Conversion of a Conventional Lathe Machine into a "Semi Automatic CNC Machine"

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Keywords –Retrofitting, Automation,

Abstract -Turning, milling, and drilling, among other operations, are performed on conventional lathes in small workshops or industries. These operations are being performed by new modern technologies such as computer software, hardware, and firm wares in industries on a daily basis. CNC machines are required for greater accuracy and superior finishing. As a result, CNC machines are becoming more important these days. This is beneficial to modernised industrialization. As a result, we must use retrofitting to convert our traditional lathe into a semi-automatic CNC machine for this modernization. As a result, this research paper investigates how to retrofit a conventional lathe to become a semi-automatic CNC machine. It is used for this purpose by replacing and adding some parts to a conventional lathe..

1. INTRODUCTION–

Retrofitting is simply the addition of new technology to an old technology system in order to improve its efficiency. When retrofitting a traditional lathe, there are primarily two factors to consider. The first is to design and programme a model to convert a traditional lathe to a semi-automatic CNC machine using computer software and hardware. The other is to reduce costs by converting it to a more accurate and efficient semi-automatic lathe. When we say retrofitting, we mean upgrading to a new technology or version of a machine or component. However, we want to use this term in lathe machines when we are in the process of replacing the CNC, servo, and drive system. Other goals of this semi-automatic CNC are:

1. To increased productivity and increase the control of machine.

2. The superior repeatability.

3. To increased geometrical accuracy and smooth finishing.

4. To reduce the machine downtime.

5. Also eliminate additional cost of tooling.

6. And the additional up gradation is less expensive.

When all conditions, such as financial and non-financial benefits, are considered, the retrofit makes sense for the business. Retrofitting a lathe is the best low-cost solution for improving the performance of an older machine tool with good dimensional accuracy and at a lower cost. Machine remanufacturing entails repairing and replacing old components with new components that meet

new feature specifications. It is done as if the machine is completely disassembled, cleaned, inspected, tested, repaired, and painted. Electrical systems are upgraded during this process. Additionally, some changes in mechanical components or parts are made for the purpose of new applications or work as required.

2. Problem Statement –

The goal of this paper is to convert a traditional lathe machine into a semi-automatic CNC machine, thereby improving the flexibility of the traditional lathe machine while also improving accuracy and finished product efficiency.

3. LITERATURE REVIEW –

1. International Research Journal of Engineering and Technology (IRJET), Volume 3, Issue 6, June 2016

   Enhancement in Conventional Lathe Machine
   H.A. Pagar,D.C.Jadhav, S.M.Mandalik,H.S.Patil,K.U.Shinde
   Department Of Mechanical Engineering, SIEM Mahirawani, Nashik, Maharashtra, India

The cost of an enhanced lathe machine is reduced by about four times when compared to the cost of a CNC machine. The repeatability and dimensional stability of the manufactured part are achieved due to the high accuracy of the job manufactured in the enhanced lathe machine. The improved lathe machine ensures that all work parts are of the same high quality, resulting in shorter lead times. It is safer to work on a machine that has been enhanced

2. International Journal of Engineering and Technical Research (IJETR), Volume-8, Issue-12, December 2018

   Conversion of a conventional bench lathe to CNC machine

   Perry S. Koradiya, Aman H. Kania, Hemanshu S. Vankhede, Parth A. Patel, Chinmay K. Desai

The machine functions as a CNC trainer for teaching by developing automation in a traditional lathe machine by retrofitting a stepper-based method. In addition, the machine's cost is reduced by about four times compared to the original CNC trainer.

Because the automation of the newly developed Converted Bench lathe is accomplished by replacing or removing components from a standard lathe machine, the setup cost is higher than a standard lathe machine, but the production rate is significantly higher. As a result, it's ideal for mass production. Because the accuracy of the job manufactured on the converted lathe machine is high, the manufactured part's repeatability and dimensional stability are achieved. Finally, some complex jobs that cannot be completed on a traditional lathe machine can be completed on a newly developed retrofitted lathe machine.

3. International Engineering Research Journal (IERJ), Volume 3 Issue 3

   Conversion of a Conventional Lathe into Semi-Automatic CNC
   Roshan N. Shirke, Makarand B Khalde, Devang M. Prajapati, Punam S. Tonde, Prof L.M. Rathod
   Students and Professor of Mechanical Engineering Department, JSPM'S Bhivrabai Sawant Institute of Technology and Research, Wagholi, Pune, Maharashtra, India

We increased the production rate by retrofitting the conventional lathe machine with a semi-automatic CNC, compared to the previous production rate. It will also be suitable for mass production. Skilled labour is not required for the job. The danger to the worker is eliminated because we use computerised numeric control. Dimensional accuracy is far superior to that of a conventional lathe. It is user-friendly because it is guided by pre-programmed codes. This retrofitted semi-automatic CNC costs four times less than the market CNC.

4. International Research Journal of Engineering and Technology (IRJET)

   Volume, 7 Issue 3, March 2020
   STUDY ON COMPUTER NUMERICAL CONTROL (CNC) TECHNOLOGY
   Nairutya Patel,
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At the same time, CNC machines have advantages and disadvantages. If we are doing mass production, we should only use CNC machines instead of traditional machines. Because CNC machines have a high initial cost, they are only reliable for mass production. If cost is a constraint, a conventional machine is preferable for low-production and small-scale industries. The initial cost of a CNC machine is high, but once installed, it will provide continuous production for a long time if proper environmental conditions are met.

4. METHODOLOGY –

Selection of Motors:

Stepper Motors:-

A stepper motor is electromechanical device which converts the electrical pulses into the discrete mechanical movements. The shaft or spindle of a stepper motor rotates indiscrete step increments when electrical command pulses are applied to it in the proper sequence. So here two types of motors but here select the stepper motor over the servo motor because they are more expensive than the stepper motors. And also not suitable for hazardous environment. Rather than servo motors stepper motors are not so expensive, simple to construct and main important thing it can be use in any working environment.

Selection of stepper motor of specifications as below:

1. Nema 17

Max torque = 4.5 kg-cm = 0.441 N-m

Torque required for X-axis lead screw = 0.38 N-m

Nema 17 should be sufficient for the operation, but the back-force and the thrust exerted by the tool and workpiece makes it unfavourable to use. So, to avoid this mishap, we took a motor of higher specification for our research.

2. Nema34

Max torque = 42 kg-cm = 4.1 N-m

Torque required for X-axis lead screw = 0.38 N-m

So Nema34 motor is suitable for X axis movement.

Stepper Motor Control Circuit

- In this , we have used a bipolar stepper motor. Hence, we used the Motor Driver PIC 16F887A, which is an H – bridge type driver. Since it is a bipolar stepper motor, there are only 4 wires we need to connect.
- So, connect the two wires from one coil to outputs 1 and 2 of 16F887A and the other two wires from second coil to outputs 3 and 4.
- The 4 inputs of the 16F887A Motor Diver IC are given from Arduino UNO. So connect them to any of the 4 digital I/O pins (here, we connected them to pins 2, 3, 4 and 5 of Arduino UNO).
- Understand the power requirements of your stepper motor and provide necessary power supply. Wrong power supply would permanently damage the motor.The control of steps is done with the help of computer using serial monitor. So, make sure that the RX and TX pins of the Arduino are not used as digital I/O. Alternatively, we can control the steps or rotation of the motor.

