.25.2: Budget constraint is Nes type and shortage constraint is Pos type.

Max EAP_1 ($Q_1, Q_2 \ldots Q_n, t_{2i}$) .... (55)

Subject to: constraint (40) and (44)

where EAP_1 = EAP with $(C_{Pi} + S_C) = \eta_1 (C_{Pi3} + S_C) - (1-\eta_1)(C_{Pi2} + S_C)$

and $C_{si} = \eta_2 C_{si3} - (1-\eta_2) C_{si2}$, **$Q_i > 0$; i =1, 2, 3…, n, 0< η_2 <1, 0< η_1 <1**

Model-3.25.3 Budget constraint is Pos type and shortage constraint is Nes type.

Max EAP_1 (Q_1, Q_2… Q_n, t_{2i}) …. (56)

subject to: constraint (42) and (44)

Where EAP_1 = EAP with $(C_{Pi} + S_C) = \eta_1 (C_{Pi2} + S_C) - (1-\eta_1)(C_{Pi1} + S_C)$

And $C_{si} = \eta_2 C_{si3} - (1-\eta_2) C_{si2}$, **$Q_i > 0$; i =1, 2, 3…, n, 0< η_2 <1, 0< η_1 <1**

Model-3.25.4 Budget constraint is Pos type and shortage constraint is Pos type.

Max EAP_1 (Q_1, Q_2… Q_n, t_{2i}) …. (57)

subject to: constraint (46) and (40)

Where EAP_1 = EAP with $(C_{Pi} + S_C) = \eta_1 (C_{Pi2} + S_C) - (1-\eta_1)(C_{Pi1} + S_C)$

And $C_{si} = \eta_2 C_{si3} - (1-\eta_2) C_{si2}$, **$Q_i > 0$; i =1, 2, 3…, n, 0< η_2 <1, 0< η_1 <1**

Model-3.26: Budget constraint is necessity type and shortage constraint is stochastic.

Max EAP_1 (Q_1, Q_2… Q_n, t_{2i}) …. (58)

subject to:

constraint equations (40) and (46)

where EAP_1 = EAP with $(C_{Pi} + S_C) = \eta_1 (C_{Pi3} + S_C) - (1-\eta_1)(C_{Pi2} + S_C)$

$Q_i > 0$; i =1, 2, 3…, n, 0< r_2 <1, 0< η_1 <1

4. Numerical Example:

The numerical examples are given below to illustrate the above solution procedure. On the basis of previous studies, let us considered the following data in proper units:

The common input parameters, which are used in the crisp model, are given as:

δ=.04, k=1, θ=.05, α=0.001and

Common input parameters for the i-th items are given in the table 1:

Table 1: Common input parameters

Item	A_i	B_i	C_{1i}	L_i	s_i	P_i	T_i	R_i	K_i	d_i	b_i	C_{Pi}	C_{2i}	C_{Si}	C_{LSi}
I	0.035	.005	0.65	12	18	45	6	800	6	25	0.04	0.2	0.9	4	**10**
II	**0.03**	**.0045**	**0.9**	**13**	**19**	**50**	**7**	**900**	**7**	**20**	**0.05**	**0.3**	**0.95**	**6**	**12**

Table2: Variation in the no. of deliveries

K	t_{21}	t_{22}	Q_{s1}	Q_{s2}	EAP
1	5.6198	6.0485	10278.1	31378.2	**131079000**
2	2.8325	3.081	2282.66	7039.2	**132640000**
3	1.89261	2.06491	977.69	3021.91	**132902000**
4	1.4201	1.5526	540.11	1671.07	**132988000**
5	1.1375	1.2389	341.992	1058.69	**133027000**
6	.9483	1.0376	235.819	730.274	**133048000**
7	.81307	.88995	172.386	533.966	**133061000**
8	.7116	.7791	131.488	407.357	**133069000**
9	.6326	.6928	103.589	320.969	**133075000**
10	.5694	.6237	83.7126	259.409	**133079000**

Table : Variation in the production quantity

Q_1=1000, t_{21}=5.6198, Q_{s1}=10278.1			
Q_2	t_{22}	Q_{s2}	EAP
1100	6.0485	31378.2	131079000
1110	6.2213	28186	646336000
1120	6.3876	24220.6	1191320000
1130	6.5477	19460.1	1766850000
1140	6.7023	13882.9	2373750000
1150	6.852	7466.82	3012860000
Q_1=1010, t_{21}=5.772, Q_{s1}=6750.99			
Q_2	t_{22}	Q_{s2}	EAP
1100	6.0485	31378.2	833842000
1110	6.2213	28186	1347670000
1120	6.3876	24220.6	1892650000
1130	6.5477	19460.1	2468180000
1140	6.7023	13882.9	3075080000
1150	6.852	7466.82	3714190000
Q_1=1020, t_{21}=5.9183, Q_{s1}=2636.78			
Q_2	t_{22}	Q_{s2}	EAP
1100	6.0485	31378.2	1575100000

1110	6.2213	28186	2088930000
1120	6.3876	24220.6	2633910000
1130	6.5477	19460.1	3209440000
1140	6.7023	13882.9	3816340000
1150	6.852	7466.82	4455450000

