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Laser Measuring Device For Lathe Machine

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Abstract: Implementation of a Laser measuring device on a Lathe machine to measure the feed given to the toolpost of the Lathe machine. To implement this tool, the data was collected from workers and industry manager to analyze so that it can minimize defects and imperfection of jobs. We aim to improve worker efficiencies and make the job more precise and accurate. The goal is to identify and eliminate errors, which is any activity that does not add value to the final product, in the production process.

Keywords--- DRO, LMD, LMS, CMCA, LVDT.

I. INTRODUCTION

The Project work presented during this paper relies on the implementation of a Laser measuring instrument on a Lathe machine in workshops to enhance the standard of jobs manufactured within the industry. The corporate selected to conduct this study is MVK Ventures Company PVT. LTD which is in Alibag, Raigad. MVK industry is one of every one of the leading jobs manufacturing industries in Maharashtra. Their clients are from everywhere in Maharashtra.

A. Measuring instruments:

A measuring device may be a device to live a physical quantity within the physical sciences, quality assurance, and engineering, measurement is that the activity of obtaining and comparing physical quantities of real-world objects and events.[1] Established standard objects and events are used as units, and also the process of measurement gives variety relating to the item under study and also the referenced unit of measurement. Measuring instruments, and formal test methods which define the instrument's use, are the means by which these relations of numbers are obtained. All measuring instruments are subject to varying degrees of instrument error and measurement uncertainty.

B. Need for Laser instrument within the industry:

In today’s competitive environment, the industry has got to increase the demand without increasing the sale price of the merchandise. This has forced the corporate to boost the effectiveness of production and other operation to scale back the price. Thus to realize this target we introduced this to create the assembly of jobs more efficient and more accurate.[2]

A key objective of this device is, this keeps track of your toolposts movement in both the axis (not at the identical time) and make the assembly faster than usual, as you may not have to make a certain confusing dial gauge for each feed given to the toolpost to provide new jobs more efficiently and precisely.

C. Market survey:

According to the current market survey, the demand for DRO is more but only a few industries use it as it is costly and have high maintenance. Deployment of LMD in industries and workshops is an effective, low-cost and efficient method of providing Contactless DRO to all to reduce waste, electricity usage, and working hours. The design of LMD and its user interface will maximize the usage of this device across a wide range of users. Currently, there are contact-based measuring devices for lathe machines in the market.

D. History of Lathe machine and DRO:

Lathe machine is an ancient tool. The earliest evidence of lathe machines is from ancient Egypt around 1300BC. But in recent years we started using DRO on Lathes to make the production easy and more efficient. But all the DRO devices are contact-based and have more errors.[3]

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E. Tangible benefits OF implementation of the Laser measuring device:

Implementation of a Laser measuring device for lathe brings many benefits to the organization. Some of those are economical and some improve human capital. The results of strategic implementation of this device can be seen in staff, environment, quality, production. The significant measurable benefits realized through the implementation of this device are depicted below:

- Upgradation of productivity
- Reduced lead-times
- Safer shop floor
- Reduction in searching times and costs
- Productivity improvement.
- Less inventory

F. Intangible benefits of Implementation of the Laser measuring device:

The significant intangible benefits realized through the implementation of this device are depicted below:

- Improved company's Reputation
- Reduction in non-value-adding activity
- Better working circumstances and rising comfort
- reduced unnecessary human motion
- Improved coordination and teamwork among employees
- Greater employee participation
- A way to avoid blaming people for defects.

II. Literature Review

Technique for Fast Measurement of Gaussian Laser Beam Parameters[4]

J. A. Arnaud, W. M. Hubbard, G. D. Mandeville, B. de la Clavière, E. A. Franke, and J. M. Franke

The purpose of this paper is to describe a device that can quickly and accurately measure the value of w (z) at any point along the beam and to point out how it can be used to determine the confocal parameter b of the beam with one simple measurement. A modification of the device that enables one to determine the beam waist location is then described. The Gaussian beam is, of course, completely specified by the value of b and the location of the beam waist since the diameter and phase-front radius can be calculated from this for any value of z. 1 The value of w can be obtained in several ways. The most straightforward is to scan the beam with a pinhole (or slit), but this method is slow and tedious. A faster and simpler method is to chop the beam periodically with a straight edge travelling at a known velocity u in the plane in which one wishes to know the value of w. For a Gaussian beam, the detected power of the chopped beam is given (on the interval during which the chopper is eclipsing the beam).

selected.

A New Method for the Measurement of the Straightness of Machine Tools and Machined Work [5]

Koichi Tozawa ,Hisayoshi Sato ,Masanori O-hori. A new algorithm to measure the straightness of a machine tool and that of a machined work is proposed. This makes it possible to investigate the correlation between the two. The case of an engine lathe is used as an example. The measurement is performed by sensing the relative displacement between the objective and the tool post which carries two sensors and is fed with steps of distance. The machine tool characteristics have the most important effect on the machined work. The method can be extensively applied to measuring cylindricity.

