3D Object 2S PCB design Engraving Machine

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Abstract— Sometimes while making PCB and objects, we required more time for designing, printing, etching, and drilling and man power respectively. Therefore, to reduce time and more efforts, we are designing this project. In this paper, there is design of engraving machine, where the carving, drill holes and the layout are automatically finding out from an image of the object/circuit in software. This paper focuses on the design and implementation of automatic PCB (object) carving and drilling machine using ARDUINO MEGA. Further the engraving machine uses path planning though co-ordinate measurements machine method which is used to make the system more stable and accurate.

Keywords: CNC, Arduino Mega, G-code, PCB, stuff, goods, milling machine

I. INTRODUCTION

3D Object and 2S PCB Designing Engraving machine is generally used in the manufacturing sector that involves the use of Arduino to control machine tools. Tools that can be controlled in this manner include carving and drilling. From this CNC technology, the biggest change in the world of digital electronics & micro-controller, we are presenting here an idea of CNC bit Miller using ARDUINO MEGA. The idea behind this project is to make a small CNC machine which can engrave on surface of object or PCB to remove unwanted material. For future purpose we will use five stepper motor on each axis X, Y, Z, A, B. It can access the G-code directly from supporting software like in scale fig. 1.

A. Milling Process

Milling is the process of removing extra material from the work piece with a rotating multi-point cutting tool, called milling cutter. The machine tool employed for milling is called milling machine. Milling machines are basically classified as vertical or horizontal. These machines are also classified as knee-type, ram-type, manufacturing or bed type, and planer-type. Most milling machines have self-contained electric drive motors, coolant systems, variable spindle speeds, and power-operated and table feeds. The three primary factors in any basic milling operation are speed, feed and depth of cut. Other factors such as kind of material and type of tool materials have a large influence, of course, but these three are the ones the operator can change by adjusting the controls, right at the machine.

B. Surface Roughness

Surface roughness is an important measure of product quality since it greatly influences the performance of mechanical parts as well as production cost. Surface roughness has received serious attention for many years and it is a key process to assess the quality of a particular product. Surface roughness has an impact on the mechanical properties like fatigue behaviour, corrosion resistance, creep life, etc. It also affects other functional attributes of parts like friction, wear, light reflection, heat transmission, lubrication, electrical conductivity, etc.

Surface roughness of turned components has greater influence on the quality of the product. Whenever two machined surfaces come in contact with one another the quality of the mating parts plays an important role in the performance and wear of the mating parts. The height, shape, arrangement and direction of these surface irregularities on the work piece depend upon a number of factors such as:

(1) The machining variables which include
- Cutting speed,
- Feed and
- Depth of cut

(2) The Tool Geometry
Some geometric factors which affect achieved surface roughness include:
- Nose radius,
- Rake angle,
- Side cutting edge angle and
- Cutting edge.

(3) Work piece and tool material combination and their mechanical properties
(4) Quality and type of the machine tool used,
(5) Auxiliary tooling and lubricant used and
(6) Vibrations between the work piece, machine tool and cutting tool.

II. RECOGNITION OF PROJECT

We are making milling machine which can be suitable for 3/5 axis.

We are using Arduino MEGA with Ramp 1.4 shield for controlling stepper motor using DRV8825 motor driver, 775 spindle motor for milling and other hardware's.

III. BLOCK DIAGRAM

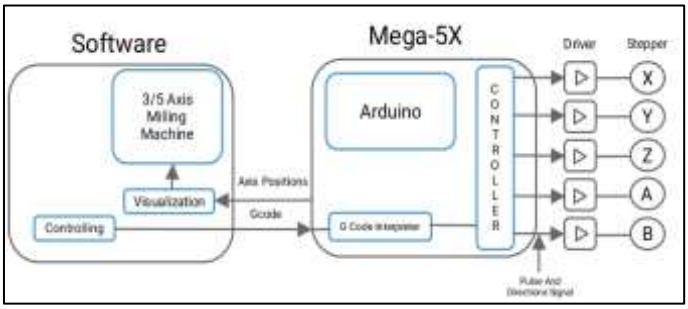

Fig. 1: General Block diagram of 3/5 Axis Milling machine

A. Block Diagram Description and working

In Fig. 1 Two block are given, one is software and other one Mega-5X. software contain visualization window,

command/control window from that we are sending g code to Arduino, the whole process like CAD-CAM-CONTROL which is shown into the fig. 2 for easy to understand.

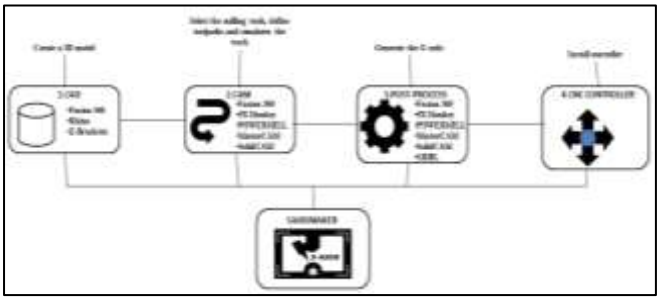

Fig. 2: software path

Arduino Mega-5X contain control parts like Arduino mega is brain of the project which is commutator between user and the motors, which drives the motors to the help of motor driver according to user applications.