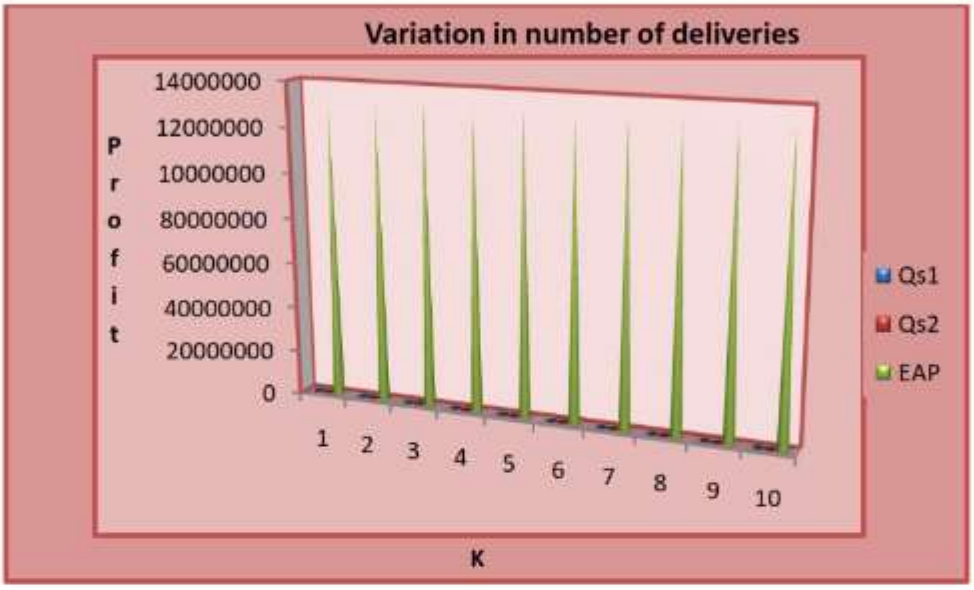

Figure 4: Sensitivity along the number of deliveries

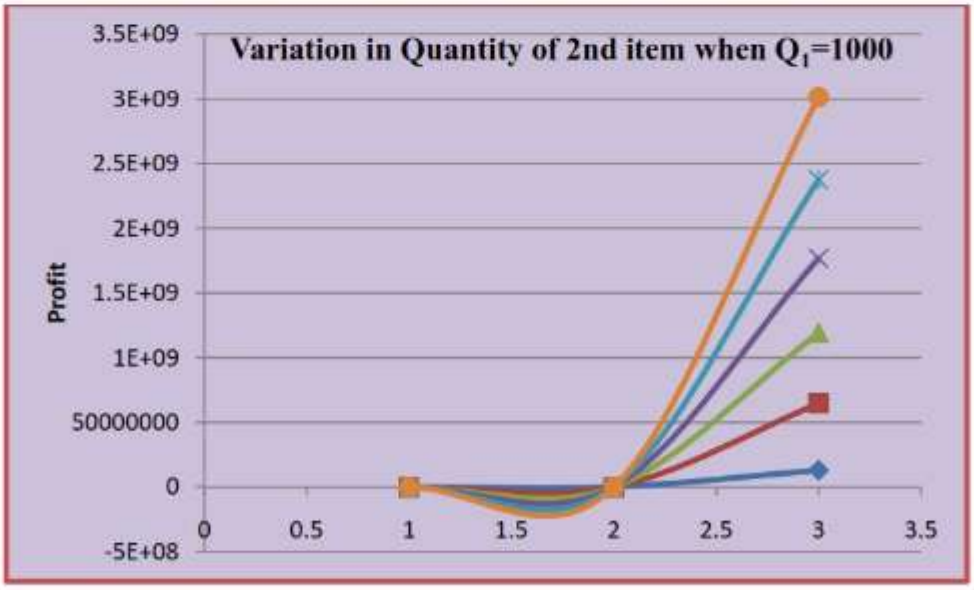

Figure 5: Sensitivity along the Quantity of 2nd kind of item when Q_1=1000 is fixed

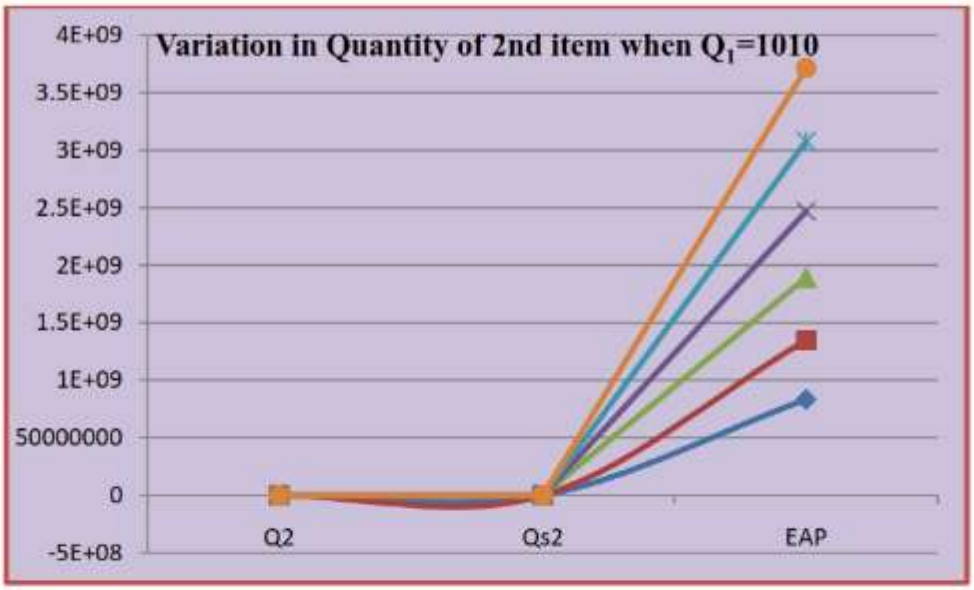

Figure 6: Sensitivity along the Quantity of 2nd kind of item when Q_1=1010 is fixed

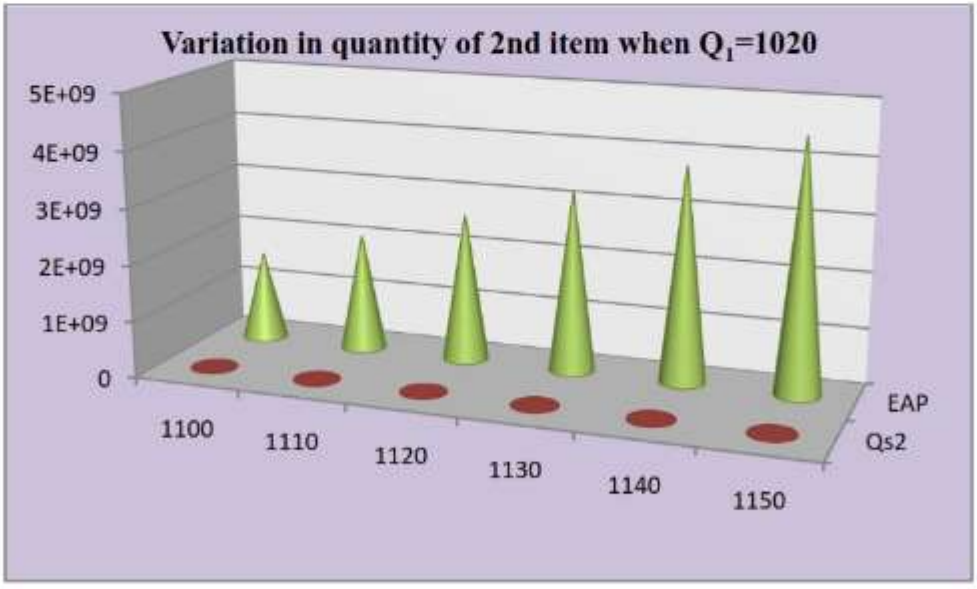

Figure 7: Sensitivity along the Quantity of 2nd kind of item when Q_1=1020 is fixed

5. Observations:

1. Number of delivery parameter 'k' is very slightly sensitive to change the parameters of time ('t_{21}', 't_{22}') and also on profit. But it is highly sensitive with the shortage parameter (Q_{s1}, Q_{s2}). As the number of deliveries increase, there is faintly change comes in the net profit.
2. Number of delivery parameter 'k' is very enormously effective on the quantity which is lost due to unavailable of stock. As the number of delivery increases then the shortages quantity is decresed. Because of this data one can say that shortages can be short because of number of deliveries.

6. Conclusion

In real world, defective products cannot be avoided in some production processes. This project highlights the situation of imperfect production process with crisp and fuzzy environment under stochastic constraint. Numerical illustration is given to show the optimality of the model. From the sensitivity analysis we can say that as the numbers of deliveries amplify, the profit also increases. The profit is highly sensitive towards total number of units which are produce. Managers can control the situation of excess of stock and no stock by using the volume flexibility in their production process. Manufacturing firms also controlled their material cost and selling price because they are highly sensitive. Inspection is an essential part of the production process they cannot ignore it. We investigated the model with variable holding cost whose idiom is depending on time.

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PERFORMA FOR PROJECT COMPLETION REPORT

To,

Head of Department

Date: 27-09-20

Name of Department: Mathematics

Name of College: KVSCAS

Findings of the project: (Max-100 words):

In real world, defective product cannot be avoided in some production process. This project highlights the situation of imperfect production process with crisp and fuzzy environment under stochastic constraints. Numerical illustration is given to show the optimality of the model. From the sensitivity analysis we can say that as the numbers of deliveries amplify. 27.09.2020

External Support:

Supported by Gyan Vigyan Sansthan for consumables

Name of PI: Dr. Neha Saxena

Name of the Department: Mathematics

Name of College: KVSCOS

Signature of the P.I.

Title of the Project: An imperfect production process with variable holding cost and stochastic demand for imprecise system

Employee Code of PI:

Duration of the Project:

Registrar
Swami Vivekanand
Subharti University
MEERUT

"ROLE OF MULTIDETECTOR COMPUTED TOMOGRAPHY IN CLINICALLY SUSPECTED ACUTE SMALL BOWEL OBSTRUCTION."

