iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** VI **Month of publication:** June 2019

DOI: http://doi.org/10.22214/ijraset.2019.6116

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue VI, June 2019- Available at www.ijraset.com

Low Cost 3-D Printer Using Arduino

Prof. Priya Charles[1], Kiran Shinde[2], Jayashri Chandugade[3], Divya Mundada[4]
[1, 2, 3, 4]*Department of E & T C Engineering, Dr. D. Y. Patil Institute of Engineering, Management & Research, Akurdi, Pune, India*

Abstract: The paper focuses on designing and implementing a Three - Dimensional printer prototype based on linear movements, which is easy to bound most models due to cubic frames and easier to understand due to its kinematics. Developed with help of mechanical parts, electronics devices, DVD drivers, embedded controllers and software interface. It will be cost-efficient.

I. INTRODUCTION

Three - Dimensional printing is a new technology that is broadly used for making a physical model of a Three - Dimensional Design. Three - Dimensional printing is one of the most oppressive prototype technique used in 20thcentury. Amongst most of the Three - Dimensional printing techniques such as Selective Laser Sintering (SLA), Powder & Solid modeling, Fused Deposition modeling is the most suitable & rapid method, it is also the most cost-effective procedure for large prototypes. Three - Dimensional printing generally is a method that is used to create a Three - Dimensional model by forming layer by layer of a material to create a model. Three - Dimensional printing, also known as additive manufacturing (AM), refers to a procedure used to design a Three - Dimensional model in which layers of material are formed to create a model. Objects can be of almost any structure or dimensions and typically are produced using digital model data from a Three - Dimensional model or another electronic data source such as an Additive Manufacturing File (AMF) file. Stereo-lithography (STL) is one of the most common file types that Three - Dimensional printers can read. Thus, unlike material removed from a stock in the conventional machining process, Three - Dimensional printing or AM builds a three-dimensional object from computer-aided design (CAD) model or AMF file by successively adding material layer by layer. The term "Three - Dimensional printing" originally referred to a procedure that deposits a binder material onto a powder bed with inkjet printer heads layer by layer. More recently, the term is being used in popular idiom to enclose a wider variety of additive manufacturing techniques. Three - Dimensional printing is associated with a suite of technological processes, to which for the quick materialization of the functional prototype involved in the product's development process, we add or we extract material. The key idea of this new quick prototyping technology is based on the Three - Dimensional decomposition on thin-section layers and stacking them "layer by layer". The major advantage of a Three - Dimensional printer is that it allows the designers to produce a prototype in a very short time, which is tested and quickly remodeled and reducing the required time from the prototype phase to obtaining the final product. At the same time, using this technique we can obtain accurate components and also complex parts in a shorter duration that, through Cartesian and other methods would take a large amount of time to accomplish it.

II. LITERATURE SURVEY

" Implementation of a Low-cost CNC Plotter Using Spare Parts ", Mohammad Kamruzzaman Khan Prince, Muhsi-Al-Mukaddem Ansary, Abu Shafwan Mondol, International Journal of Engineering Trends and Technology (IJETT) – Volume-43 Number-6 - January 2017.

This project is about building prototype of a CNC plotter machine which is able to draw a PCB layout of 20cm by 20cm (or any image/text) i.e. 2D printer on a given solid surface. It utilizes less power and works with top perfection due to precise controlling of stepper motors. This is an economical project compared to other CNC products. It is made with easily available components and spare parts. It is designed for individual manufacturing and small-scale applications in educational institutes and small industries. The machine is designed with a very simple construction plan and can be carried anywhere without many endeavors. The algorithm used is simple and easy. The pen here can be replaced for changing the application. Software that has been used is open source and user-friendly.