Static and Fatigue Analysis of Lathe for Maximum Cutting Force[6]

Author links open overlay panel G.Pan⁎ H.Xu⁎ C.M.Kwan⁎ C.Liang⁎ L.Haynes⁎ Z.Geng⁎

In this paper, the effect of approach angle, feed, depth of cut and nose radius on cutting force components were investigated. The experiments were conducted on PSG 124 lathe machine using carbide coated cutting tools on material hardened EN9. The orthogonal array of L-16 was used for the optimization of tests. Cutting forces generated during lathe turning operation were measured using a three-axis lathe tool dynamometer. The statistical regression analysis method was applied to investigate the maximum cutting force generated and which was found at an approach angle = 450, feed = 0.3 mm, depth of cut = 1 mm and nose radius = 0.8 mm. Static and fatigue analysis has been carried out numerically by considering different forces acting on the lathe spindle. Results of this analysis show, the present design of the spindle are safe.

EFFECTS OF VARYING JOB PARAMETERS ON RELEASE TIME USING LATHE MACHINE[7]

T. I. OGEDENGBE, B. KAREEM, O. O. OJO, This paper amply studied the effects of varying job parameters on the release time of jobs produced on lathe machines and further showed the significance of the careful selection of optimum complexity for lathe produced jobs. Job parameters are the salient factors apart from mechanical inputs or machine parameters on which the release time of jobs is subject. These parameters include the complexity of job, material, and length of job and depth of cut employed in metal cutting. Directly measured release times were obtained at ranges of machine parameters of spindle speed from 300-550 rev/min and feed rate from 0.068-0.117 mm/rev on the lathe machine and the job parameters were conversely documented. The assessment of job parameters on the release time of jobs produced on lathe machines was carefully investigated using exponential, linear, logarithmic, polynomial, and power regression analyses. The R-square value on charts was employed as the decision criterion for checking the correlation between release time and each of

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the job parameters. A change in any of the job parameters brings about a proportional effect on release time. The polynomial model gives the optimum correlation for each of the job parameters

III. Working

A. Measuring Principles:

A laser distance meter works by using measuring the time it takes a pulse of laser light to be reflected off a target and returned to the sender. This is known as the "time of flight" principle, and the method is known either as "time of flight" or "pulse" measurement. The distance between the meter and target is given by D=ct/2, where c equals the speed of light and t equals the amount of time for the round trip between the meter and target. The laser Distance Measurement device was invented in 1993 in Leika Geosystems at Batimat show in Paris. The first Leika measuring device was the size of the brick and having the same weight. The range of the device was 100 feet (30.48mts) and having a precision of 1/8 foot. The idea behind the first DISTO was to empower people who rely on precise measurements, or who need to measure things in hazardous or inaccessible areas, to transform their jobs. Starting with accurate measurements early in the process, and making it easy to re-check measurements on the job, meaning that even the first LDM helped people produce a better-finished product in less time—a fact that did not go unnoticed by other tool manufacturers.[8]

B. *Methodology:*

- ✓ LMD (Laser measuring device) is to be mounted on the tool post.
- ✓ A metal platform is made connecting the toolpost to mount the device on it.
- ✓ The device is mounted on the bearing which will help it rotate on both axes.
- ✓ A solid surface or backplate should be provided along the x-axis and y-axis to reflect the laser to the device, according to the type of operation and convenience of the operator.
- ✓ The surface should be flat and regular in shape and also can be adjustable.
- ✓ We will set the reading of the LMD at zero (reset) when the machine is stationary i.e no operation is running and the tool is touching the circumference of the workpiece.
- ✓ As we will move the tool towards or outwards while working on a 'JOB' we will get an accurate reading of the movement of Tool on LMD.
- ✓ This will take place due to the change in the position of the tool with respect to its axis (x-axis or y-axis)
- ✓ As this setup will be digital operators can also get readings that are very small and cannot be seen on conventional devices.