Research Proposal Submitted

By

DR. B.B THUKRAL

Department of Radio-diagnosis & Imaging

Subharti Medical College, Meerut (U.P)

INTRODUCTION

Intestinal obstruction is a common clinical abnormality that is usually suspected on the basis of clinical signs and patient history. However, it is essential to manage treatment properly, to determine the site, level, and cause of obstruction, and even to try to establish a prognosis prior to surgery. A variety of diagnostic radiologic procedures are available, ranging from conventional radiography through contrast studies to computed tomography (CT). For many decades, evaluation was based on findings at conventional radiography, with a sensitivity of 69% and a specificity of 57%.[1]Several studies have demonstrated the value of CT in confirming the diagnosis (site and level) and revealing the cause of small bowel obstruction, with a sensitivity of 94%–100% and an accuracy of 90%–95%.[1]Newer multidetector CT scanners with multiplanar reformation capability are significantly more efficient in Small Bowel Obstruction evaluation as well as correlation of the degree of obstruction with pathologic tissue damage. The examination is fast, does not require oral contrast material (the retained intraluminal fluid serves as a natural negative contrast agent) and it is capable of early demonstration of strangulation.[2]

Cross sectional imaging of the small bowel (CT and MRI) offer distinct advantages over fluoroscopic barium examination including depiction of the intraluminal pathologies, entire bowel wall and extra intestinal manifestations coupled with the advantage of multiplanar imaging. Computed Tomographic Enterography (CTE) combines the improved spatial and temporal resolution of MDCT with neutral oral contrast and intravenously administered contrast material, thus permitting excellent assessment of the small bowel wall and lumen.[3]

Small bowel obstruction (SBO) accounts for 80% of all mechanical intestinal obstruction, the remaining 20% results from large bowel obstruction. It has a mortality rate of

~5%.Causes can be divided into congenital and acquired. Acquired causes may be extrinsic causing compression, intrinsic, or luminal.

In developed countries, adhesions are by far the most common cause, accounting for ~75% of obstructions while in developing countries incarcerated hernias are much more common accounting for 80% of obstructions.

The following are the list of cause of SBO -

Congenital

- jejunal atresia
- ileal atresia or stenosis
- enteric duplication
- midgutvolvulus
- mesenteric cyst
- Meckel's diverticulum

Extrinsic causes

- fibrous adhesions
    - main cause in developed countries (75% of cases)
    - almost all are related to post-operative adhesions with a small percentage secondary to peritonitis
    - diagnosis of exclusion as adhesive bands are not seen on CT

- abrupt change in calibre without mass lesion, inflammation or bowel wall thickening at transition point

- abdominal hernia
  - 10% of cases in developed countries
  - external hernia related to abdominal or pelvic wall defect (congenital weakness or previous surgery)
  - internal hernia with protrusion of viscera through peritoneum or mesentery into another abdominal compartment
- masses
  - extrinsic neoplasm
  - intra-abdominal abscess
  - aneurysm
  - Haematoma
- endometriosis
  - rare cause of SBO
  - endometrial implants are typically on anti-mesenteric edge of the bowel
  - solid enhancing nodule contiguous with or penetrating the thickened bowel wall
  - may infiltrate the submucosa with a hypoattenuating layer between the muscularis and mucosa

Intrinsicbowelwallcauses

- inflammation, e.g. Crohn, tuberculosis, eosinophilic gastroenteritis
    - small bowel obstruction in Crohn disease may relate to:
        - acute flare with luminal narrowing secondary to transmural inflammation
        - cicatricial stenosis in long-standing disease
        - adhesions or incisional hernias from previous surgery
- tumour (rare)
    - primary small bowel neoplasms are rare (<2% all GI malignancy) and usually advanced at the time of SBO.
        - GIST, adenocarcinoma, lymphoma
        - asymmetric and irregular mural thickening at transition point
    - small bowel involvement of metastatic disease is more common
        - peritoneal carcinomatosis with extrinsic serosal disease in association with the transition point
    - caecal malignancy involving ileocaecal valve
- radiation enteritis
    - produces adhesive and fibrotic changes in the mesentery with luminal narrowing and dysmotility

- may cause obstruction in the late phase (>1 year after therapy)

- intestinal ischaemia
  - occlusion or stenosis of the mesenteric arterial or vascular supply
  - produces small bowel wall thickening and obstruction
  - pneumatosis and portal venousgas if advanced
- intramural haematoma
  - trauma, iatrogenic, anticoagulant therapy, Henoch-Schonlein purpura
  - produces luminal narrowing
  - better seen on non-enhanced CT with homogenous, regular and spontaneously hyper-attenuating wall
- intussusception
  - rare in adults (<5% of SBO)
  - lead point may relate to neoplasm, adhesion or foreign body
  - bowel-within-bowel with or without mesenteric fat and mesenteric vessels
  - leading mass should be carefully interpreted and differentiated from the soft-tissue pseudotumour that represents the intussusception itself

Intraluminalcauses

- swallowed, e.g. foreign body, bezoar
- gallstone ileus
  - rare complication of recurrent cholecystitis

- biliary-intestinal fistula with impaction of a gallstone in the small bowel

- meconium ileus (or meconium ileus equivalent, distal intestinal obstruction syndrome)
- migration of gastric balloon.[5]

AIMS AND OBJECTIVES

1. To evaluate the demographic profile of patients with small bowel obstruction.
2. To assess the level,severity and cause of small bowel obstruction.
3. To determine any complication which has important implication on patient management.

MATERIALS AND METHODS

Prospective observational study.

SAMPLE SIZE:

The study will be conducted on minimum of 50 patients.

Duration of Study :

The source of data for this study are patients referred to Department of Radio diagnosis, Imaging and interventional radiology from OPD/IPD of C.S.S. Hospital, under the ageis of N.S.C.B Subharti Medical College,Meerut for a period of 2 years, from October 2019 to August 2021.

InclusionCriteria

1. All patients in any age group referred to the radiology department with clinical suspicion of acute small bowel obstruction.
2. Patients with diagnosis of subacute SBO referred from other departments of SMC hospital.
3. Patients with distention of abdomen and not passing flatus and faces.

Exclusion Criteria

1. Patient requiring urgent laparotomy.
2. Radiological findings suggestive of perforation.
3. Radiological findings suggestive of large bowel obstruction.
4. Patient unfit for CT scan(acute renal failure, high serum creatinine)

METHODOLOGY:

- After obtaining clinical history(ANNEXURES-A)relevant clinical examination will be done.
- CT examinations will be done on Philips Ingenuity 128 Slice(MDCT).
- Imaging and Diagnosis of Small Bowel Obstruction will be made as per departmental protocols.

CT *examination*

. CT of the patients in suspected case of small bowel obstruction.

- CT was performed using the following device

Technique:

Positioning:

- Every patient will lay supine with abdomen in neutral position and arms over the head on the table.
- The table will then slide into the scanner with feet first into it.
- The patient at times will be asked to hold breath.

Protocol of CT imaging

Patients included in the study shall be subjected to routine CT of the small bowel by :

AXIAL VIEW

Slice thickness:5 mm

Matrix :512

Pitch:1.014

Reconstruction:1mm

Contrast:Non ionic iodinated iohexol(omnipaque)

Contrast delay:20sec

Rate of injection:2.5ml/sec

Patient dose:1ml/kg

Statistical Analysis:using SPSS statistics and MS excel

ANALYSIS

- Data will be entered in MS excel and will be analysed using Statistical Package for Social Sciences (SPSS) version 21.0

- Quantitative data will be expressed in mean, standard deviation and difference between two comparable groups will be tested by 'paired t test'.
- Statistical differences between the proportions will tested by Chi square test or Fisher's exact test.
- Pearson correlation coefficient will be used to see the correlation between quantitative variables.

• 'P' value less than 0.05 will be considered statistically significant.

ANNEXURE-A
(WORKING PROFORMA)

Identification details

Patient Name: **Hospital Reg no:**

Age: **Sex:**

Address: **Occupation:**

Clinical details and findings:

Duration of complaints:

Chief complaints:

History of present illnesss:

History of trauma:

Deformity:

Swelling:

Previous treatment received:

Other medical history:

History of drug intake and allergy:

Any other significant history:

GENERAL PHYSICAL EXAMINATION:

I. INSPECTION :

1. Shape of the abdomen.
2. Flanks - Full or not
3. Venous prominence (examine in sitting or standing position with asking the patient to cough).
4. Umbilicus
5. Condition of skin
6. Any localised swelling.

II. PALPATION :

a) Superficial —

b) Deep —

1. Liver (in details).
2. Spleen (in details).
3. Gall bladder.
4. Kidneys (in details).
5. Colon.
6. Palpation of the testes - It is a must.
7. Any other lump in the abdomen
8. Deep tender spots - McBurney's point, gall bladder point, epigastric point, renal angle etc.

Clinical diagnosis:

CT Findings:

STATISTICAL ANALYSIS: using SPSS statistics and MS excel

PERFORMA FOR PROJECT COMPLETION REPORT

To,

Head of Department

Date: 11-11-2021

Name of Department: Post graduate department of Radio-diagnosis and Imaging

Name of College: Subharti medical college

Findings of the project: (Max-100 words): Out of 50 subjects 78% of the subjects were males and 22% were females. Abdominal distension, constipation, vomiting and abdominal pain was seen among 58% / 76% 58% and 54% of subjects respectively. Most common cause of small bowel dilatation was inflammatory wall thickening and adhesion followed by strictures. Site of obstruction determined on MDCT was jejunum proximal ileum, distal ileum and IC junction in 12% 32% 42% and 6% of the subjects respectively. CT signs predicted true positive in 60.7% and false positive in 57.14% and in 7.14% with respect to cause of obstruction and true positive in 89.28% and false positive in 10.71% with respect to site of obstruction.

External Support: Yamuna Buddhist society and research foundation

Name of PI: Dr. B.B Thukral

Name of the Department: Department of Radio-diagnosis and Imaging

Name of College: Subharti Medical college

Title of the Project: Role of MDCT in diagnosis of suspected acute small bowel obstruction

Duration of the Project: 2018-2019

Registrar
Swami Vivekanand
Subharti University
MEERUT

"ASSOCIATION OF VITILIGO WITH THYROID DYSFUNCTION AND DIABETES MELLITUS ALONG WITH ASSESSMENT OF QUALITY OF LIFE".

Research Proposal Submitted

By

Dr. Shruti Kharbanda and Dr. Arvind Krishna

DEPARTMENT OF DERMATOLOGY, VENEREOLOGY AND LEPROSY

Subharti Medical College & Hospital

INTRODUCTION

Vitiligo, a common acquired depigmenting disorder, affects approximately 1% of the population worldwide and is clinically characterized by well-demarcated areas of depigmentation as a result of loss of melanocytes[1][2].

It presents as an idiopathic acquired skin disease, characterized by pearly-white macules of different shapes and sizes, with a tendency to increase in size centrifugally[3].Average age of onset occurs around the second to the third decade of life[4]. Adults and children of both genders are equally affected, but some studies indicate a slightly increased prevalence of cases among females[3][5].

Different theories regarding its pathogenesis have been put forward, autoimmunity being the most popular one. The latter is based mainly on the association of vitiligo with known autoimmune diseases and the presence of organ specific antibodies in affected patients[6].Many studies from abroad have described an association of vitiligo with other autoimmune disorders such as thyroid disease (Hashimoto's thyroiditis and Graves' disease), Addison's disease, pernicious anemia, insulin – dependent diabetes mellitus and alopecia areata.[7]

Thyroid functional disorders and autoimmune thyroid diseases have been reported in association with vitiligo and the incidence of clinical and subclinical thyroid involvement is more common in vitiligo patients than healthy subjects[7].Hashimoto thyroiditis and Graves' disease are the most important and prevalent autoimmune thyroid diseases associated with vitiligo. Elevated levels of anti-TPO are seen in more than 90%

cases of Hashimoto thyroiditis and about 75% of Graves' disease cases. This figure is only 10% in healthy people although it may reach 30% in the elderly[8][9].

Diabetes mellitus is a metabolic disorder characterized by elevated fasting and postprandial blood glucose levels and a variety of multisystem complications, mainly in the blood vessels, eye, kidney, nervous system, and integument[10]. The association between diabetes and vitiligo has been proposed by several studies[11].The occurrence of vitiligo and diabetes mellitus may be the result of autoimmune mechanisms in the same patient. Long standing diabetes mellitus impairs melanocytes, resulting in anti-melanocyte antibody formation and destruction of melanocytes which causes vitiligo[12].

Although generally considered to be a cosmetic issue, vitiligo is usually psychologically devastating, especially in darker individuals[13].Vitiligo could be considered as a psychosomatic disorder, which means physical and psychological factors concomitantly are involved in appearance, progression, relapse and remission of vitiligo[14].Patients with vitiligo often suffer from poor body image along with low self-esteem, and experience discomfort, inferiority, and discrimination in social and societal relationships,leading ultimately to an impaired quality of life (QoL)[15][16].

In India, sometimes vitiligo is considered as white leprosy, which has a significant stigma [15].Many vitiligo patients felt distressed and stigmatized by their condition. They attract undue attention from the general public sometimes whispered comments, antagonism and ostracism. The self-image of the vitiligo patients drops considerably and may lead to depression. These patients often develop negative feelings about it, which are reinforced by their experiences over a number of years. Most patients of vitiligo report feelings of embarrassment, which can lead to a low self-esteem and social isolation[17][18].

In India,very few studies have focused on the association of thyroid dysfunction and diabetes mellitus with vitiligo .Though many studies have been successful in quantifying the negative impact of vitiligo on Quality of Life , its direct correlation with disease severity remains equivocal.Hence , this study will be conducted on association of vitiligo with thyroid dysfunction and diabetes mellitus along with assessment of quality of life.

AIMS & OBJECTIVES

1. Association of thyroid dysfunction with vitiligo.
2. Association of diabetes mellitus with vitiligo.
3. Assessment of quality of life in patients with vitiligo.

MATERIALS & METHODS

STUDY DESIGN

A prospective case control study will be conducted on 50 clinically diagnosed patients of vitiligo and 50 age and sex matched healthy volunteers attending the out-patient department of Dermatology, Venereology and Leprosy of Chhatrapati Shivaji Subharti Hospital, Meerut within 2 years of approval by the university (From September 2018 to August 2020). Ethical committee clearance will be obtained.

SELECTION CRITERIA

INCLUSION CRITERIA

1. All new cases of vitiligo aged ≥5 years presenting to Dermatology OPD.

2. Patients with vitiligo diagnosed on routine dermatological examination will also be included in the study.

EXCLUSION CRITERIA

1.Pregnant women

2. Patients on Anti-Thyroid drugs , thyroid replacement therapy , previous history of thyroid surgery or irradiation

3. Patients <5 years of age.

METHODS

After the purpose and the contents of the study have been fully explained, written informed consent will be obtained from all patients fulfilling the inclusion criteria.

HISTORY

A detailed history will be taken with reference to the age at onset, duration,site of onset, history of atopy, history of other autoimmune diseases, family history of vitiligo andpersonal or family history of common systemic diseases associated with vitiligo (alopecia areata , thyroid dysfunction or diabetes mellitus) and VIDA scoring[37].

EXAMINATION

A thorough dermatological examination will be done and an approximate percentage of the body surface involved will be calculated using the rule of nine.All the vitiligo patients will be classified into four groups: focal , segmental , acrofacial and generalized vitiligo.The distribution, morphology and any associated leukotrichia will be

seen.A complete general examination and clinical examination of the thyroid gland will be done in all cases and controls.