2" Mechatronic System Design Project: A 3D Printer Case Study", Range Kayfi, Dana Ragab and Tarek A. Tutunji, 2015 IEEE Jordan Conference on Applied Electrical Engineering and Computing Technologies (AEECT)

The experience attained in designing and implementing a 3D print prototype was given. The developed prototype is a fully functional mechatronics system that included electronic components, electrical motors, mechanical structure, embedded program, and software interface. Different design options were studied and an Eventorbot Rep Rap method was chosen. Arduino MEGA 2560 was used as the microcontroller and three stepper motors were chosen to position the 3-axes. As for the sensors, six hall effect sensors were chosen to detect the limits of each axis. Ponterface was used as the main host interface software and all metal Rostock

delta combo: extruder & Bowden hot end was chosen to print the models. The developed 3D prototype is a good step in building local knowledge in this new and fast-growing technology and industry. The presented work followed a step-by-step design which can be used as a case study for a mechatronics design education. The paper also summarized and highlighted available 3D printer information and therefore can be used as a reference to readers interested in developing such printers.

" Automatic mini CNC machine for PCB drawing and drilling" Kajal J.Madekar, Kranti R. Nanaware, Pooja R. Phadtare, Vikas S. Mane, International Research Journal of Engineering and Technology (IRJET) Volume: 03 Issue: 02 Feb-2016

This setup of hardware with a fusion of G-code gives better perfection and minimizes the workload. G code make easy to find the knowledge of locations of all stepper motor operations, as the status of our operating motor is directly seen on computer hence we can start or stop the machine whenever we require. Making a small machine brings a flexibility in the work.

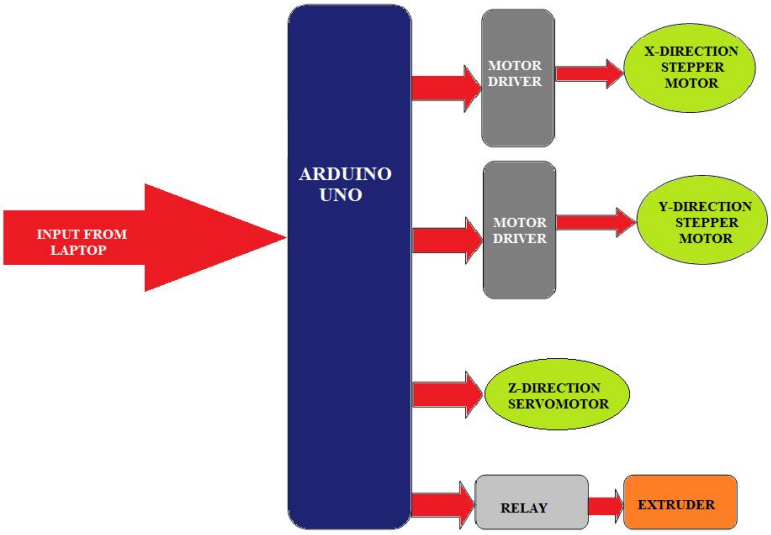
III. METHODOLOGY

A. *Problem Statement*

1) The present 3D printing technology is very time consuming with a high manufacturing cost.

2) This project aims not only to reduce the cost of the 3D Printer but also working upon its accuracy and time constraints.

B. *Block Diagram*



Block Diagram

C. *Block Diagram Explanation*

In the input which is given to the arduino first we select an object or create an object in software. Then we save that image with an extension of '. gcode'. Then that Gcode we open in the processing software. Using this software, we given the Gcode to the arduino. Here arduino is used for interfacing and command passing in between laptop and motor drivers. These drivers are used to control the motors and the servo motor used to control linear positions. Here we are giving Stepper Motor to the X-direction and Y-direction and Servo Motor to the Z- direction. Relay is used as a switch to the extruder. Extruder is nothing but the 3-D pen which is connected to the all the direction X, Y and Z direction.

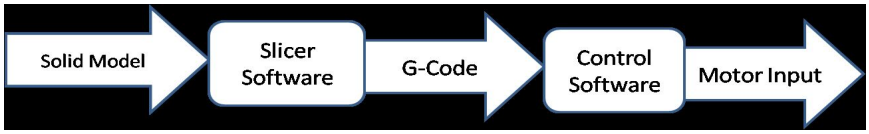
IV. SOFTWARE IMPLEMENTATION

The software involved in the 3D printing process is comprised of two basic parts. First, a slicer program converts a CAD model, typically an STL file, into machine G-code. Next, control software converts G-code into electrical pulses that move the motors. This process is outlined in Figure 18.

