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Conversion of Conventional Lathe into Semi-Automatic CNC

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ABSTRACT

In small workshops or industries, turning, milling, and drilling etc. operations are done by conventional lathe. Day by day these operations done by new modern technologies like by using computer software, hardware, and firm wares in industries. For getting more accuracy and great finishing CNC machines are needed to be used. Therefore CNC machines have more importance in these days. This helpful for modernized industrialization. Hence for this modernization we have to convert our conventional lathe into semi-automatic CNC by using retrofitting. So this research paper deals with the study of how to convert conventional lathe into semi-automatic CNC by retrofitting. For this it is adopted by replacing and adding some parts of conventional lathe.

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I. INTRODUCTION

Retrofitting is nothing but the addition of new technology to the old technology system for improvement of its efficiency. There are mainly two consideration are take for retrofitting a conventional lathe. The first one is to design and programme a model to change conventional lathe to semi automatic CNC by using computer software's and hardware's . And the other one is with reducing cost converting it into more accurate and efficient semi automatic lathe. When we are going to say retrofitting regarding some machine or components means upgradation to the new technology or version. But now we want to use this term in lathe machines at time it is process of replacing CNC, servo and spindle system on. The other objectives 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.

By considering all conditions like financial and non financial benefits the retrofit makes some sense to the business. For good dimensional accuracy and lower cost demanded product retrofitting in lathe is the best low cost solution to improve in performance of an older machine tool one. The remanufacturing of machine means to repair replace old components with new components as new feature specifications. It is done like machine is fully disassembling, cleaning, inspecting, testing, repairing and painting. In this process electrical systems are upgraded. Also the some changes in mechanical components or parts is done for purpose of new applications or work as demanded.

II. PROBLEM STATEMENT

The aim of this article is to convert the conventional lathe machine into semi-automatic CNC and thus side by side improving the flexibility of traditional lathe machine, improve accuracy and finished product with high efficiency.

III. LITERATURE REVIEW

1. International Journal of Engineering Development and Research, Volume 2, Issue 2, 2014(IJDER)

Review on Advance Automation of Conventional Lathe Machine

By Mr. Prakash N. Parmar, Prof. Vikas R. Gondalia, Prof. Niraj C. Mehta

Department Of Mechanical Engineering, Noble Engineering College, Junagadh, Gujrat

By doing automation in conventional lathe using stepper motors based retrofitting it is automatically converted into semi automatic CNC trainer which can be used for teaching the students or for demo practical. The normal CNC trainer is much costlier than this CNC trainer. Also by using this the cost of CNC trainer is reduced by 4 times approximately .

2. International Journal of Emerging Technology and Advanced Engineering, Volume 4, Issue 5, May 2014

Investigation on Automation of Lathe Machine

By Prakash N. Parmar, Prof. N. C. Mehta, Prof. Manish V. Trivedi

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As retrofitted lathe machine is done by replacing and adding new components to old one, so the initial setup cost is high as compared to lathe but by this the production rate is increased and it can be able to use for mass production. The jobs which can not be generated easily on conventional lathe is able to produce easily on retrofitted semi automatic CNC. The repeatability and dimensional stability for the complex job is achieved in retrofitted lathe machine.

3. Quest Journals, Journal of Research in Mechanical Engineering, Volume 3, Issue 5 (2017), 8Apr, 2017

Computer Numerical Control (CNC) Milling and Turning for Machining Process in Xintai Indonesia

By Sutarman, Haryono, Edihermawan, Sarmidi

Lppm Stmik Triguna Utama JI. Mh, Thamrin Komplek Mahkota Mas Blok E 28-31 Cikokol Tangerang BantenComputer

Numerical Control (CNC) Machine is a machine tool which is operated by programmed instructions that are in the form of numeric codes which is stored in the storage medium. The work on the CNC machine is done in the form of chisel instructed by computer numeric control using the coordinates of CNC turning machines. They are with three coordinate axis, X-axis defines horizontal movement, Y-axis defines transverse movement and Z-axis defines vertical movement.