SCORING

The clinical severity of vitiligo will be assessed using the vitiligo area severity index(VASI)[38]which is a standardized, sensitive method to measure the extent and percentage of depigmentationand/or repigmentation. This index divides the patient's body into five mutually exclusiveregions: the hands, upper extremities (includes axillae), trunk, lower extremities (includes buttocks and inguinals), and the feet. The face and neck will be assessed separately. For each region, the VASI will be determined by measuring in 'hand units' (1% per unit), the area of vitiligo, and multiplying this with the extent of depigmentation within each 'hand unit' (possible values being 0, 10, 25, 50, 75, 90 or 100%: 10%, only specks ofdepigmentation; 25%, pigmented area exceeds depigmented one; 50%, pigmented area is equal to the depigmented area; 75%, depigmented areaexceeds the pigmented area; 90%, only specks of pigmentation and 100%, complete depigmentation). The total VASI, with a score ranging from 0 to 100, will be then calculated using the formula:

VASI = Σ (all body sites) (hand units) × (residual depigmentation).

INVESTIGATIONS

1.) T_3, T_4 ,TSH.

2.) Anti-TPO antibodies.

3.) Fasting Blood Glucose.

Criteria for the diagnosis of DM include a fasting plasma glucose ≥126 mg/dL[39] .The normal range for serum T3 will be 70-200 ng/dl, for serum T4 will be 5-13 ng/dl and for serum TSH will be 0.5-5 micro U/ml. A diagnosis of hypothyroidism will be made when thyroid function tests will show a raised TSH with or without low T3/T4 levels.

Hyperthyroidism will be diagnosed if T3/T4 levels are raised with associated lowered levels of TSH. Antithyroid antibodies will be assayed by enzyme-linked immunosorbent assay using commercial kits.

STATISTICAL METHODS

Case statistical analysis will be carried out in the study .Results on continuous measurement will be presented as Mean +SD and results on categorical measurements will be presented in Number and Percentage (%). The significance of study parameters will be calculated by student's t test for continuous data.

Statistical software : The statistical software which will be used is Microsoft Excel and SPSS software 16.0 for analysis of data and Microsoft Word to generate graphs, tables etc.

THE DERMATOLOGY LIFE QUALITY INDEX

The Dermatology Life Quality Index[18]questionnaire is designed for use in adults, i.e. patients over the age of 16. It is self explanatory. All participants will be asked to fill out a Quality of Life assessment questionnaire comprising the dermatology quality of life index (DLQI). Both Hindi and English versions of the questionnaire have been included in the materials. Those who have difficulties in completing questionnaires by themselves will be helped, but every answer will be solely based on participant's own response. DLQI is attached as annexure A.

THE CHILDREN'S DERMATOLOGY LIFE QUALITY INDEX

The Children's Dermatology Life Quality Index[18]questionnaire is designed for use in children, i.e. patients between the age of 5 – 16 years. It is self explanatory. All participants will be asked to fill out a Quality of Life assessment questionnaire comprising the dermatology quality of life index (DLQI). Hindi, English and picture versions of the questionnaire have been included in the materials. Those who have difficulties in completing questionnaires by themselves will be helped, but every answer will be solely based on participant's own response. CDLQI is attached as annexure B.

PERFORMA FOR PROJECT COMPLETION REPORT 223

To,

Date: 11/11/2021

Head of Department

Name of Department: DERMATOLOGY VENEREOLOGY AND LEPROSY.

Name of College: SUBHARTI MEDICAL COLLEGE

Findings of the project: (Max-100 words):

A clear Association b/w Vitiligo, autoimmune Hypothyroidism and diabetes Mellitus. These associations indicate that Vitiligo shares a common genetic etiological link with these autoimmune disorders

External Support:

N/A Dinker Buddhist Society and Research foundation

Name of PI: Dr Shanti Kharbanda

Name of the Department: Dermatology Venereology and Leprosy.

Name of College: Subharti Medical College.

Title of the Project: Association of Vitiligo with Thyroid dysfunction and Diabetes Mellitus along with Assessment of Quality of life

Duration of the Project: 2018-2020.

Signature of P.I.

Employee Code

Registrar
Swami Vivekanand
Subharti University
MEERUT

"TO EVALUATE MATERNAL VITAMIN D LEVELS IN PATIENTS WITH HYPERTENSIVE DISORDERS OF PREGNANCY"

Research Proposal Submitted

By

DR. MAMTA TYAGI

Department of Obstetrics & Gynaecology

INTRODUCTION

Vitamin D was considered important for bone and calcium. Historically thought to be important for bone and calcium metabolism but recent studies have redefined its role. There is some evidence now that low levels of Vitamin D are associated with the risk of preeclampsia but more studies are needed to prove the same[1]. Maternal vitamin D deficiency is a wide spread public health problem. Vitamin D deficiency during pregnancy is linked with a number of adverse outcomes like IUGR, skeletal problems, Diabetes, Asthma and other adverse pregnancy outcome

Hypertension is the most common medical problem encountered during pregnancy complicating 5-10% of pregnancies[2].

Data from the Nationwide Inpatient Sample of the Healthcare Cost and Utilization Project and National Hospital Discharge Survey have shown marked increase in the incidence of gestational hypertension and preeclampsia in the past two decades, and more women entering pregnancy with chronic (preexisting) hypertension[3,4].Women with chronic (preexisting) hypertension have been shown to have a markedly increased risk of severe adverse outcomes, such as maternal cerebrovascular accidents and placental abruption, compared to normotensive women[5]. Worldwide, the incidence of preeclampsia ranges between 2% and 10% of pregnancies. WHO estimates the incidence of preeclampsia to be seven times higher in developing countries (2.8% of live births) than in developed countries (0.4%)[6].Various risk factors and preventive measures for pre eclampsia have been tested, still there are no definitive preventive measures*-[7-11].

Pathogenesis of hypertensive disorders in pregnancy is believed to involve maternal immune rejection of the placental cytotrophoblastic invasion of spiral arteries leading to shallow implantation and hypoxia and release of inflammatory mediators. Hypertensive disorders in

pregnancy are characterized as excessive maternal inflammatory responses to pregnancy. Inflammation involves a complex network of cytokines released from stressed cells and damaged tissues. The recognition of immunomodulatory properties of vitamin D has been the

subject of recent research. Evidence also exist that vitamin D is able to regulate key target

*

.genes associated with implantation of the embryo, trophoblast invasion and implantation tolerance[8].Vitamin D receptors and 1-a hydroxylase are expressed both in decidua and trophoblastic cells providing an evidence for role of vitamin D in placentation[9]. Disorders of calcium metabolism, including hypocalciuria and low vitamin D level, have been consistently described, during in the course of pregnancy of women who later developed preeclampsia [10,12]. The known racial disparity in hypertensive disorders with dark skin women being more likely to develop severe pre eclampsia and suffer greater morbidity associated with the disorder than white women suggests that vitamin D may be a relevant factor in developing Hypertension. Prevalence of Vitamin D deficiency is quite high in our country. The reasons for this is dark complexion of Indians, wearing of covered clothing, no stringent food fortification policy, vegetarian diet, coupled with skin pigment melanin which absorbs ultraviolet B photons and reduces vitamin D synthesis by greater than 90%[13].

Since pre eclampsia contributes to 9% of maternal deaths in India, finding relation with vitamin D may lead us to a non expensive measure to possibly prevent it[14]. This would have widespread maternal health implication as so far we do not have definitive preventive measures. So this study will be conducted to investigate the maternal vitamin D levels in cases of Hypertensive disorders of pregnancy and healthy pregnant females.

AIMS AND OBJECTIVES:

1: To evaluate maternal serum Vitamin D levels in patients with hypertensive disorders of pregnancy.

$

2: To compare maternal serum vitamin D levels and cord blood levels with normotensive women.

3: To evaluate maternal and neonatal outcome in these patients.

STUDY DESIGN

It is a prospective case control study which will be carried out for a period of 2 years.