3D printers have varying degrees of software integration. Some are fully integrated, which means they can receive STL files and simply print the parts. The slicing and positional control is done internally. Others may require carrying out intermediate steps on a separate device, such as a laptop or tablet.

1) *Slicer Software:* Most 3D printer models under $1,000 use open-source slicer software that is available for download on the Internet. The most widely used program to convert STL files to G-code is Slic3r. This software has options for speed, temperature, and feed control (Slic3r). There are similar programs such as Skein forge, Cura, and Kisslicer, which are all available for free, download online (Edutech).
2) *Control Software:* Unlike slicer software, control software is usually designed for each specific printer Configuration and mechanism. Such software can be programmed onto a programmable logic controller (PLC) or a microcontroller. One way this can be achieved is by using Yaskawa's Motion Works software, which is based on the industry standard IEC 61131 programming languages for PLCs.

There are open-source options for control software as well. The most popular of these is Repetier-Host, which was developed for the Rep-Rap printing platform. There are also programs that combine the slicing and control software. Netfabb is one such package that is available for free online (Edutech).



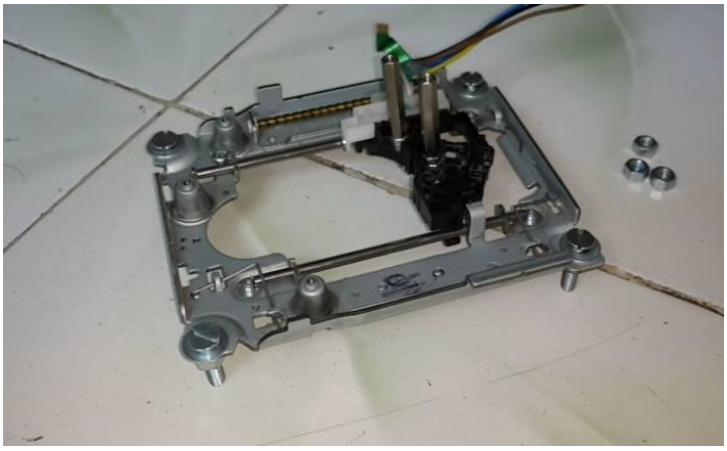
3D Printing Software Chain

V. HARDWARE IMPLEMENTATION

A. *Components Required*

1) 2x stepper motor with driver board or CD and DVD drive
2) 1x servo motor
3) 1x Desktop Computer Power Supply
4) 2x Stepper Motor Drivers (Easy driver)
5) 1x Arduino Uno
6) Wires
7) Bread board
8) Various screws/nuts/bolts
9) Soldering Iron
10) 2x rectangular casing for printing
11) 2x metallic square plate
12) M-M/M-F wires
13) Drill [10]
14) 3D GUN

a) *Mounting the Motor Trays:* Rectangular casing are required to mount the motor trays. The motors are mount in X, Y and Z axis. First the mounting of Y-axis is done. This axis moves back and forth. A motor tray is mount on the one of the rectangular casing with the help of nuts and bolts.



Required Part of CD-ROM along with stepper motor

For the X-axis mount it perpendicular to the length of another rectangular casing, again making it close to one end and aligning it as straight as possible. As for the Z-axis motor itis mounted on top of the X-axis drive with the help of metallic square plate, this will provide a platform to house the Z drive. Another metallic square is housed in top of the Y drive to create a platform for printing.

