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A DUAL EXTRUSION 3D PRINTER USING ARDUINO MEGA 2560

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Abstract: - Automation plays a key role in the development of the product. In recent times, the use and adaptation of emerging technologies have given a greater impact on the field of education. This study deals with 3D printing technology which is also known as additive manufacturing technology where the object is created by laying down successive layers of material until the object is created. 3D printing makes it possible to create complex shapes with fewer materials. It is a tool less manufacturing method that is high in precision & less cost process for the production of objects. 3D printing is used in a wide range of industries, including medicine, automobiles, aerospace, and engineering.

Keywords: Automation, 3D Printing, Additive Manufacturing.

1. Introduction

3D printing is the process of layering material of creating a three-dimensional solid object designing technique, rapid prototyping mode without mold making. These layers are often very thin and made out of various materials including plastic or metal. The layers of fabric are laid down successively in several shapes. It constructs by printing the materials layer by layer which supports the 3D digital model file. Successive layers of fabric are laid down in several shapes. The methods involve the traditional machining process which removes the fabric by drilling and cutting whereas the layers of 3D printing are added successively. Changing the configuration of the model, more flexibly, could answer the demand of the consumers. Not only that, additive manufacturing is additionally currently getting used in fields like nanotechnology and biological engineering where various nanobots, animal tissues, and human hearts are being fabricated through 3D printing technology. All this freedom of making the foremost complex objects is by CAD (Computer-Aided Design software) provided within the designing of objects that would be fabricated using 3D printers.3D printing and other modes of digital production will promote the belief of the third technological revolution together. The broad selection of applications based on these rapid prototyping features will be applied in different fields of activities: testing, engineering, defense, medical industry, PC industry, construction, architecture, fashion, education, and lots of others. Additive Manufacturing has a whip hand to any quite subtractive manufacturing process thanks to its efficiency within the usage of materials. One of the most reasons for the recognition of 3D printers is not any wastage of any material that is needed to manufacture [1]. Over the past few years, the technology of 3D printing has continuously improvement, mainly the progress within the material application. There are quite 100 raw materials are frequently used fin the technology of 3D printing. They include thermoplastic plastics, metal, nylon, acrylic, plaster, ceramic, and edible material. Interestingly, the value of acquiring 3D printers has been

decreasing with the increase in technological advancements.

2. Literature Survey

There is a misconception that 3D printing is a replacement concept. During the year 2009, when the FDM (fused deposition modelling) license was cancelled, 3D printing became an alternative innovation concept. Initially, the 3D printing was stereo lithography (SLA) but not FDM. The first patent was applied in the year 1980. There is the historical scenario of 3D printing innovation from 1980. At that time, three primary 3D printing systems are initiated. The first person to showcase the bedded approach for the grouping was Kodawas, and he was the lead in developing a rapid prototyping strategy, and the additive processes got established [2]. A moving head is used to perform the metal removal process through a three-dimensional work tray that converts most of the staple layer by layer into the required shape. 2010 was the first decade during which metal end-use parts (such as engine bearings and giant nuts) were manufactured through printing rather than using machines.

3. Hardware Design

Figure. 1 shows the block diagram of the proposed system. It consists of the following components. Those are Arduino Mega 2560, Stepper Motor, Heat Bed, Extruder, End stop switch, Rams 1.4 shield.

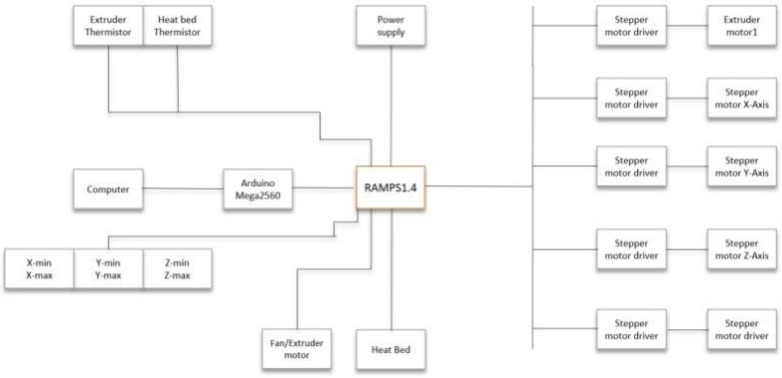

Figure 1: Hardware Design

3.1 Arduino Mega 2560:

Figure 2: Arduino Mega 2560

Figure.2 shows the microcontroller board of **Arduino Mega 2560** [3]. The number of digital I/o pins is 54. It supports 16 analog inputs. It consists of four Universal Asynchronous Receiver Transmitters. The frequency of the Quartz crystal oscillator is 16MHz...

3.2 Stepper Motor

The type of stepper motor used in the proposed model is NEMA 17. It is a hybrid stepping motor and provides a step angle of 1.8° which means that (200 steps/revolution). Every phase will withdraw 1.2 A at 4 V, by using a holding torque of 3.7 kg-cm The motor has 6 lead wires and about 12 volts of rated potential.