STUDY GROUP

One hundred patients with hypertensive disorders of pregnancy and satisfying the inclusion criteria will be enrolled and profiled as a part of this study.

INCLUSION CRITERIA :

All pregnant women with hypertensive disorders presenting in labour at term to Subharti hospital.

EXCLUSION CRITERIA:

♦♦♦ Multifetal gestation ♦♦♦ Epilepsy

- Bone disorders
- History of any multivitamin intake
- Renal disease
- Liver disease
- Thyroid disease or any endocrinal disease ♦> Haemmorhagic disorders

CONTROL GROUP

The control group in this study will include one hundred normotensive pregnant women with similar gestational age.

Patients will have to meet the American college of Obstetricians and Gynaecology (ACOG)criteria for diagnosing Hypertensive disorders of pregnancy(Diastolic Blood pressure >=90mmhg or systolic blood pressure>=140mmhg or both)

Hypertensive Disorders of Pregnancy (HDP)can be divided into 4 subgroups according to ACOG:

T.Preeclampsia(PE)-Eclampsia(EC)

PE is defined as blood pressure > 140/90 and proteinuria > +1, measured at least twice 4—6 h. apart after *gestational week 20. Eclampsia is defined as onset of convulsion in a woman with PE that* cannot *be attributed to other causes.*

2: Chronic Hypertension

Chronic (preexisting) hypertension is defined as hypertension (systolic blood pressure >140 mmHg or diastolic blood pressure > 90 mmHg or both) that is present before 20 weeks of gestation or prior to pregnancy.

3:Chronic Hypertension with superimposed preeclampsia

When preeclampsia develops in women with chronic (preexisting) hypertension, the classification of disease is chronic (preexisting) hypertension with superimposed preeclampsia.

4: Gestational Hypertension

GH is defined as development of hypertension (i.e., systolic BP > 140 mmHg and diastolic BP> 90 mmHg) for the first time after mid pregnancy (after 20 weeks) gestation without

proteinuria or other features of preeclampsia; this terminology replaces the term "Pregnancy Induced Hypertension.

All women who fit into the Inclusion criteria will be informed about the study protocol and their written and informed consent will be taken.

Detailed history of these women which includes age, religion, literacy, occupation, residence, socioeconomic status will be noted. Obstetrics history, past history, any history of previous pregnancy affected by HDP, family history, pre-existing medical conditions, gestational age, education, socioeconomic status, prenatal vitamin D use, smoking status, intake of any vitamin D rich products and sun exposure habits will also be enquired .

Equal number of healthy pregnant women will be taken under control group.

PROCEDURE:

After detailed history, general examination and obstetrical examination of patient will be done which will include: General condition, Pulse, BP, Temp, Respiratory rate, Pallor, Icterus, Cyanosis, Clubbing, Pedal Edema, Lymphadenopathy, Urine albumin, Per Abdomen and Per Vaginal.

Blood Pressure will be measured by auscultatory method using mercury sphygmomanometer in recumbent position after making patient comfortable and after atleast 10 mins of rest.-, Systolic blood pressure will be recorded at the appearance of the first Korotkoff sound and diastolic will be recorded at the disappearance of fifth phase of Korotkoff sound.

In all women fasting blood samples for serum vitamin D, serum calcium, serum phosporus, serum parathormone, will be drawn from mother during first stage of labour, Details of delivery will be taken such as: Mode of delivery, Outcome, Complications

Subsequently cord blood samples of baby will be drawn for serum vitamin D, serum calcium, serum parathormone ,serum phosporus levels. Neonatal outcome of the baby will also be enquired such as baby, birth weight, APGAR score, baby admitted to NICU or not or any other complication.

Vitamin D concentration will be determined by the concentration of 25-OH vitamin D in ng/ml. Vitamin D deficiency will be defined as 25(OH)D levels below 15ng/ml.[22]Severe vitamin D deficiency will be defined as 25(OH)D levels below 10ng/ml[23]. .

MEASUREMENT :

Venipuncture will be used to collect fasting blood samples. Quantitation of serum 25(OH) vitamin D [25(OH) D2 plus 25(OH) D3] will be performed using Chemiluscence method by Centaur XP in the biochemistry laboratory of Subharti Medical College, Meerut. This method can detect 25(OH) vitamin D in the range of 4.2-150ng/ml. This method can detect 25(OH)D3 concentration as low as 4.2ng/ml.

Calcium will be measured by use of O-Cresolphthaleincomplexone and will be done using Dimension by RXL. Parathormone will be measured using Chemiluminometric technology using Centaur XP. This PTH assay is a 2-site sandwich immunoassay .

Because there is no universally acceptable definition of vitamin D deficiency, we will use cutoff points suggested recently by some studies[24,25,26]. Serum samples will be drawn at a similar gestational ages in in both the groups.

The collected data will be tabulated and analysed.

PERFORMA FOR PROJECT COMPLETION REPORT

To,

Date: 11/11/2021

Head of Department Dr. manita tyagi

Name of Department: Department of Obstetrics and Gynaecology

Name of College: Subharti Medical College.

Findings of the project: (Max-100 words):

In this study we concluded that incidence of vit D deficiency was found more in patients i hypertensive disorders of pregnancy but no relation was found between severity of vit D deficiency and maternal complication.

External Support: Younker Buddhist society and Research foundation

Biochemistry Deptt SMC

Name of PI: Dr. manita tyagi

Name of the Department: Department of Obstetrics and Gynaecology

Name of College: Subharti medical college

Title of the Project: To evaluate Maternal vit D levels in patient with Hypertensive disorders of pregnancy.

Duration of the Project: 2 years

Employee Code

Signature of P.I.

Registrar
Swami Vivekanand
Subharti University
MEERUT

STUDY TO EVALUATE CLINICAL AND MICROBIOLOGICAL RESPONSE OF INHALED ANTIBIOTICS IN RESPIRATORY TRACT INFECTION DUE TO MULTI DRUG RESISTANT ORGANISMS.

Research Proposal Submitted

By

Dr. Eema Chaudhary

Department of Respiratory Medicine

Subharti Medical College

Meerut

INTRODUCTION

Respiratory tract infection (RTI) refers to any of a number of infectious diseases involving the respiratory tract. An infection of this type is normally further classified as an upper respiratory tract infection (URI or URTI) or a lower respiratory tract infection (LRI or LRTI). Lower respiratory infections, such as pneumonia, tend to be far more serious conditions than upper respiratory infections, such as the common cold.

LRTI-

Pneumonia is an infection of the pulmonary parenchyma. Despite being the cause of significant mortality and morbidity, pneumonia is often misdiagnosed , mistreated and underestimated. Pneumonia is typically classified as community acquired (CAP) hospital acquired (HAP) ventilator associated(VAP) or Health Care associated (HCAP)[1]

Community-acquired pneumonia (CAP) refers to a pneumonia in a patient who is first bacterial respiratory culture who do not meet VAP or HCAP definition.

Hospital-acquired pneumonia (HAP) or nosocomial pneumonia refers to pneumonia in a patient inwhom first bacterial respiratory culture finding is more than two days from admission who do not meet VAP definition.

Ventilator-associated pneumonia (VAP) refers to pneumonia in a patient receiving mechanical ventilation forat least 24 hours with first positive bacterial respiratory culture finding after ventilator start date.

Health care-associated pneumonia(HCAP) refers to a pneumonia in a patient in which first positive bacterial respiratory culture with in two days of admission and any of the following-

1. Transfer from another health care center.
2. Receiving long term haemodialysis.
3. Prior hospitalisation within 30 days who do not meet VAP definition.

