

Design of Automatic Coil Winding Machine

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Abstract— The main objective of this paper is to develop a coil winding machine to wind coils for Transformers, Condensers, Coil rolls etc. according to industry requirement. This machine should wind coils of copper wires up at limited Gauge (or 32 Gauge). The operation of coil winding machine is performed by using a stepper motor. Currently, this process is done manually which is being automated. This method can reduce the manufacturing cost and also increase the rate of productivity. It reduces the manual work and also reduce the delay of delivery.

Key words: Motors, Arduino, CNC Shield, Stepper Motor, DRV4988, Pulley

I. INTRODUCTION

Now a day's a generations is faster hence the entire world is switching to automation technology such as automation. It is a process in which all the process is done using different ways i.e less man power, reduce delay of delivery. Design of Automatic coil Winding Machine is one of the easiest ways to manufacture coil winding for all type of motors and pumps. It is an upgrade version of existing manual coil winding machine.

Various coil winding machine is available in market, but they are more costly. This coil winding machine which is develop can be used for small scale industry i.e. in repairing industry. The aim is to reduce man power and delay of delivery. The machine is useful to wind coils very accurately. Thereby this machine can be used to wind coils of transformers, condensers, motors etc.

II. PROBLEM DEFINITION

To complete a coil manually will be of waste of time. Furthermore to have a good quality of automatic coil winding machine requires expensive tools and it is not so user friendly. Therefore, fabrication of coil winding machine will be done which is controlled by a simple arrangement using motors, CNC, signalling device i.e Bluetooth, arduino etc.

III. NEED OF AUTOMATION

Automation can be achieved through computers, hydraulics, pneumatics, robotics, etc., of these sources for low cost automation. Automation plays an important role in mass production. The advantages of Automations are:

- 1) Reduction of labour and material cost
- 2) Reduction of overall cost
- 3) Increased storage capacity
- 4) Reduction in fatigue
- 5) Improved personnel comfort
- 6) Increased safety

IV. OBJECTIVES

- 1) To design and build a coil winding machine that has a small-scale size and at a lower cost.

- 2) To create a program that control stepper motor movement by using Arduino.
- 3) To avoid accidents that occurs during manual universally applicable to all gauges of wires.winding.
- 4) To avoid delays in delivery and to reduce skilled manpower requirement.
- 5) To ensure that the prepared machine will work at faster speed than existing one.

V. SELECTION OF COMPONENTS

A. Stepper Motor

Nema 17 (Bipolar)	Current (A): 0.5
Step angle: 1.8°	Torque (kg.cm): 4.2
Voltage (V): 8	Control Wires: 4



Fig. 1: Nema 17 Stepper Motor

A stepper motor is a brushless DC electric motor that divides a full rotation into a number of equal steps. The motor's position can then be commanded to move and hold at one of these steps without any position sensor for feedback (an open-loop controller), as long as the motor is carefully sized to the application in respect to torque and speed.

B. Arduino

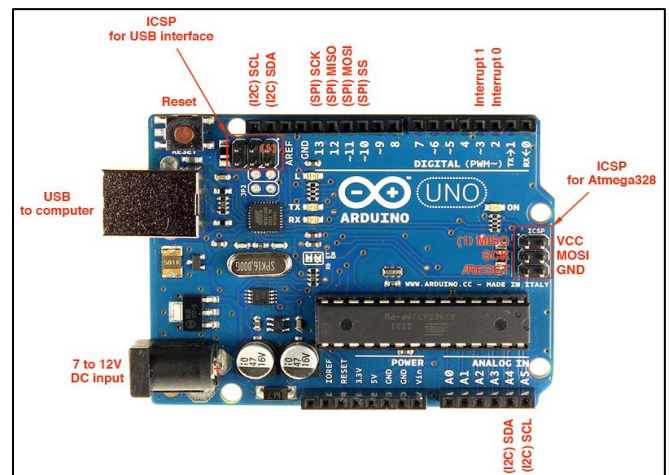


Fig. 2: Arduino Uno

Uno R3

Microcontroller: ATmega328
Operating Voltage: 5 V
Input Voltage: 7-12 V
Analog Input Pins: 6
Clock Speed: 16 MHz

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

C. Motor Driver

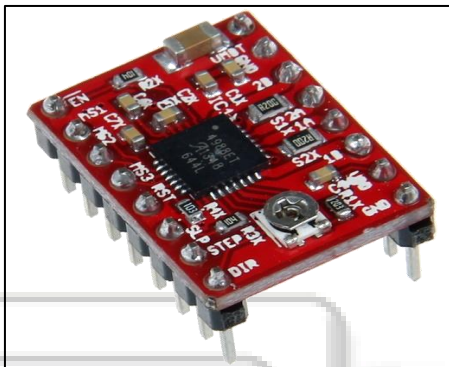


Fig. 3: motor driver A4988

This breakout board for allegro's A4988 microstepping bipolar stepper motor driver features adjustable current limiting, over current and over-temperature protection, and five different microstep resolutions. It operates from 8V to 35V and can deliver upto approximately 1A per phase without a heat sink or forced air flow.