Fig.1 Laser measuring device

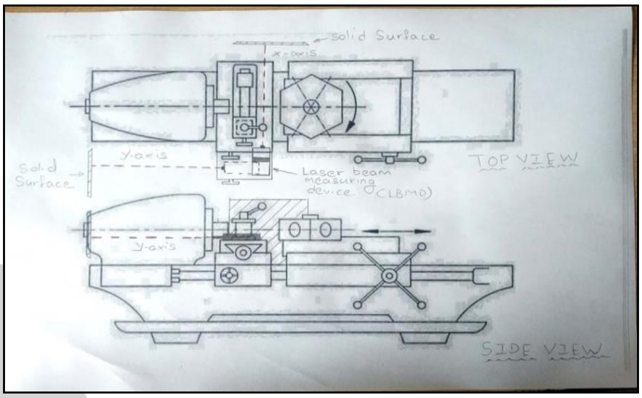

Fig.2 Concept design 1

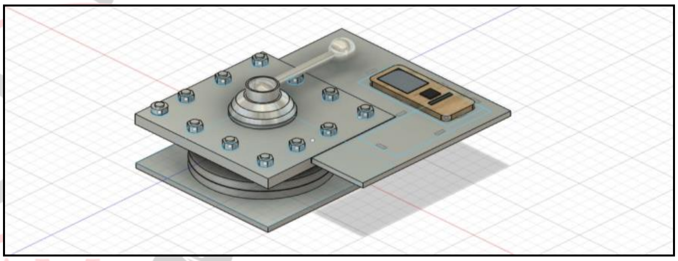

Fig.3 Concept Design 2

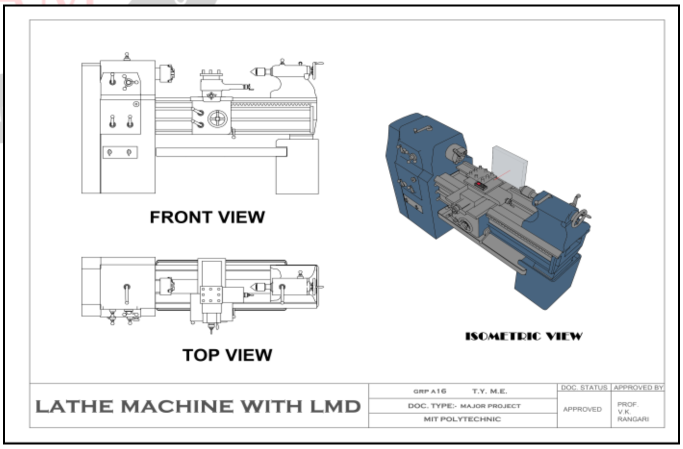

Fig.4 Device mounted on Lathe machine

IV. Implementation of Device

A. Identification of problem:

The first problem in the implementation of a measuring device is identifying the problem that prevents the company to achieve its goal. First, a manual method of identifying a problem will be employed which include

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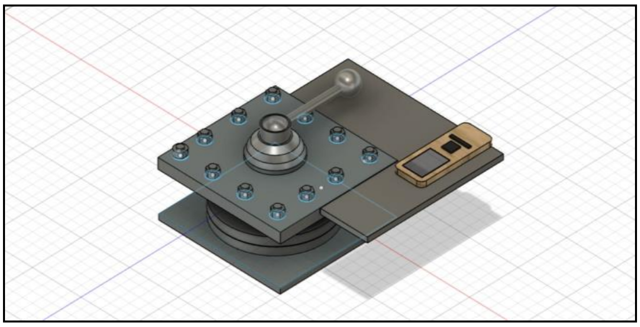
walking across the shop floor, interactions with workers and supervisors etc. After the survey, the problem came up, which prevents them to manufacture more précised jobs on Lathe machines.

B. Finding the cause of the problem:



Number The second step in implementation is to explore the cause of the problem that was identified during the first step. Exploring the cause of the problem basically highlights the lack of any more précised or modern measuring device on tool post to measure the feed precisely. According to the nature of identified problem following ideas were discussed:

1. DRO using LVDT
2. DRO using Vernier calliper (glass scale)
3. DRO using a Laser measuring device

C. Decision:

As we knew the cause of the problem, we decided to implement any one device of these three devices to solve the problem regarding more précised job manufacturing. After discussing various factors like errors, costs, availability, life, etc we ended up finalizing the DRO using a Laser measuring device.

D. Implementation:

1.LMD (Laser measuring device) is to be mounted on the tool post.

2.A solid surface or plate should also be provided along the x-axis and y-axis according to the type of operation and convenience of the operator.

3.The surface should be flat and regular in shape and also can be adjustable.

4.We should reset the LMD when the machine is stationary i.e no operation is running and the tool is touching the workpiece.

5.As we will move the tool towards or outwards we will get an accurate reading of the movement of Tool on LMD.

6.This will take place due to the change in the position of the tool concerning its axis (x-axis or y-axis)

7.As this setup will be digital operator can also get readings that are very small and cannot be seen on conventional devices.

V. Conclusion

This device is extremely useful as this saves time, raw material and electricity. Our aim was that this product should be used in other industries and we succeed to do so. This device helped MVK Industry to make their jobs more precise and also minimized their production time. This device also helps to avoid stress on workers, it indirectly improves productivity.

Acknowledgement

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