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Design and Analysis of Runout Measuring Machine using Fea

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ABSTRACT
Industrial engineering is a branch of engineering which deals with the optimization of complex processes or systems. It is concerned with the development, improvement, implementation and evaluation of integrated systems of people, money, knowledge, information, equipment, energy, materials, analysis and synthesis, as well as the mathematical, physical and social sciences together with the principles and methods of engineering design to specify, predict, and evaluate the results to be obtained from such systems or processes. While industrial engineering is a traditional and longstanding engineering discipline subject to (and eligible for) professional engineering licensure in most jurisdictions, its underlying concepts overlap considerably with certain business-oriented disciplines such as operations management. Depending on the subspecialties involved, industrial engineering may also be known as, or overlap with, operations management, management science, operations research, systems engineering, management engineering, manufacturing engineering, ergonomics or human factors engineering, safety engineering, or others, depending on the viewpoint or motives of the user. For example, in health care, the engineers known as health management engineers or health systems engineers are, in essence, industrial engineers by another name.

KEYWORDS: *V- block, shaft, taper roller bearing, combine I.D. Go and Nogo plug guage*

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I. INTRODUCTION

1.1. What is industrial engineering?

Industrial engineering (IE) is about choices. Other engineering disciplines apply skills to very specific areas. IE gives you the opportunity to work in a variety of businesses. The most distinctive aspect of industrial engineering is the flexibility that it offers. Whether it's shortening a rollercoaster line, streamlining an operating room, distributing products worldwide, or manufacturing superior automobiles, all share the common goal of saving money and increasing efficiencies.

As companies adopt management philosophies of continuous productivity and quality improvement to survive in the increasingly competitive world market, the need for industrial engineers is growing. Why? Industrial engineers are the only engineering professionals trained as productivity and quality improvement specialists. Industrial engineers figure out ways to do things better. They engineer processes and systems that improve quality and productivity. They work to eliminate waste of time, money, materials, energy, and other commodities. Most important of all, IE's save companies money. This is why more and more companies are hiring industrial engineers and then promoting them into management positions.

Many people are misled by the term "industrial engineer." The "industrial" does not mean just manufacturing. It encompasses service industries as well. It has long been known that industrial engineers have the technical training to make improvements in a manufacturing setting. Now it is becoming increasingly recognized that these same techniques can be used to evaluate and improve productivity and quality in service industries.

1.2. What do industrial engineers do?

Industrial engineers figure out ways to do things better. They engineer processes and systems that improve quality and productivity. IE's make significant contributions to their employers by saving money while making the workplace better for fellow workers. In addition to manufacturing, industrial engineers apply their skills in a variety of settings.

1.3. Here are a few examples:

- As a management engineer in a hospital, an IE may help doctors and nurses
- Make the best use of their time in treating patients.
- As an ergonomist in a television manufacturing plant, an IE may change the tools workers use to assemble televisions to reduce the risk of repetitive stress Injuries.
- As an operations analyst for an airline, an IE may design a bar coding system for identifying and transporting passengers luggage to ensure that it does not get lost.

- As a quality engineer for a public gas and electric company, an IE may improve customer satisfaction by designing a process to schedule service calls around the availability of the customer.

Manufacturing firms and service industries hire a significant number of IE's. Today, more and more businesses hire IE's in areas like sales and marketing, finance, information systems, and personnel. Other industries employing IE's are hospitals, airlines, banks, railroads, and social services. Industrial engineering has provided a systematic approach to streamline and improve productivity and efficiency in the business world.

- IE's provide leaner, more efficient, and more profitable business practices while increasing customer service and quality.
- IE's make the work environment safer, faster, easier, and more rewarding.
- They provide a method by which businesses can analyze their processes and try to make improvements to them. Staying focused on optimization - doing more with less - which helps to reduce waste in society.
- IE's help reduce costs associated with new technologies, thus allowing more of the population to better their lives by being able to afford these advances.

1.4. Where do industrial engineers work?

Manufacturing firms and service industries hire a significant number of IE's. Today, more and more businesses hire IE's in areas like sales and marketing, finance, information systems, and personnel. Other industries employing IE's are hospitals, airlines, banks, railroads, and social services.

1.5. Objective and Scope:

Objective:

IPE make processes better in the following ways:

- More efficient and more profitable business practices.
- Better customer service and product quality.
- Improved efficiency.
- Increase ability to do more with less.
- Making work safer, faster, easier, and more rewarding.
- Helping companies produce more products quickly.
- Making the world safer through better designed products.
- Reducing costs associated with new technologies.
- Modification of machining parts if necessary.