D. Bluetooth

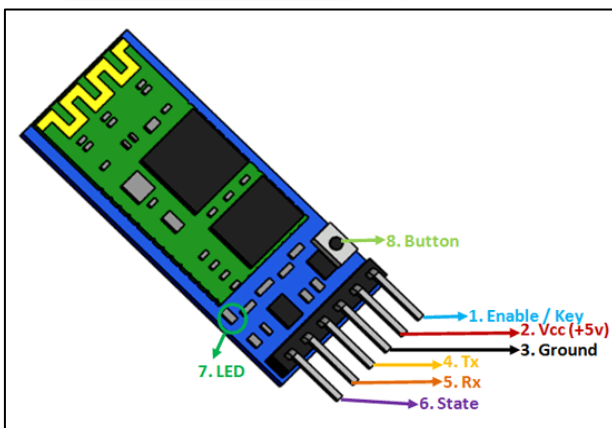


Fig. 4: Bluetooth HC 05

HC-05 is a bluetooth device used for wireless communication with bluetooth enabled devices like smart phone. This module can be used in a master or slave configuration. It is used for many applications like game controllers, wireless mouse, wireless keyboard and many more applications. Default settings of HC-05 Bluetooth module can be changed using certain AT commands. It communicates with microcontroller using serial port.

E. CNC Shield

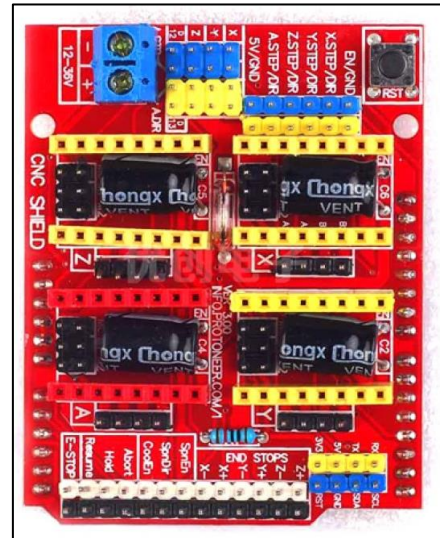


Fig. 5: CNC Shield V3.0

CNC Shield V3.0 can be used as drive expansion board for engraving machine, 3D printers and other devices. There are 4 slots in the board for stepper motor drive module, can drive 4 stepper motors, and each stepper motor only need two IO port, that is to say, 6 IO port can quit well to manage 3 stepper motor, it's very convenient to use.

VI. DESIGN



VII. WORKING

In this coil winding machine two stepper motor are used. One is used for rotation motion and another is use for linear motion. These two stepper motors runs in synchronization such that one revolution of shaft the slider advances according to the diameter of bobbin. This help in winding without gap. This is done by the program set in arduino,

As per the winding i.e. for motor or transformer the program can be easily changed.

Initially the coil is setup is done i.e., the coil is firstly attached to the armature manually through the slider assembly. The power supply is connected and Arduino is started. Then the program is allowed to run. According to the program this two stepper motor rotate, after one revolution of shaft the slider linearly advanced. The program helps in synchronizing these two shafts and slider to obtain accurate rotation.

In this machine Bluetooth model is used for communication purpose between arduino and android phone. we give command by phone using a GRBL application, as per the command stepper motor rotates and coil wound on the bobbin or rotor.

VIII. ADVANTAGES

- Less space is required.
- Skill worker is not required.
- Cost of the machine is less.
- More production in less time.
- Assembling and disassembling is easy.
- Production is easy.
- Accuracy and control.
- Reduce paper insulation and coil wastages.
- Efficiency and maintenance is easy.
- Fully automatic system so that quality production achieved in less time

IX. CONCLUSION

The earlier method of manual coil winding was time consuming. The accuracy of winding was very low and even spacing between two consecutive winding could not be achieved. While the Automatic winding machine currently used in the industry is complex, bulky and costly. The main objective of the project was to overcome these hurdles by building a low cost and compact automatic coil winding machine.

X. FUTURE SCOPE

- This project if produce on a large scale would be cheaper.
- This saves considerable time in production of coils.
- Reducing costs of transformer, condensers etc.
- This project could be commercialized if modified.

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