

ARDUINO UNO USING CONTROL STEPPER MOTOR AND DESIGN PCB LAYOUT

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ABSTRACT

This project presents the design of automatic PCB drilling machine. The design of low cost automatic PCB drilling machine is used to reduce cost, man power and increase accuracy, productivity. The aim of this project is to implement and develop a low cost PCB drilling machine based on Arduino controller, where the drill holes are automatically detected from a PCB layout. The main challenging task is to find the drill hole coordinate from PCB layout. G code software is used in this system. this work is operate the CNC machine G code is a standard machine language.

Keywords

Arduino controller, stepper motor and stepper motor driver A4988

I. INTRODUCTION

Drilling holes in a Printed Circuit Board (PCB) is a complicated task especially when the numbers of component mounting/soldering holes are more.[2] 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.[4] 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.[5] 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.[3] 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 Problem statement

PCB Drilling Process is Manual, Labour 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

1.2 Objective

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.

1.3 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.

II. BLOCK DIAGRAM

As shown in figure.1 the block diagram of the automatic PCB drill co-ordinates to ATmega328 via serial communication. A serial communication driver is needed for this. ATmega328 receive co-ordinates in the form of X, Y and Z then it operates motor to reach that co-ordinates and then drill machine drill the respective points. Motor are heavy to drive so it needs more current. for this purpose, an additional supply will be used.

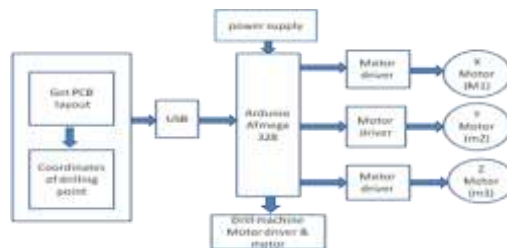


Fig 1- Block diagram

2.1 Arduino uno board



Fig 2-Arduino uno board

Arduino uno board is controller unit in this system. this is used to control the whole process of this system. arduino uno is a based on ATmega 328. this board available the 14 digital pins and 6 analog pins. arduino programming is simple and easily available in minimum cost so this controller is select

2.2 Stepper motor



Fig 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. this is a full step mode stepper motor. stepper motor is stronger carry to load compare to other motor.

2.3 Stepper motor driver (A4988)



Fig 4- Stepper motor driver

A4988 is a stepper motor driver is used in this system. stepper motor driver is used to controlling the stepper motor. Stepper motor driver is protect the stepper motor ageist the over voltage, over current, over temperature. this is a micro stepping bipolar stepper motor driver. there are five different step revolution. but this is select the full mode step mode.

III. DESIGN THE PCB CRICUIT DIAGRAM

Schematic diagram

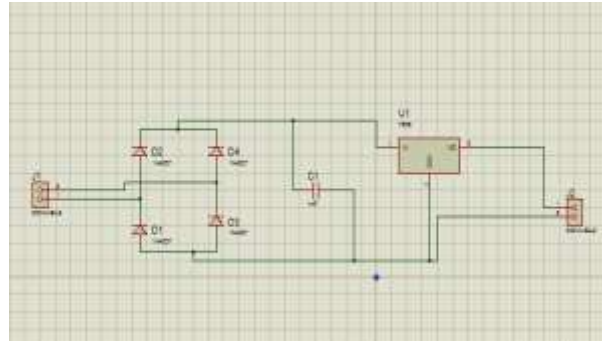


Fig 5- Schematic diagram

Result

PCB layout

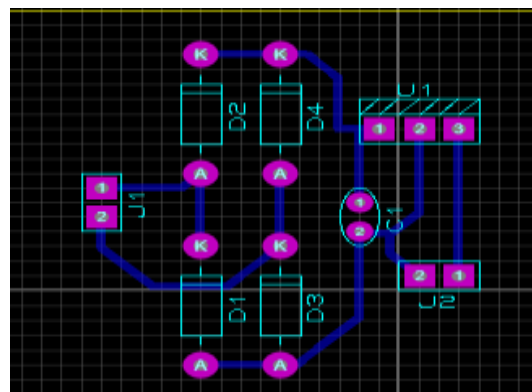


Fig 6-PCB layout

IV. DESIGN INTERFACING STEPPER MOTOR AND STEPPER MOTOR DRIVER A4988 WITH ARDUINO UNO BOARD

Block diagram

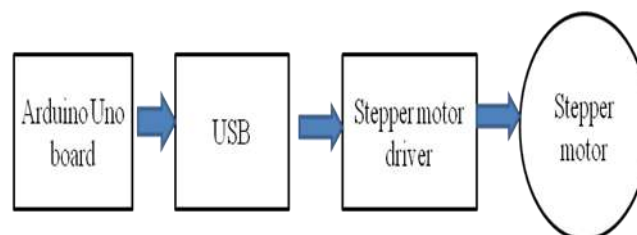


Fig 7- Block diagram

The Arduino uno board is connected USB cable through stepper motor and stepper motor driver. Arduino uno board is a hardware. this is used to control the all process. this is very simple programming language and simple hardware.USB cable is used to communication of arduino uno board and stepper motor, stepper motor driver. A4988 stepper motor driver is used in this concept.

Result

Hardware setup of the experiments

Interfacing of stepper motor



Fig 8- Interfacing stepper motor

V. CONCLUSION

This setup of hardware is stepper motor and stepper motor driver(A4988) interfacing with Arduino uno board. getting the output is stepper motor rotate in forward and backward direction and control the angle. and getting the PCB layout image using proteus software

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