Scope:

Operations Research, Management Science, Financial Engineering, Supply Chain, Manufacturing Engineering, Engineering Management, Systems Engineering, Design Engineering, Ergonomics, Process Engineering, Value Engineering and Quality Engineering.

1.6. Overview:

While the term originally applied to manufacturing, the use of "industrial" in "industrial engineering" can be somewhat misleading, since it has grown to encompass any methodical or quantitative approach to optimizing how a process, system, or organization operates. Some engineering universities and educational agencies around the world have changed the term "industrial" to broader terms such as "production" or "systems", leading to the typical extensions noted above. In fact, the primary U.S. professional organization for Industrial Engineers, the Institute of Industrial Engineers (IIE) has been considering changing its name to something broader (such as the Institute of Industrial & Systems Engineers), although the latest vote among membership deemed this unnecessary for the time being. The various topics concerning industrial engineers include management science, work-study, financial engineering, engineering management, supply chain management, process engineering, operations research, systems engineering, ergonomics / safety engineering, cost and value engineering, quality engineering, facilities planning, and the engineering design process. Traditionally, a major aspect of industrial engineering was planning the layouts of factories and designing assembly lines and other manufacturing paradigms. And now, in so-called lean manufacturing systems, industrial engineers work to eliminate wastes of time, money, materials, energy, and other resources.

Examples of where industrial engineering might be used include flow process charting, process mapping, designing an assembly workstation, strategizing for various operational logistics, consulting as an efficiency expert, developing a new financial algorithm or loan system for a bank, streamlining operation and emergency room location or usage in a hospital, planning complex distribution schemes for materials or products (referred to as supply-chain management), and shortening lines (or queues) at a bank, hospital, or a theme park.

II. LITRATURE REVIEW

Satish Kumar "Impact of Six-Sigma DMAIC approach on Manufacturing Industries". International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) [1]

The concept of Six-Sigma has dominated the management scene for some decades. Six-Sigma is a rigorous, disciplined, data-driven methodology that was developed to enhance product quality and company profitability by improving manufacturing and business processes. Many organisations all over the world have tried to use Six-Sigma DMAIC (Define, Measure, Analyze, Improve, and Control) approach and its tools to get optimised organisational achievements. The present work is an attempt to study the impact of Six Sigma DMAIC approach in manufacturing industries of Ludhiana. This study is to explore the level of usage and level of difficulty of different tools of DMAIC approach. Barriers in implementing Six-Sigma DMAIC approach and the benefits achieved after successful implementation of DMAIC approach have also been identified. A well designed questionnaire has been used to collect data from 23 manufacturing industries. The results from the analysis of data have shown that, the manufacturing organizations have less educated man power (Mean=2.8260 significant at 5% level) and also they are lacking in to provide adequate training to them for effective implementation of Six-Sigma tools. Furthermore, the results have shown that maturity phase of DMAIC approach enhances the improvements as compared to initial and developing phase, yet it can be concluded that Six Sigma DMAIC approach is still growing in manufacturing organizations. Also, the results of correlation analysis indicate that DMAIC approach is significantly used to improve the quality (r=0.443122 significant at 5% level) of product.

Varsha M. Magar, Dr. Vilas B. Shinde "Application of 7 Quality Control (7 QC) Tools for Continuous Improvement of Manufacturing Processes". International Journal of Engineering Research and General Science Volume 2, Issue 4, June-July, 2014. [2]

In this paper a review of systematic use of 7 QC tools is presented. The main aim of this paper is to provide an easy introduction of 7 QC tools and to improve the quality level of manufacturing processes by applying it.QC tools are the means for Collecting data , analyzing data , identifying root causes and measuring the results. these tools are related to numerical data processing .All of these tools together can provide great process tracking and analysis that can be very helpful for quality improvements. These tools make quality improvements easier to see, implement and track. The work shows continuous use of these tools upgrades the personnel characteristics of the people involved. It enhances their ability to think generate ideas, solve problem and do proper planning. The development of people improves the internal environment of the organization, Which plays a major role in the total Quality Culture.

H. A. Salaam, S. B. How, M. F. Faisae "Productivity improvement using industrial engineering tools" 1st International Conference on Mechanical Engineering Research 2011 (ICMER2011) Faculty of Mechanical Engineering, University Malaysia Pahang (UMP), Pekan, Pahang Darul Makmur, 26600, Malaysia[3]

Minimizing the number of defects is important to any company since it influence their outputs and profits. The aim of this paper is to study the implementation of industrial engineering tools in a manufacturing recycle paper box company. This study starts with reading the standard operation procedures and analyzing the process flow to get the whole idea on how to manufacture paper box. At the same time, observations at the production line were made to identify problem occurs in the production line. By using check sheet, the defect data from each station were collected and have been analyzed using Pareto Chart. From the chart, it is found that glue workstation shows the highest number of defects. Based on observation at the glue workstation, the existing method used to glue the box was inappropriate because the operator used a lot of glue. Then, by using cause and effect diagram, the root cause of the problem was identified and solutions to overcome the problem were proposed. There are three suggestions proposed to overcome this problem. Cost reduction for each solution was calculated and the best solution is using three hair drier to dry the sticky glue which produce only 6.4 defects in an hour with cost of RM 0.0224.