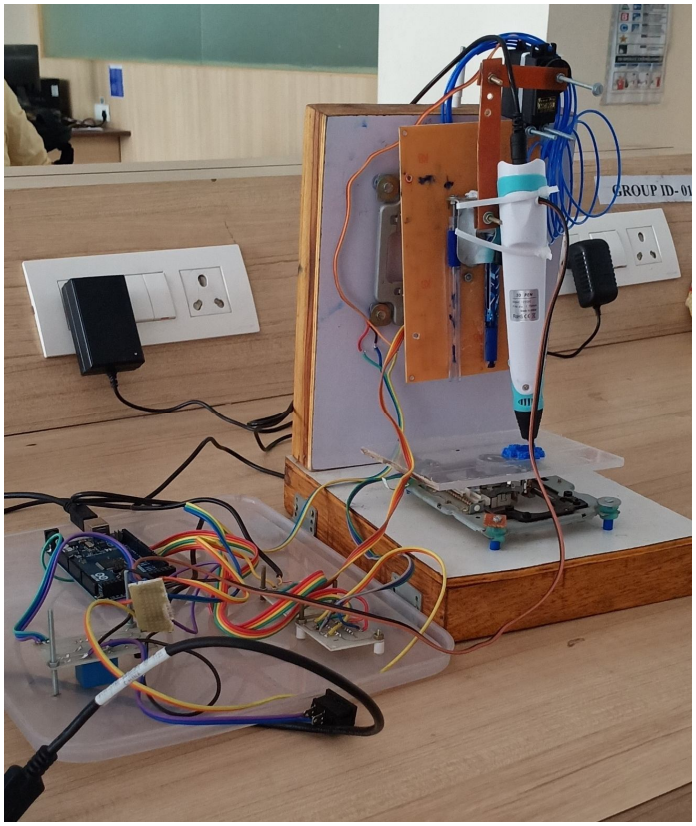
Mechanical assembling of 3D Printer

Now solder all the stepper motor terminals connect these wires to the easy driver or stepper motor driver. Connect all the stepper motor and servomotor driver to the Arduino terminals. Arduino is called as the 'brain' of the mechanism and the easy drivers are hand and legs of the stepper motor.

These drivers take the command form the software that is gcode and through arduino, it gives that to the 2 stepper motor and 1 servomotor all these 3 axis are connected to the 3-D Pen which is called as extruder which has a nozzle through which the material is placed down on the bed.

The moments of these axis are clear and steady so that we get an proper object as out come.

The material used is PLA (Polylactic Acid) which is a biodegradable material. It can be recycled.



VI. RESULT

The model made here is a gear which was succesfully implemented.

A. Application

1) Medical
2) Chemical industries
3) Toys
4) Food industries
5) Automotive industries

B. Advantages

1) Time to market
2) Save money
3) Clear communication
4) Feedback
5) Get the feel
6) Personalize it

VII. CONCLUSIONS

In this project, a 3D printer is modeled using Fused Deposition Modeling method consisting of three Stepper motors, extruder, Nozzle. Designed a 3D object using CAD software and its step file is provided as the input. It has many applications that include making a physical object from a three-dimensional digital model, typically by laying down many successive thin layers of a material. 3D printing technique is the improved technique as it increases the speed and accuracy of the printer along with expecting reduction in the cost and the time taken to print a product.

VIII. FUTURE SCOPE

A. Automotive & Industrial Manufacturing

1) Consolidate many components into a single complex part.
2) Create production tooling.
3) Produce spare parts and components.

B. Aerospace

1) Create complex geometry parts not possible with traditional manufacturing.
2) Control density, stiffiness, and other material properties of a part; also grade such properties over a part.
3) Create lighter parts.

C. Pharma/Healthcare

1) Plan surgery using precise anatomical models based on CT scan or MRI.
2) Develop custom orthopedic implants and prosthetics.
3) Use 3D printer cadavers for medical training.