COPD WITH PNEUMONIC EXACERBATION-

COPD is a common disease. Over the prolonged, chronic course of the disease, episodes of acute exacerbation often occur. These episodes have a deleterious effect on the patient's quality of life and necessitate utilization of health-care services, including hospitalization some of the time. Although the definition of an acute exacerbation of COPD (AECOPD) is problematic,[1] it is generally diagnosed and categorized on the basis of clinical criteria of increasing shortness of breath, and/or an increase in the amount or purulence of sputum.[2] Community-acquired pneumonia (CAP) is an infectious disease with a broad spectrum of severity. Among CAP patients with the highest severity of disease who require hospitalization, COPD is the most common comorbidity.[345]

These two diagnoses, CAP and AECOPD, come together when COPD patients acquire AECOPD caused by CAP. The clinical manifestations of these episodes meet the accepted criteria for the diagnosis of AECOPD, and CAP is determined only in those cases in which a chest radiograph is obtained and a pulmonary infiltrate is found.

DAIGNOSIS-

Clinical –

Patients having an acute (duration less than 29 days) or worsening cough, shortness of breath, wheezing, thoracic pain, auscultation abnormalities, reported fever (≥38°C), perspiring, headache, myalgia .

Investigations-

1. Haematological- the investigations that are to be done are complete blood counts in which raised total leukocytes count indicate infection along with esr.

2. Gram Stain : The gram stain is probably one of the most talked about but least performed investigation in pneumonia. It can be performed quickly on expectorated specimen to predict the possible etiology of the infective organism. This can result in more effective empiric antibiotic therapy which is crucial in a country like India where an etiologic agent is not identifiable in more than half the number of patients. It is important to stress on the quality of expectorated specimen which needs to be from the deep lung and free from salivary contamination. The expertise of the micro biologist and recent antibiotic therapy will also play a key role in the final outcome of a gram stain examination. Needless to say that a ZN stain to look repeatedly for acid fast bacilli will be vital in ruling out TB which can mimic many of the pneumonias in presentation.

3. Sputum Culture: This is a sensitive means of identifying the bacteria. The gross appearance of sputum may provide a clue to the quality of the expectorate - a grossly purulent sputum is likely to yield better results then a sputum which is contamination with saliva. A corelation between the gram stain and culture will augment the final validity of the organism in question. The ability to perform quantitative cultures will definitely improve the quality and will also be a prognostic indicator of treatment response. Tissue culture techniques will be required to isolate viruses and atypical organisms.

4. Blood Culture : Blood cultures are an absolute necessity in patients who are sick enough to be in hospital. It may be not be necessary in out patients but this need to be modified according to the clinical picture. Antibiotic therapy prior to presentation may have a profound effect on the final outcome of the blood culture.

5. Urine culture and sensitivity- patients with systemic infection, manifesting pneumonia as a part of it , may also have etiological organisms in urine

6. Radiology: A chest radiograph- is an absolute necessity in patients with suspected pneumonias not only for confirming diagnosis but also to rule out other abnormalities. The infections can be confined to the airways or to the lung parenchyma. Three distinct radiological patterns are identifiable. Lobar or non segmental pneumonia – bronchopneumonia or lobular pneumonia and interstitial pneumonia. The radiological presentation can sometimes give us a clue to the infecting organisms.

CT Scan -Areas of air-space consolidation were not detected in patients with viral pneumonia and were less frequently seen in patients with Pneumocystis cariniipneumonia than in bacterial, Mycoplasma pneumoniae, and fungal pneumonias .There is no significant differencein the prevalence or distribution of consolidation between bacterial, Mycoplasma pneumoniae, and fungal pneumonias. Extensive symmetric bilateral areas of ground-glass attenuation are present in patients with Pneumocystis carinii pneumonia and are not seen in other pneumonias except in association with areas of consolidation and nodules. Centrilobular nodules are present less commonly in bacterial pneumonia than in Mycoplasma pneumoniae, viral, or fungal pneumonia.Except for Pneumocystiscarinii pneumonia and Mycoplasma pneumoniae pneumonia, which often have a characteristic appearance, high-resolution CT is of limited value in the differential diagnosis of the various types of infective pneumonia..

ROLE OF INHALED ANTIBIOTIC IN RESPIRATORY TRACT INFECTION-

Inhaled antibiotics have been used to treat chronic airway infections since the 1940s. The earliest experience with inhaled antibiotics involved aerosolizing antibiotics designed for parentral administration. These formulations caused significant bronchial irritation due to added preservatives and nonphysiologic chemical composition. A major therapeutic advance took place in 1997,when tobramycin designed for inhalation was approved by the U.S. Food and Drug Administration (FDA) for use in patients with cystic fibrosis (CF) with chronic Pseudomonas aeruginosa infection. Attracted by the clinical benefits observed in CF and the availability of dry powder antibiotic formulations ,there has been a growing interest in the use of inhaled antibiotics in other lower respiratory tract infections, such as non-CF bronchiectasis, ventilator-associated pneumonia, chronic obstructive pulmonary disease, mycobacterial disease, and in the post–lung transplant setting over the past decade.

RESISTANT MICRORGANISM IN RTI-

Isolation of multidrug resistant bacteria such as extended spectrum beta-lactamase (ESBL), metallo beta–lactamase (MBL) producing and Methicillin resistant Staphylococcus aureus

(MRSA) causing lower respiratory tract infection (LRTI) is associated with various risk factors and a major challenge in treatment. Bacterial etiology of lower respiratory tract infection and antibiotic sensitivity pattern with special reference to ESBL, MBL, and MRSA strains along with risk factors associated with such strains---- Pseudomonas aeruginosa , Acinetobacterbaumannii, Klebsiellapneumoniae, Escherichia coli and Staphylococcus aureus.

INTRA VENOUS Vs INHALED ANTIBIOTICS-

The rationale for inhaling antibiotics is to maximize drug delivery to the target site of infection (i.e., the airways) and limit the potential for systemic side effects. Aerosol delivery of antibiotics was first reported in the 1940s, but the early use of inhaled antibiotics was hampered by the lack of reliable nebulizer systems to maximize delivery to the airway. Most of the early formulations, which consisted of reconstituting antibiotics designed for parenteral administration, were poorly tolerated by patients due to hyperosmolarity

DOSING AND ADMINISTRATION

Several antibiotics, such as gentamicin, amikacin, tobramycin and colistin designed for parenteral administration have been repurposed for nebulization and used off-label to treat lower airway infections .Most of these drugs have been studied in a nonrandomized, uncontrolled manner, and therefore optimal drug dosing remains undefined. Optimal nebulizer systems also remain indeterminate, but most studies have used jet nebulizers, which use air or oxygen under high pressure to generate the aerosol .During mechanical ventilation, nebulizers are connected to the inspiratory limb of the ventilator circuit, and the antibiotic can be administered continuously or only during inspiration.[2]

INHALED ANTIBIOTICS CURRENTLY USED IN CLINICAL PRACTICE

A major challenge to the use of inhaled antibiotics has been the prolonged administration time (typically 15–20 min) of the jet nebulizer systems. The recent development of more efficient nebulizer systems and formulations have been a major advance for antibiotic delivery to the lower airways and should improve patient convenience and therefore adherence to therapy. Two examples of these new technologies for administration of inhaled antibiotics are provided.

Vibrating mesh nebulizers driven by piezoelectric actuators have been developed to replace the older compressor-driven jet nebulizers. Droplets generated are similar in size to the mesh aperture (usually about 3 μm), thus reducing heterodispersion (i.e., size variability) compared with conventional nebulizers. This advance significantly increases the efficiency of drug delivery to the lower airway and shortens nebulization time .Vibrating mesh nebulizers are also portable devices, as they are hand held and battery powered.

Recently, studies of inhaled amikacin , colistin and tobramycin have focused on liposomal formulations with the goal of protecting the antibiotics from the harsh environment of the sputum, improving penetration into biofilms, and allowing for more sustained release of drug within the airway, allowing for once-daily administration. Based on *in vitro* studies, liposomes demonstrate excellent penetration into CF sputum and *P. Aeruginosa* biofilms [3-5]

COLISTIN:- They were obtained in late 1940 from bacillus colistinus these are polypeptide antibiotics active against gram negative bacteria only all except proteus, serratia and nesseria are inhabhited.