IV. METHODOLOGY

Selection of Motors:

1. **Servo motors:**

Servomotors are special electromechanical devices that produce precise degrees of rotation. Servomotors are also called control motors as they are involved in controlling a mechanical system. The servomotors are used in a closed-loop servo system as A reference input is sent to the servo amplifier, which controls the speed of the servomotor.

2. **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
Torque required for Y-axis lead screw = 0.716 N-m

So Nema 17 motor is only eligible for X-axis lead screw but torque required for z-axis movement is greater than max torque.

2. **Nema 23**

Max torque = 20 kg-cm = 1.9 N-m
Torque required for X-axis lead screw = 0.38 N-m
Torque required for Y-axis lead screw = 0.716 N-m

So Nema 23 motor is suitable for both axis movements.

Stepper Motor Control Circuit

- In this , we have used a bipolar stepper motor. Hence, we used the Motor Driver IC L293D, 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 L293D and the other two wires from second coil to outputs 3 and 4.
- The 4 inputs of the L293D 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

Establishing Retrofitting in Conventional Lathe Procedure:

1. Buying all electronic parts from market.

The electronic parts are like stepper motors, stepper drives, Arduino circuits, and switches.

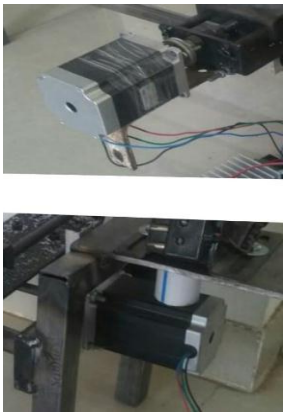

Fig.1 Two stepper motors

Fig.1 Stepper motor control circuit

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.

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.

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 he machine body. Also checked the both screws slide properly by stepper motor or not.

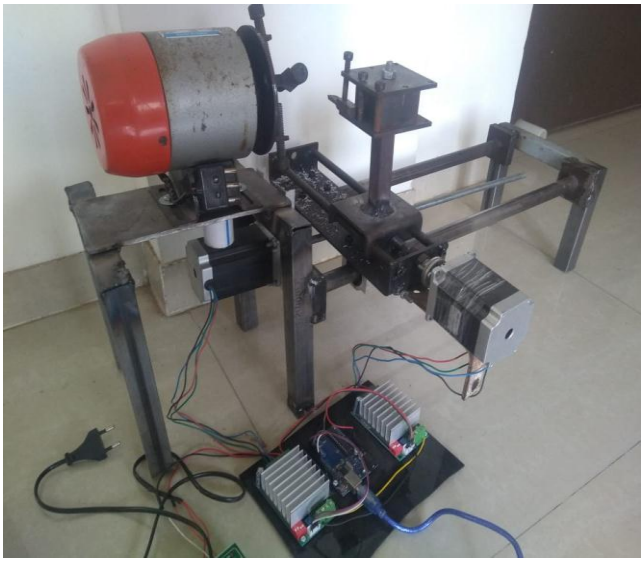

Fig 2. After assembling all the parts

V. RESULT

The job or workpiece created on the retrofitted CNC machine is more dimensionally accurate and smooth finished than the workpiece done on conventional lathe machine. Also the production rate and dimensional stability is achieved good. Firstly installation cost is high for installing retrofitting in conventional lathe but machine set up time and machine down time is getting lower.

VI. CONCLUSION

As we upgraded the conventional lathe machine into the retrofitted semi-automatic CNC, the production rate is increased as compared to the previous production rate. And it is going to be suitable for mass production. The skilful labour is not require for doing job . As we uses the computerised numeric control the danger for the worker is eliminated. The dimensional accuracy is getting far better than the conventional lathe. It is user friendly due to instructed by programmed codes. The cost of this retrofitted semi-automatic CNC is 4 times lesser than the market CNC .

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