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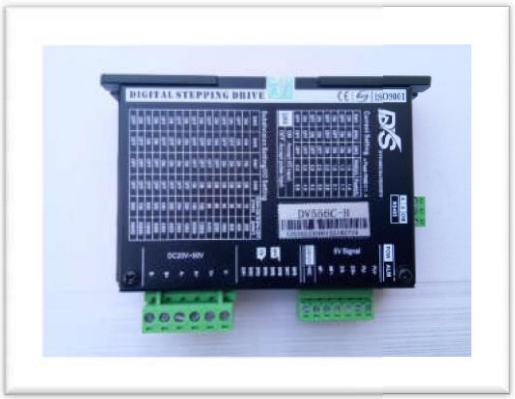
Establishing Retrofitting in Conventional Lathe

Procedure:

1. Buying all electronic parts from market.

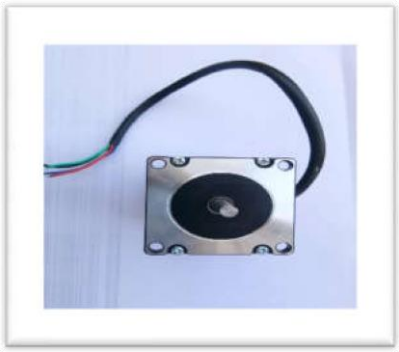
The electronic parts are like stepper motors, stepper drives,



(Fig.1)

(Fig.2)

(Fig.3)



(Fig.4)

2. Disassembling conventional lathe.

The lathe machine is disassemble according to the retrofitting definition, means to remove some non use or non essential parts from the conventional lathe.

3. Designing new mechanical parts.

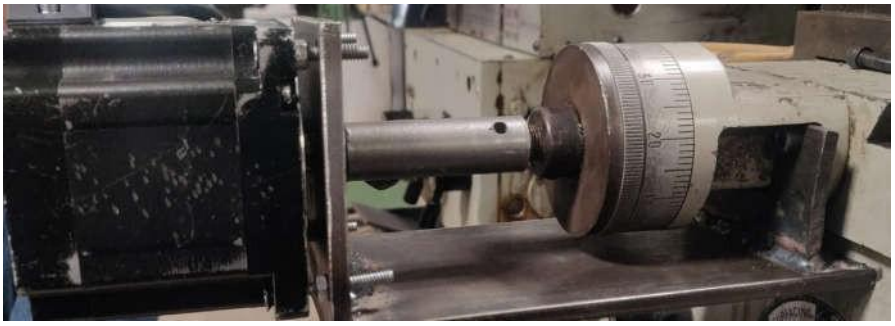
Design new mechanical parts which have to be added to conventional lathe for retrofitting as per upgradation.

(Fig.5) (Fig.6)

 (Fig.7)

4. Assembling all the parts and electronics devices at appropriate locations.

Now after manufacturing all the designed parts, assembly of the all parts takes place. And the all electronics and mechanical components are attached at proper location.



(Fig.8)

5. Inspection of the newly developed retrofitted semi automatic CNC lathe.

In this step, check all the components or parts are to be attached properly and aligned to hemachine body. Also checked the both screws slide properly by stepper motor or not.

5. RESULT:-

The job or workpiece created on the retrofitted CNC machine is more dimensionally accurate and smooth finished than the workpiece created on a conventional lathe machine. The production rate and dimensional stability are also satisfactory. For starters, the installation cost for retrofitting in traditional lathes is high, but machine set up and down time are decreasing.

6. CONCLUSION:-

We increased the production rate by retrofitting the conventional lathe machine with a semi-automatic CNC, compared to the previous production rate. It will also be suitable for mass production. Skilled labour is not required for the job. The danger to the worker is eliminated because we use computerised numeric control. Dimensional accuracy is far superior to that of a conventional lathe. It is user-friendly because it is guided by pre-programmed codes. This retrofitted semi-automatic CNC costs four times less than the market CNC.

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APPENDIX –

Figure 1 and 2: stepping drivers
Figure 3 and 4: stepper motor
Figure 5: Component to be attached to the lathe machine
Figure 6: horizontal bar which acts as the resting plate for both, the component attached to the lathe machine and the component attached to the stepper motor
Figure 7: motor attached to the third component
Figure 8: Assembly

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