Salman T. Al-Mishari, S. M. A. Suliman "Sensitivity Analysis of Six-Sigma Applied to a Reliability Project" International Journal of Mechanical & Mechatronics Engineering IJMME-IJENS Vol: 11 No: 03- [4]

Abstract: The Six-Sigma DMAIC process was applied to improve the reliability on a group of water disposal pumps at a number of oil facilities. The anticipated cost avoidance in terms of production losses and maintenance costs was simulated to be about half the current costs. After the completion of the project, a number of what-if scenarios were conducted to assess the importance of each step in the DMAIC process. Examples of such scenarios are "what if the problem was not well Defined, Measured, Analyzed, Improved, or Controlled?" This paper presents the results of the simulated scenarios in terms of monetary figures. The purpose is to illustrate the significance of each step in the DMAIC process.

Pratik J. Patel, Sanjay C. Shah, Sanjay Makwana "Application of Quality Control Tools in Taper Shank Drills Manufacturing Industry" [5]

Abstact: The aim of this paper is to improve the quality level by finding out the root causes of the quality related problems. Quality control tools are important tools used widely at manufacturing field to monitor the overall operation and continuous process improvement. Check Sheet, Pareto Diagram, Histogram, Cause-and-effect diagram, Control Chart, Run-Chart and Scatter-Diagram are used in enhancing the process by continuous monitoring through quality tools.

III. OBJECTIVE OF STUDY

To analyze the study, design and analysis of run-out measuring machine

IV. PROBLEM STATEMENT

We focused on this subject due to accuracy of part to be measure is very high and required lot of time to measure the part. so our aim is to design a run-out machine in such way it should fulfill accuracy as well as reduces time to measure.

V. METHODOLOGY

Working: As the mounting is horizontal the tulip is inserted horizontally on the mandrel. Now the worker present at the inspection section turns the tulip clockwise physically such that the needle touches over the entire profile of the tulip. The Tulip has three profiles and three depressions. The readings of the three profiles is recorded by the mechanical dial gauge and the runout is calculated. For Example: If profile 1 mesures 0.8 micron, profile 2 measures 1 micron and profile 3 measures 0.6 micron then the runout of the tulip can be calculated as,

Runout = Highest profile reading – Lowest profile reading
= 1 – 0.6
Therefore Runout = 0.4 micron

Now the criteria for the acceptable runout is that the runout calculated should be under 0.6 micron. In the example the runout is 0.4 micron which is within the acceptable range. hence the tulip part will be approved as OK.

Here the worker has to orally keep in mind all the three profile readings and then further calculate the runout orally.

In this study we are going to analyze the method of run-out measuring instruments and improvement in such kind of instrument which gives high productivity and good quality work. we are going to design a run out measuring machine in such a way that it gives the run-out of part and quality of inner diameter gauging. In current instrument of run out machine horizontal set up with V-block and shaft, but in that case it is a lengthy process i.e. time consumable process also such process check only run-out. we are designing a machine in such way it not only calculate run-out but also gives us inner diameter in gauge format also the this machine mounting vertical did not required V-block. our set up requires taper roller bearing, base to hold bearing, upper plate, gauge for I.D. measurements. If such product is design perfectly such machine give run-out as well as I.D. gauging i.e. this will help us to reduced time for checking and helps to improved productivity.

The solution of industrial process design can be implemented in a few conceptual designs. It is easy to design early stage of model in the CAD modeling design was performed by using CATIA P3 V5.

V. CATIA MODELING

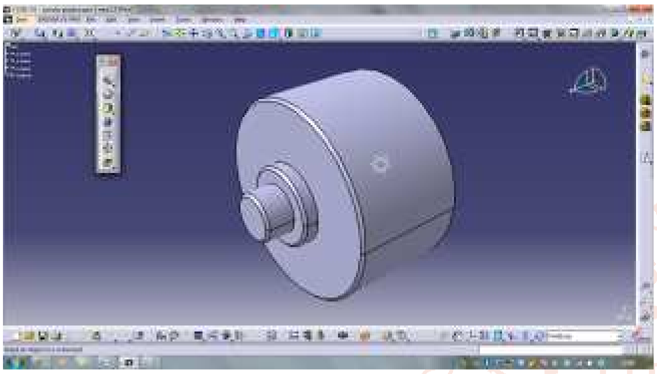

Fig. 1 CAD Model of Base of machine

In above model is a base of machine, having an arrangement of holding a bearing of ID 17mm.

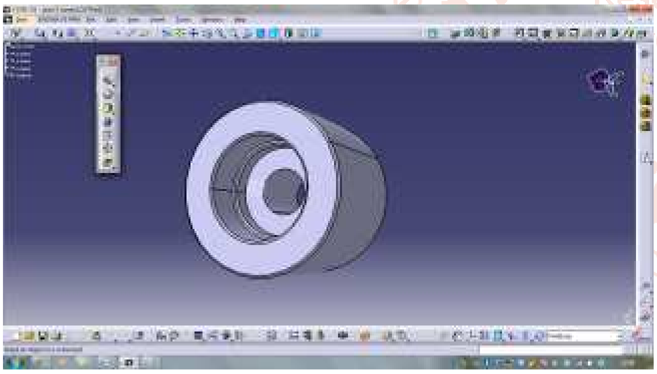

Fig. 2 CAD Model of Upper Part of machine

Above part is a upper portion of machine having an holding arrangement of bearing cap.

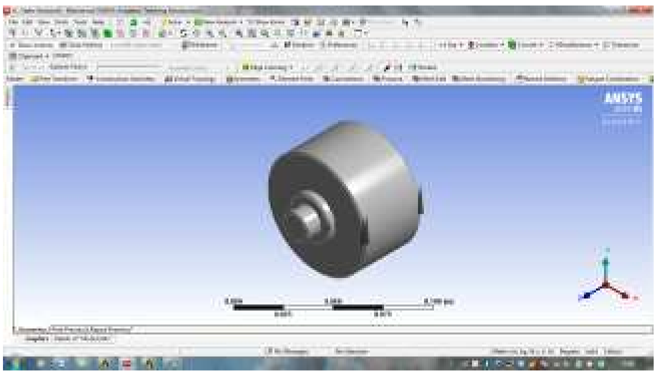

Fig. 3 ANSYS Model of Upper Part of machine

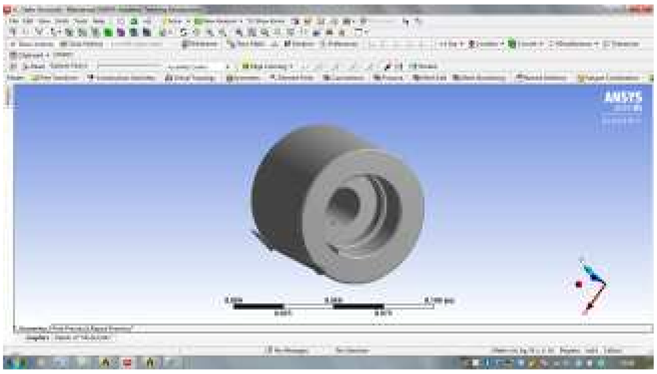

Fig. 4 ANSYS Model of Upper Part of machine

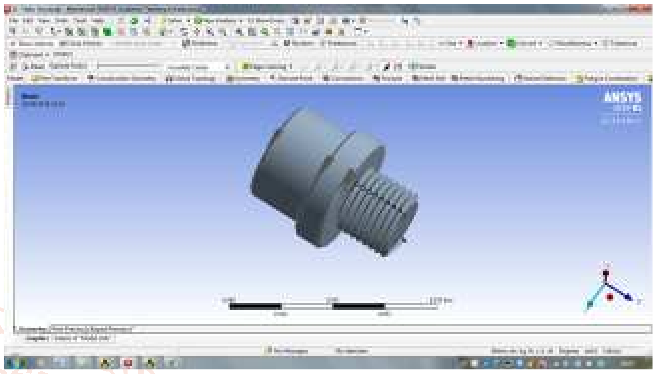

Fig. 6 ANSYS Model of Work Piece Holder

VI. MATERIAL USED IN MODEL

As our model is very light in weight but due to continuous rubbing between material to be inspected and model we need to hard material. so we choose WPS, D2, Hard die steel. we are interested to take wps material because it having a hardness of 60 to 62 HRC after heat treatment.

VII. CONCLUSION

From the above scenario it is concluded that such machine have an ability to measure run-out of part in few seconds. Machine have simple construction and easy for manufacture also it is very cheapest. The measurable ability of such machine depends on run-out of machine mounting which have to care during manufacturing.

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