

Design and Implementation Interfacing Stepper Motor with Arduino

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Abstract – PCB Drilling Process is Manual, Labor operated and the Assembly units i.e. imported machines with high It is not suitable for small scale industries so it is necessary to automate process for Faster Response and effective drilling also in minimum cost. Cost. output of this project will be the automatically drills the PCB.

Key Words: Aurdino Uno, Stepper motor, Stepper driver,

1. INTRODUCTION

Drilling holes in a Printed Circuit Board (PCB) is a complicated task especially when the numbers of component mounting/soldering holes are more. The automated process of drilling holes in a PCB may not be a new idea as PCB milling machines generally is called as Computer Numerical Control (CNC) machines. It has a basic capability of drilling the holes automatically with minimal user inputs. A standalone PCB drilling machine is designed and implemented that can be used for drilling holes in PCB with ease. The basic operation of the PCB drilling machine would be to position the drill bit to desired hole position and then to bring down the drill bit to make the hole. There are such various machines available in market but have a considerably high cost; which may not be affordable for a small scale industry. It is aimed to provide automation to the existing machine set-up with the help of G-codes and a microcontroller. This approach drastically reduces the cost of automation at the same time provides customization through programming. The PCB pattern of circuit schematic diagram will be drawn on screen with the help of software. This pattern will be printed to make PCB from layout computer control drill automatically through programming.

1.1 Design idea

PCB Drilling Process is Manual, Labor operated and the Assembly units i.e. imported machines with high Cost It is not suitable for small scale industries so it is necessary to automate process for Faster Response and effective drilling also in minimum cost.

2. RELEVANCE

The demand for automation in industries is increased incredibly. At the same time, the cost of such automated devices also increases. The Indian industries (small scale/ large scale) have to depend mostly on imported machines. If we don't want to invest on the cost, then we have to think of an indigenious. Nowadays many industries are computerized numerical control for PCB drilling machine in industry, it takes long time for large number of drills. To achieve more

effective result this automatic optimization system is required in drilling machine. CNC machine will be used and controlled by an innovative controlling method which is the G code along with a suitable controller. Particularly for this system, it is necessary to automate process for faster response and effective drilling and in minimum cost. :

3. LITERATURE REVIEW

Mohammed Abdalla. A. used MATLAB for finding the drilling co-ordinates from PCB layout as a tool. In MATLAB they used various types of row and column scanning. It was observed that use of MATLAB makes the process very long and difficult. As well as if a standalone machine has to be prepared, they had to use a digital signal processor which makes the system still more expensive. In the proposed concept, the drilling location is found automatically using simple microcontroller.

P.L.S.C.Alwis.et al state in their research work that manually operating drilling machines have limitations like low accuracy and longer time processing. So they have used path planning algorithm in their project for drilling. The path generated from this algorithm reduces the total time taken to drill all holes. At the same time, path planning drilling machine is easier to manufacture. But limitation of this machine is that, they cannot move along curve path way.

If it is need to drill the component at different depths, then manual operating machine cannot drill properly and one has to enter drilling co-ordinates every time. This makes the process more complicated. Electrical drilling machines are simple and used to drill the specified depth. To overcome these problems, G.Nirangan et al developed "Automated Drilling Machine with depth controllability" which is capable of drilling with depth controlling.

From all this analysis we formed this project which can be used at small industries because of its low cost. It gives more accuracy and increases productivity. Also it reduces manual errors by increasing controllability over the complete mechanism.

4. PROPOSED WORK

4.1 Objectives

Objective of this work is to automate the existing human interaction drilling process with advanced drilling machine set-up to increase accuracy and productivity with low cost solution. The important constraint to deploy this system is low setup time with accurate result.

4.2 Methodology

For the working of complete project, it is needed to combine hardware and software then final implementation of the CNC machine will drill the holes on the PCB. The proposed project consist of mechatronic setup which can move the stepper motor in X,Y and Z direction with the help of driving software program. Software program will control over all operation of the machine. The mechanical setup has a flat layer on X-axis where PCB is put on it for remaining process. Above the X-axis, there is a drill that can move along Y and Z axis. The drill can also move up and down for a specified amount of distance through Z-axis.

4.3 Block Diagram and Working

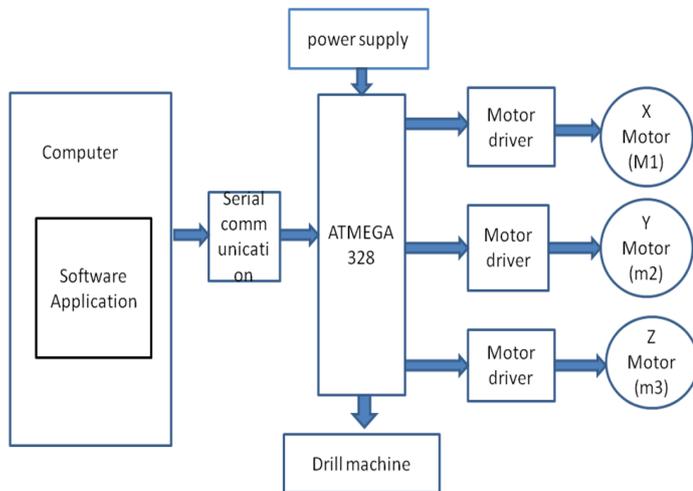
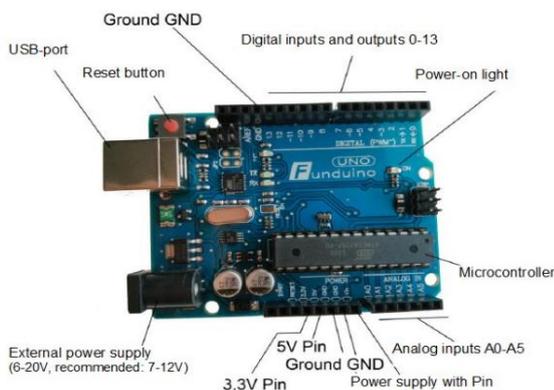