Theese are rapidly acting bactericidal agent having a detergent like action on cell memberane, these have high affinity for phospholipid. The peptide molecule orient between the phospholipid and protein films in gram negative bacterial cell membrane causing membrane distortion or pseudopore formation. As a result amino acids ions etc leak out. Sensitive bacteria take up more of the antibiotics they may also inactivate the bacterial endotoxin.

Resistance to these antibiotics have never been a problem. There is no cross resistance with any other antimicrobial agent.

No clinically useful absorption of colistin occurs in the gastrointestinal tract. For systemic infection, colistin must, therefore, be given by injection. Colistimethate is eliminated by the kidneys, but colistin is supposed to be eliminated by non-renal mechanism(s) that are as yet not characterised.

Tobramycin:- it was obtaines from S. tenebrarius in 1970s. the antibacterial and pharmakokinetic properties as well as doses are almost identical to gentamycin but it is 2-4 times more active against pseudomonas and proteus including some resistance to gentamycin, but majority are cross resistance. However it is not useful for combining with penicillin in the treatment of enterococcal endocarditis. It should be used only as an alternative to gentamycin. Serious infection caused by pseudomonas and proteus areits major indication. Autotoxicity as well as nephrotoxicity is less than gentamycin.

Like all aminoglycosides, tobramycin does not pass the gastro-intestinal tract, so for systemic use it can only be given intravenously or intramuscularly. Ophthalmic (tobramycin only, Tobrex, or combined with dexamethasone, sold as TobraDex) and nebulised formulations both have low systemic absorption. The formulation for injection is branded Nebcin. The nebulised formulation (brand name Tobi) is indicated in the treatment of exacerbations of chronic infection with *Pseudomonas aeruginosa* in patients diagnosed with cystic fibrosis. A proprietary formulation of micronized, nebulized tobramycin has been tested as a treatment for bacterial sinusitis. Tobramycin (injection) is also indicated for various severe or life-threatening gram-negative infections: meningitis in neonates, brucellosis, pelvic inflammatory disease, *Yersinia pestis* infection (plague).Tobramycin is preferred over gentamicin for Pseudomonas aeruginosa pneumonia due to better lung penetration.

Tobramycin works by binding to a site on the bacterial 30S and 50Sribosome, preventing formation of the 70S complex. As a result, mRNA cannot be translated into protein, and cell death ensues. According to Kotra, Haddad and collaborators "aminoglycosides, including Tobramycin, are multifunctional hydrophilic sugars that possess several amino and hydroxy functionalities. The amine moieties are mostly protonated in biological media; hence, these antibiotics can be considered polycationic species for the purpose of understanding their biological interactions. Since they are polycationic, they show a binding affinity for nucleic acids. Specifically, aminoglycosides possess high affinities for certain portions of RNAs, especially the prokaryotic rRNA. In addition, aminoglycosides bind to the *hammerhead* ribozyme, tRNA(Phe), the Rev response element (RRE) transcriptional activation region in human immunodeficiency virus (HIV), the ribozyme from hepatitis delta virus, and group I self-splicing introns.

ADVERSE EFFECTS OF INHALED ANTIBIOTICS

Known or potential adverse effects of inhaled antibiotics fall into three main categories: local, systemic, and emergence of antibiotic resistant organisms.[6-11]

LOCAL EFFECTS

As mentioned above, topical effects include transient bronchoconstriction due to osmolality and preservatives within some of the solutions. In one study of different preparations of inhaled tobramycin, acute drops in both vital capacity and FEV_1 were very common (in preparations with and without phenol preservatives) but normalized quickly and were usually responsive to pretreatment with albuterol. Experience with inhaled aztreonam has also demonstrated acute changes in FEV_1 after inhalation, with the majority recovering to within 15% of baseline by 2 hours. Due to the frequent occurrence of bronchospasm, patients are often routinely instructed to administer bronchodilators before dose. Altered taste, dysphonia, and throat irritation are also commonly reported side effects related to inhaled antibiotics.

SYSTEMIC EFFECTS

Current knowledge of the systemic effects of inhaled antibiotics remains limited, particularly for antibiotics under development. Systemic effects such as ototoxicity or nephrotoxicity were not noted in either phase 2 or 3 trials of inhaled TOBI . Although extremely rare in patients with normal renal function, case reports have noted both ototoxicity and renal toxicity in patients with and without CF treated with tobramycin solution for inhalation or colistin, primarily in the setting of diminished glomerular filtration rate resulting in systemic drug accumulation .

AIMS AND OBJECTIVES

TO ASSES CLINICAL AND MICROBIOLOGICAL RESPONSE OF INHALED ANTIBIOTICS IN RESPIRATORY TRACT INFECTION.

MATERIAL AND METHODS

The present prospective study is a single center based cohort study to evaluate the clinical and microbiologial results in patients receiving inhaled antibiotic in respiratory tract infection due to multidrug resistant organism. The study would be initiated after clearance from the institutional ethical committee. Patients admitted under the department of Respiratory Medicine at ChattarpatiShivaji Hospital of Subharti Medical Collage,Merrut,Uttar Pradesh between October 2017-December 2019 will be included in the study after fulfilling the inclusion and exclusion criteria. All patients will be included after a well informed written consent.

Inclusion criteria:

1 Age > 18 yrs

2 Patients diagnosed with LRTI

3 Multi drug resistance organism isolation on sputum culture and sensitivity

Exclusion criteria:

1. Age less than 18 yrs

2. Patient with acute renal failure

3. Patient with ototoxicity

4. Unwilling patients

5. Pregnancy

6. Lactating Women

Initial work up of the patients would include:

1. Clinical history

2. Examination

3. Blood samples for complete blood counts and blood cultures

4. Sputum aerobic culture and sensitivity

5. Chest X Ray PA view Digital

6. Urine culture and sensitivity

7. Urine routine microscopy

8. KFT

WORKING PROFORMA

PATIENT PARTICULARS

NAME:

AGE/SEX:

IPD NUMBER:

ADDRESS:

HISTORY

CHIEF COMPLAINS DURING ADMISSION:

PRESENT HISTORY:

PAST HISTORY:

OCCUPATION:

DRUG HISTORY:

ADDICTION:

FAMILY HISTORY:

EXAMINATION:

VITALS

PR-

BP

OXYGEN SATURATION BY PULSE OXIMETRY -

TEMPERATURE-

GENERAL EXAMINATION

PALLOR-

ICTERUS-

CLUBBING-

CYNOSIS-

LYMPHADENOPATHY-

(539)

PERFORMA FOR PROJECT COMPLETION REPORT

To,

Date: 15/02/2020

Head of Department Dr. Leena Chaudhary.
Name of Department: TB & Resp Ds
Name of College: SMC.

Findings of the project: (Max-100 words): 50 subjects were studied. Clinical and microbiological end points both were looked into 75% patients were male, 25% females. Most patients were of OPD. On 2 weeks follow up, Microbiological eradication was achieved in 49% pt.s. 37 patients get completely cured. Poorer Outcomes was noted in higher age group.

External Support: ~~Nil~~
ABVSHIS GRAMIN
SEWA
SANSTHAN

Name of PI: Dr. Shivam Mohan Pandey
Name of the Department: TB & Resp Ds
Name of College: SMC.
Title of the Project: Prospective cohort study to evaluate clinical & Microbiological response.
Duration of the Project: 02 yrs.

Leena

Employee Code

Signature of P.I.

Registrar
Swami Vivekanand
Subharti University
MEERUT

Jai Hind!!

Swami Vivekanand Subharti University, Meerut
(Established under U.P. Govt. Act no. 29 of 2008 and approved under section 2(f) of UGC Act 1956)