First, we have to set raw materials size Carving and drilling operations we have to set the software by according to application (positioning), after these steps we can see the working process live or on simulation window.

B. Circuit Diagram

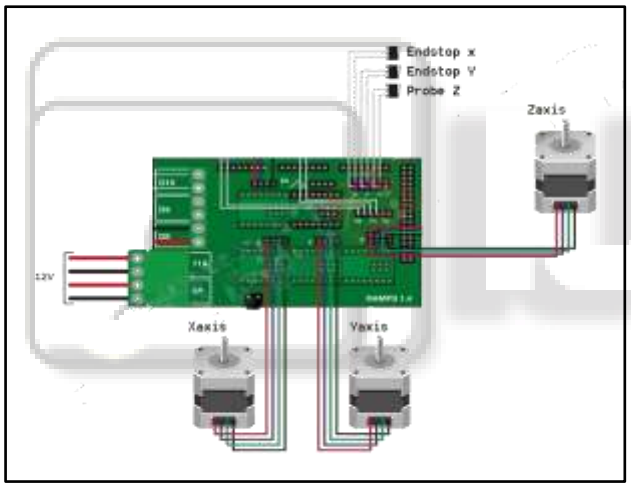

Fig. 3: Circuit Diagram

Basically ramps 1.4 shield made for 3D printer system but we can use it for 3/5 axis cnc system operation.

Ramps shield requires 12v and 11A for operation, we connected steppers motors wires on configure pins according to X, Y and Z axis. Also join DRV8825 stepper motor drivers.

For DC supply we are using 12v-20A (SMPS), Some Switches use for security purpose.

IV. Results

PCB layout we can see which shown below Fig 4.

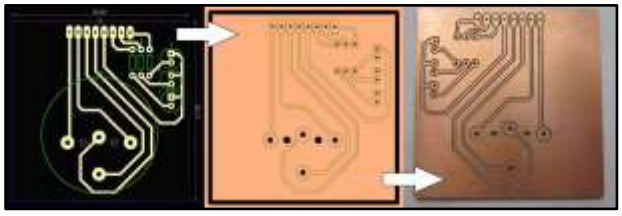

Fig. 4: PCB layout

First, we have to make layout or take image convert into gerber and then set into 2side or single side PCB design set drill bit preference converts into g-code then we get result which was shown in above Fig. 4.

Object (wood wrench) is shown below Fig. 5

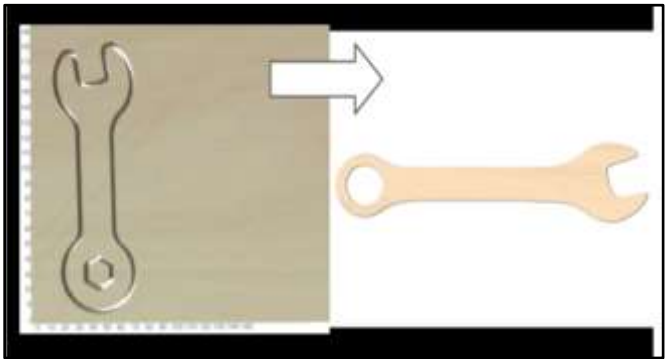

Fig. 5: Object

We have to set file by tool path then convert g-code according to tool and feed rate and we get result was shown in above Fig. 5.

V. Advantages

- We can make model from raw materials and also carve PCB design.
- Also, we can use for drilling purpose for accuracy
- Training in the use of CNCs is available using virtual software. This is software that allows the operator to practice using the CNC machine on the screen of a computer. The software is like a computer game.
- Without limit switch it has safety margin to prevent overriding
- For emergency we are implemented switch button to on/off spindle motor as well as whole machine.
- Our 3D object and 2s PCB design engraving machine also suitable for laser.
- Modern design software allows the designer to simulate the manufacture of his/her idea. It depends on user there is need to make a prototype or a model or not. There are many designs are available on that software. It saves not only time but also money.

VI. Disadvantages

Without limit switch positioning is difficult while some time motor torque unbalance and it is in result in differ in the distance of actual and Processing from that positioning return to zero some errors occur in distance.

VII. Future Scope

Presently, We can use this project at 3axis based to make PCB design and some parts making from wood which are useful for us but some 3d part we can't make for that require 5axis machine, we have to upgrade for the 5axis.

In future upgradation we can also make it as 3 in one 3d object 2s PCB design engraving/printing machine which contains 3 modes milling/laser/printing we can use it on business purpose.

VIII. CONCLUSION

We are pleasure to conclude our project on the topic “3D Object 2S PCB design Engraving Machine”. The detail of this project has been made by members of our team sincerely with the inspiration of our tutors.

As our main aim was to overcome the problems faced during manufacturing PCB’s or objects, from this project we achieved that.

And with little modification this project can be used in industries as it has every advantage which an industry looks for.

Through this project we have done some stuff design without limit switches.

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