Figure. 1: Automatic PCB drilling machine

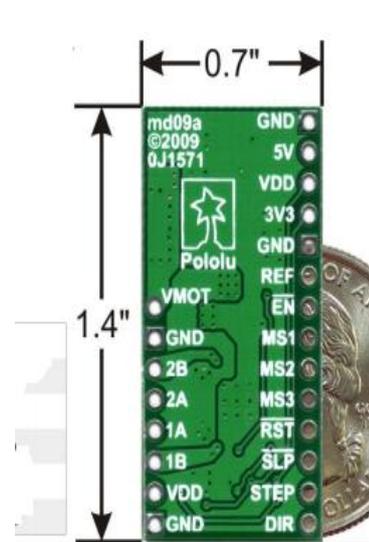
As shown in the block diagram of the automatic PCB drilling Machine, G code software sends drill co-ordinates to ATmega 328 via serial communication. A serial communication driver is needed for this. Atmega 328 receives co-ordinates in the form of X,Y and Z then it operates stepper motors to reach that co-ordinates and then drill machine drills the respective points. Stepper motors are heavy to drive so it needs more current. For this purpose, an additional supply will be used.

4.3.1 Aurdino Uno board



For this project, the Arduino Uno is used to control the stepper motor and initialize sensor. Arduino Uno is a microcontroller board based on Atmega328. The Arduino Uno was chooses rather than other Arduino such as Arduino Diecimila and early Duemilanove because it use Atmega328 which is suitable to control stepper motor.

4.3.2 Stepper Motor Driver



Stepper motor driver is used to privet the excess current and it meets the following specifications,

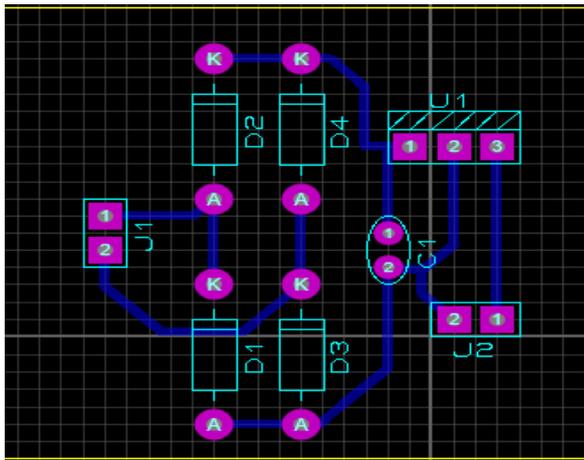
Specification:-Low cost, Small sizeBipolar,4 lead wire,1.8 deg/stepTorque-2.8kg.cm,Size-33mm ,Voltage begin applied & test- 6v to 12v

4.3.3 Stepper motor



This is a bipolar stepper. electrical energy is converted to the mechanical energy. 12V power supply stepper motor is most power full and efficient. this stepper motor is used to manage the sequence of the signal and rotate the step by step.

PCB Layout



5. DESIGN AND IMPLEMENTATION

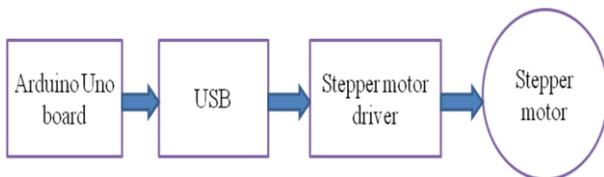


Figure.2: Design and Implementation

Figure.2 shows the flow of the system Design and Implementation .It starts with generating PCB layout as software counter path and directs stepper motor to drill at appropriate location from the software.

Stage I: Mechanical Hardware Design

There are fixed joints to hold PCB at one origin on board. The PCB will be mounted on solid platform. The upper body and base joints are fixed to move easily together. The vertical ports will hold motor and drilling mechanism. Both base and vertical body are joined by mechanical shaft, to move together.

Stage II: Embedded Hardware Design

Here mechanical setup will be controlled by stepper motor with the help of shaft driven by Aurdino board. The setup will hold and control all the movement through the programming in Aurdino. The stepper motor can precisely be controlled by program and with Accurate co-ordinates for drilling machine will operate for specific delays.

Stage III: Software Design

The software Application will be designed to identify PCB layout file co-ordinates. The software application will prepare list of co-ordinates to be provided to Aurdino. The serial data Transmission can be possible by interfacing software with machine.

5.1Result

Fig.2 shows the stepper motor interfacing with Airdino Uno board through USB .rotating motor get results the drills the Holes.

6. CONCLUSION

Stepper motor and stepper motor driver is interfacing with Aurdino Uno. getting the output will stepper motor rotate in clockwise or anticlockwise direction, to get PCB layout image using any PCB design Software.

7. REFERENCES

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