D. Retail

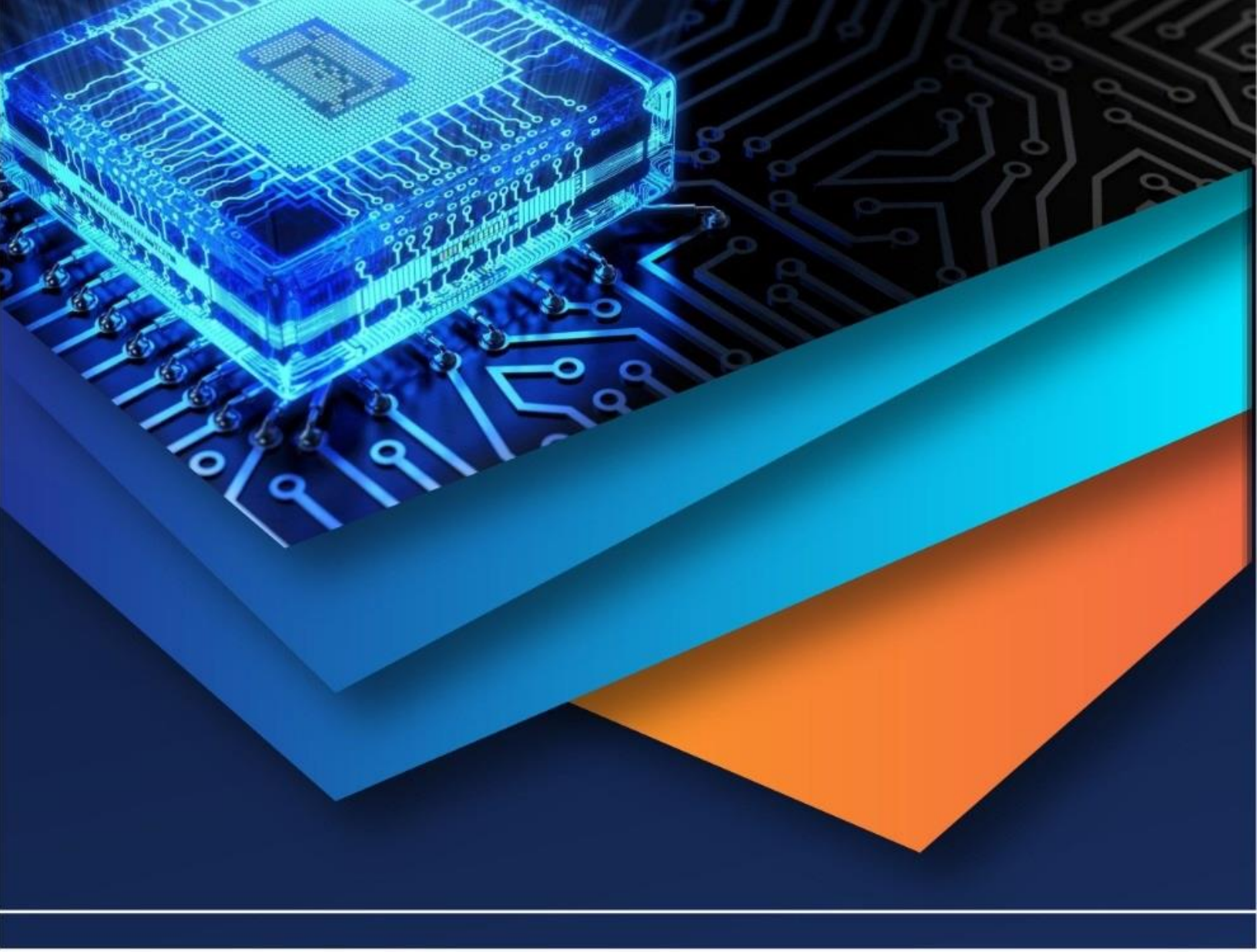
1) Create custom toys, jewelry, games, home decorations, and other products.
2) Print spare or replacement parts for auto or home repair.

IX. ACKNOWLEDGMENT

We thank Dr. D.Y. PATIL INSTITUTE OF ENGINEERING, MANAGEMENT AND RESEARCH, AKURDI, PUNE. We also would like to thank Department of Electronics and Telecommunication for their encouragement and technical support.

REFERENCES

[1] http://www.mechanicalhero.com/2011/11/cnc-computer-numeric- control.html
[2] http://www.toptenreviews.com/computers/articles/history-of-3D- printing
[3] https://redshift.autodesk.com/history-of-3D-printing
[4] https://3Dprintingindustry.com/3D-printing-basics-free-beginners- guide/history
[5] https://www.allthat3D.com/3D-printing-history
[6] Siddharth Bhandar, B Regina "International Journal of Computer Science and Information Technology Research" Vol. 2, Issue 2, pp: (378-380), Month: April-June 2014
[7] http://3Dprintingforbeginners.com/3D-printing-technology
[8] Dipayan Dey, Souvik Mondal2, Arijit Kumar Barik "3-Axis CNC Router Modifiable to 3D Printer" International Journal of Innovative Research in Science, Engineering and Technology Vol. 5, Issue 9, September 2016
[9] http://3Dprinting.com/what-is-3D-printing
[10] http://www.tinkernut.com/portfolio/hack-old-cd-roms-into-a-cnc- machine



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY