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Upgradation of Manual Magnetic Core Drill Machine

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***Abstract*—** This paper deals with the upgradation of existing manual core drill machine. The existing manual core drill machine requires a labor operator every time to drill the hole till the drilling gets completed. So more time is required and accuracy is reduced. So the main aim is to make core drill machine fully automatic. So the automatic part can be developed by developing some of the part related to current sensing and controlling, depth sensing using encoder, no load position sensing , enrolling the required depth through the keypad and operating it with the stepper motor.

Keywords: *PIC Microcontroller, Stepper Motor, Stepper Motor Driver, Keypad, Liquid Crystal Display(LCD), EEPROM.*

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I. Introduction

Drilling is one of the most widely used machining operations and approximately represents 40% of all the machining operations carried out in the industry. As the demand and usage of flexible manufacturing is increasing now a days by leaps and bounds, hence there are numerous automatic feed control has been introduced apart from handheld drilling process[1].A drill is a tool fitted with a cutting tool attachment or driving tool attachment, usually a drill bit or driver bit, used for boring holes in various materials or fastening various materials together with the use of fasteners.

Mechatronics is becoming ever more widely used in the products on the consumer goods markets, where efficient control and guide processes can he implemented using very inexpensive sensors, processors, and actuators[5].The rotary hammer is representative of this product group. To achieve optimum drill performance, it is necessary to set the two variables , rotational speed of the drill' and strike rate of the hammer' of the tool, whether guided by human hand or robot, in such a way that, with a minimum of guidance and recoil power, maximal drill penetration can be achieved in the rock. The 'mechanics' of a system consisting of the guiding human (or robot), the row hammer, and the rock create a complete multi- body system during the drilling process, which, at any given combination of rotation rate and strike rate, delivers an optimal drill penetration rate. Changes in the drill diameter, the type of rock, or the drilling pressure result in a false adjustment of the multi-body system, which needs to be Re-optimized by an intelligent readjustment of the two servo-controlled drives. To achieve a flexible and automatic adaptation of the strike and rotation rate of the rotary hammer to different material and tool types, the IITB in cooperation with an industry partner developed and built a prototype of an adaptive, multi sensor drive control. The proposed solution envisages a self-learning neuro-fuzzy component which can identify the given parameters from the sensory signals of the integrated system of 'operator rotary hammer-wall'. The optimal strike and rotation parameters can then be read from a look-up table and adjusted automatically. The multisensory intelligent rotary hammer is thus capable of determining the optimal operating parameters for each type of rock and tool and to adjust them automatically[5].

Human force is required to drill the hole, drilling depth cannot be estimated properly, job may spoil due to human errors, and different size holes cannot be drilled without changing the drill bit. Consumes lot of time for doing repeated multiple jobs, these all are the drawbacks. To overcome all these problems this automated drilling machine was designed which was aimed to drill the holes automatically over a job according to the drilling depth data programmed through a key board[8].

II. Design Consideration

The main aim is to upgrade the existing manual core drill machine. increase the productivity in less time,we are going to develop the automatic core drill machine which will automatically drill the hole and will also automatically come to its original position after completing the drilling. This will help the industry to gain profit within less time.

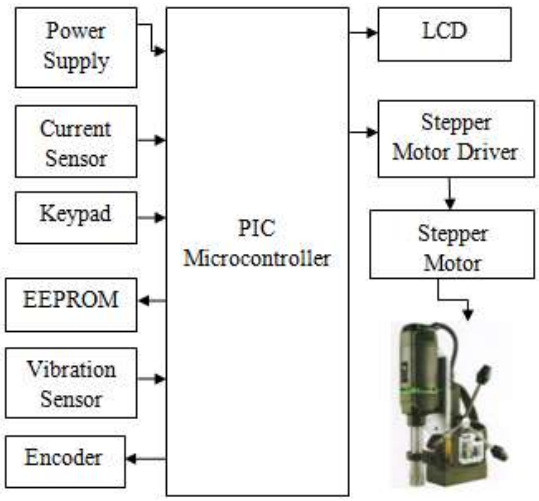
Fig 1.A magnetic core drill machine making hole.

Thus Up-gradation of Manual Core drill machine is done with microcontroller interfaced with stepper motor, LCD and keypad to make it fully automatic as well as to auto reverse the position of drill bit in order to make more productive and increase the accuracy. The existing machine is shown in fig below.

Fig 2.KBM 38 Magnetic Core Drilling Machine.

The Automatic working of machine will begin by giving values to the keypad. This includes two separate parts:1.) Set and 2.) Drill. The 'Set' part includes the setting of depth by entering the size. The depth and length of the values are taken as an input through keypad and displayed in LCD. Then manually drilling is done. The Encoder is used to measure the revolutions required for specific depth and that database will be stored in EEPROM. After drilling the respective input depth of machine recovers its home position. The 'Drill' part includes automatic drilling of given depth value on keypad. The drill depth is set through the 4x4 keypad connected with the microcontroller. The entered value is recognized by the microcontroller and starts the drill bit. The drilling is started after the depth and length is entered and stops at the given end point. Thus the initially stored value of depth in EEPROM will be used and automatic drilling will take place in which encoder will measure the revolutions required for the specific depth and vertical motion of the drill will be controlled by stepper motor. With the help of the position encoder the microcontroller will be able to find the position of the drill bit and bring back it to the home position.

A. Block Diagram



III. Methodology

1.Microcontroller

The system software is executed on the PIC microcontroller. A microcontroller is a processor which is equipped with memory, timers, (parallel) I/O pins and other on-chip peripherals. The driving element behind all this is cost. Integrating all elements on one chip saves space and leads to both lower manufacturing costs and shorter development times. This saves both time and money, which are key factors in embedded systems. Additional advantages of the integration are easy upgradability, lower power consumption, and higher reliability, which are also very important aspects in embedded systems.

2. Keypad

The 4x4 alphanumeric keypad is used to set the depth of drill.4x4 Keypad board features 16 push buttons arranged in 4x4 matrix to form standard alphanumeric keypad.It is used for loading numeric to microcontroller. Keypad is ideal for numeric input in decimal or hexadecimal form, required in some embedded devices.

3. LCD

16x4 LCD is used. LCD is used to show the inputs and outputs. It has built - in controller (KS 0066 or Equivalent).5x8 dots includes cursor. LCD is used to display the depth of diameter entered.

4. EEPROM

EEPROM is used to store the database. It is used to store the size of the depth of diameter and also revolutions needed for each depth .

5. Current Sensor

Current Sensor is used to sense the current . A constant 6A current is maintained by the current sensor. It is used for the circuit protection.

6. Encoder

Encoder shows output in form of pulses with respect to rotation**.** With the help of the position encoder the microcontroller will be able to find the position of the drill bit and bring back it to the home position.

7. Vibration Sensor

Vibration sensor is used to control the vibrations of drill machine.

8. Stepper Motor

Stepper motor is used to control the vertical movement of drilling.

9. Stepper Motor Driver Circuit The stepper motor cannot be directly driven using the controller I/O pins as the controller cannot supply the required current to drive the Stepper Motor. Also, the Stepper Motor will cause a Back EMF in the circuit while it is accelerating or decelerating. This can cause to controller to be damaged. Hence we use a Driver circuit which isolates the Stepper Motor circuit from the controller circuit. The driver circuit must be able to withstand the current required by the stepper motor.

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