3.3 Heat Bed

Figure 3: Heat Bed

Figure. 3 shows the structure of the Heat bed. A heated bed is another module that will be used in a 3D printer. It provides the cooling mechanism for obtaining good results of printing. Heat beds avoid thermal runaway. And also avoid the problems like low adhesion between layers, less adhesion to the print bed.

3.4 Extruder

Figure 4: Extruder

Figure 4. Shows the 3D extruder which is an important module of the 3D printer that dips material in fluid or semi-fluid for storing it in progressive layers inside the 3D printing volume. In most cases, the extruder helps only for depositing the bonding agent and further material will be solidified.

3.5 End Stop Switch

Figure 5: End Stop Switch

Figure.5 shows the module of the End stop switch. The basic operation of those end-stops is to line the logical state of a pin within the ATmega (or other controller board) to point when the bound was reached. Hardware end-stops are electrically associated with the end-stop ports of the printer control board and will give a sign when the end stop condition has triggered.

3.6 Ramps 1.4 Sheild

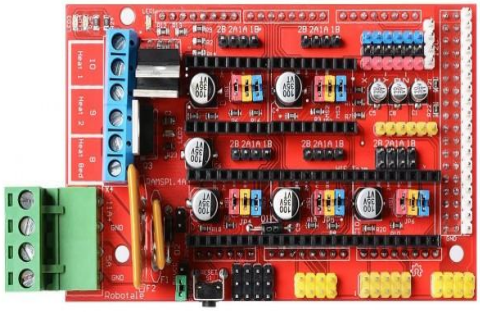

Figure 6: Ramps 1.4 Sheild

Figure.6 shows the module of the Ramps 1.4 shield. The RAMPS interfaces an Arduino Mega with the robust Arduino MEGA stage and has bounty space for extension. It consists of stepper drivers and extruder control hardware on an Arduino MEGA safeguard for clear assistance, part substitution, redesign capacity, and extension.

4. Software Implementation

4.1 Arduino IDE

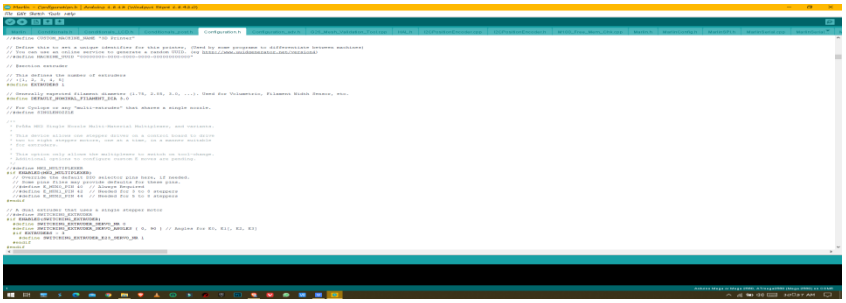

Figure 7: Arduino IDE Interface

The Arduino Integrated Development Environment (IDE) is a cross-stage application that uses C++ and C functions. With the help of IDE's programs can be written and uploaded onto a compatible board of Arduino. Fig.7 shows the Arduino IDE interface.

4.2 Pronterface

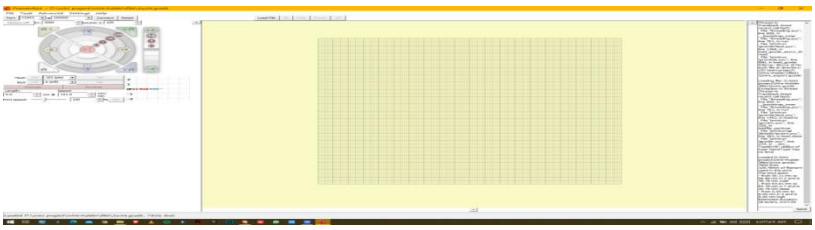

Figure 8: Pronterface Interface

The full set-up of host interfaces for 3D printers and CNC is printrun, comprising of Pronterface, a completely highlighted GUI, Pronsole, and also provides intelligent guidance [4].

4.3 SLIC3R:

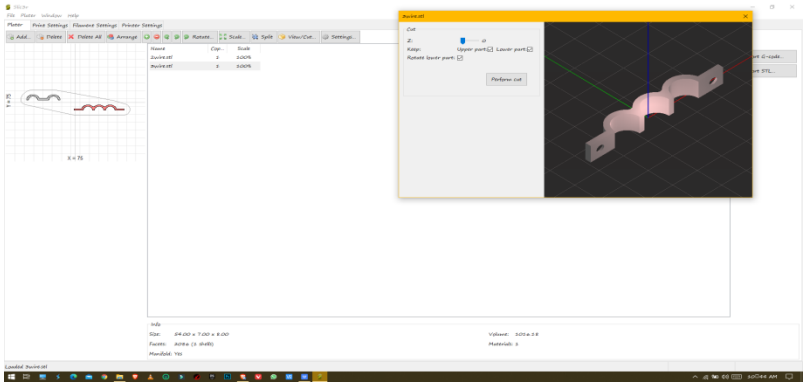

Figure 9: SLICR3 Interface

The tool which converts the 3D model into printing instructions is Slic3R [6]. It cuts the model into level cuts (layers), creates toolpaths to fill them, and calculates the quantity of fabric to be extruded.Fig.9 shows the platform of Slic3R.

5. Experimentation and Results

Essentially 3d printer printing begins from the. stl document that we de-endorsed in CAD programming. This record is given as a contribution to the Arduino board that we are utilizing because of the essential regulator for the whole printer. At the point when the record is given to the regulator, it provides fundamental order to the stepper engine drivers. These drivers fill in as a scaffold between the regulator and in this way the stepper engine. At the point when the engine gets the order from the drivers then the engines will turn reliable with the arranging.

At first, the printer checks its pivot and cutoff points for them wanting to ensure it doesn't surpass all the more than that. Presently the extruder starts to allow the fiber that is joined thereto. That fiber will be shipped off the hot end to frame that fiber to liquefy [5]. To print something the fiber should be dissolved which softened fiber is shipped off the spout.

The results will be carried out with the following steps

Step 1: Design and develop a 3D model using CAD software.

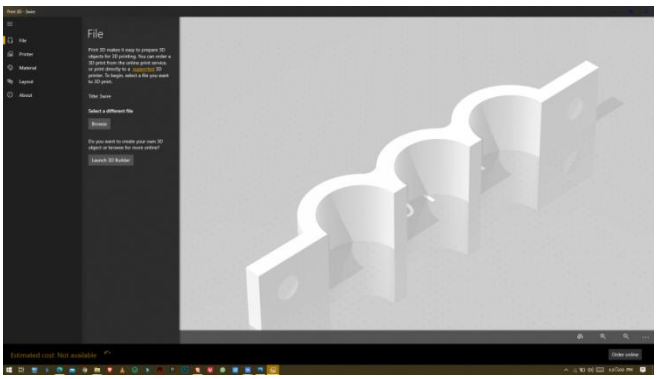

Figure 10: Model using CAD software

Step 2: The CAD model is converted to the quality Standard Tessellation Language (STL) format.

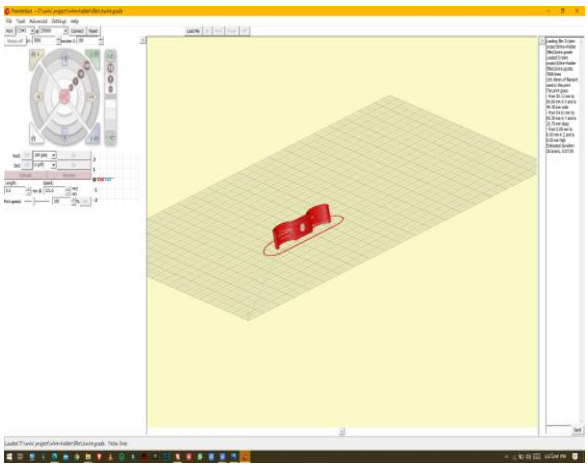

Figure 11: STL Format

Step 3: The STL file is sent to the pc which controls the 3D printer. There, the user decides the dimensions and orientation for the printer and configure the printing.

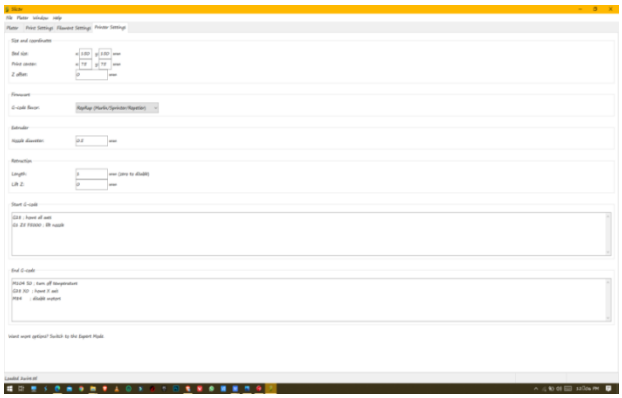

Figure 12: Dimension Representation

Step 4: Each machine has its own requirements for setup, like refilling the polymers, binders and other consumables the printer will be used by the printer.

Step 5: Start the machine and wait for the build to complete.

Step 6: The printed object has done printing. The object will be taken out.

Step 7: The last step is in 3d printing is post-processing. Many 3D printers require some sort of post-processing, like ignoring and cutting off unwanted left out.

The image shown in Figure 13 is the product developed by the proposed 3D printer.

Figure 13: Product developed by the proposed 3D printer

6. Conclusions

It is typically accepted that 3D printing is going to be a revolutionary force in manufacturing industries. Despite issues over counterfeiting, several firms have already started the technology to repeatedly manufacture tortuous parts, for instance in automotive and part producing. In the future, more studies can be done on the different types of printing machines and the materials which are suitable for each type of machine.

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