Compressive Study on Wireless 3d Printer Using Lua Code

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Abstract—3-D printing is a unique technology in the realm of CNC. Often this technology is referred to as Rapid Prototyping as its functional use is often one of (relatively) quickly producing a physical object from a CAD design model. This object can be used to test form, fit, and function prior to building the object in its real material, which likely costs more in time and material stock to produce. As a prototype, this object is fully (exceptions below) workable and functions to test both visual and engineering specifications, as well as completeness, correctness, and overall design integrity.

Wireless 3D Printers are machines that produce physical 3D models from digital data by printing layer by layer using Lua code. It can make physical models of objects either designed with a CAD program or scanned with a 3D Scanner. It is used in a variety of industries including jewelry, footwear, industrial design, architecture, engineering and construction, automotive, aerospace, dental and medical industries, education and consumer products.

Wireless 3D printer uses LUA code for transfer the data to the Wi-Fi model which sends information to the 3d printer.

Keywords—*Rapid prototype,CAD,Printing layer by layer,lua code,*

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I. INTRODUCTION

The 3D printing idea of custom producing is energizing to about everybody. This progressive system for making 3D models with the use of inkjet innovation spares time and cost by wiping out the need to plan; print and paste together separate model parts. Presently we can make a complete model in a solitary procedure utilizing wireless 3D printing. The essential standards incorporate materials cartridges, adaptability of yield, and interpretation of code into a unmistakable design. 3D Printer uses printing materials like plastic, metal, nylon, and more than a hundred different materials. It can be utilized for making outlandish little models eye wear frames, yet it can likewise print manufacturing models, end client items, quasi-legal weapons, air ship motor parts and even human organs.

We live during a time that is witness to what numerous call it as Third Industrial Revolution. 3D printing, all the more professionally called additive manufacturing, moves us far from era of large scale manufacturing line, and will convey us to another reality of adjustable, one-off generation. Need a section for your washing machine? As it is currently, you'd ask to your repair guy who gets it from a dealer, who got it sent from China, where they mass - produced a great many them at once, most likely infusion shaped from an extremely costly form. Later on, the starting of which is now here now, you will basically 3D print the object in your home, from a CAD model you downloaded. In the event that you don't have the right printer, quite recently print it at your nearby fab.

3D printers utilize an assortment of altogether different sorts of added substance producing advancements, yet they all offer one center thing in like manner: they all make a three dimensional object by building it layer by layer successively, until the whole process is finished. It's much like imprinting in two measurements on a sheet of paper, yet with an included third dimension, the Z-axis. The 3D Printers are implemented with the following priorities.

- Very low cost prototyping.
- Less development time for prototype.
- Stable, portable and robust solution for 3D printing.
- Simple and easy to build.

II. WIRELESS 3D PRINTING TECHNOLOGIES

The term 3D printing is the regular term for the right assembling term of "additive manufacturing." It sounds ridiculous when saying things like, "I'm going to go additively fabricate another iPhone case." Hence 3D printing will remain the term of decision everyone is going to say as "I will 3D print" it.

So there are mainly two types of techniques used for rapid prototyping (3D Printing). They are as follows:

1) Additive Manufacturing
2) Subtractive Manufacturing

A. Additive Manufacturing

Additive manufacturing processes, such as Stereolithography and Fused Deposition Modeling, create parts and prototype of objects by fusing layers of material one on another to build the part from scratch. In Additive manufacturing processes, the part is "developed" layer-by-layer, a couple of thousandths of an inch at once. Every thin layer can be greatly itemized, and it is situated decisively with the majority of the others. The inside of an empty or open part is developed in the meantime as the outside with no extra test. The outcome is a section with amazingly high outline resistances both all around. Also, every part is collected straightforwardly from the CAD records, with no human data needed. The procedure is totally mechanized.

Additive manufacturing processes makes something by adding material to the item. Some here, some there, and nowhere it's not required. No waste. Exceptionally productive. There are many kind of 3D printers, yet regardless of the innovation included, its additive manufacturing all of them are using

Additive assembling is especially suited to making single models or little clusters, as it considers fast creation without much lead time. There is no special setup needed for a SLS or SLA to create a specific part past guaranteeing it is stacked with the right base material. Interestingly, subtractive assembling techniques oblige a lot of setup to make a solitary part. Programming a CNC switch's tooling way, for occurrence, takes a lot of time and expertise, particularly contrasted with the about computerized procedure of printing a 3D piece.

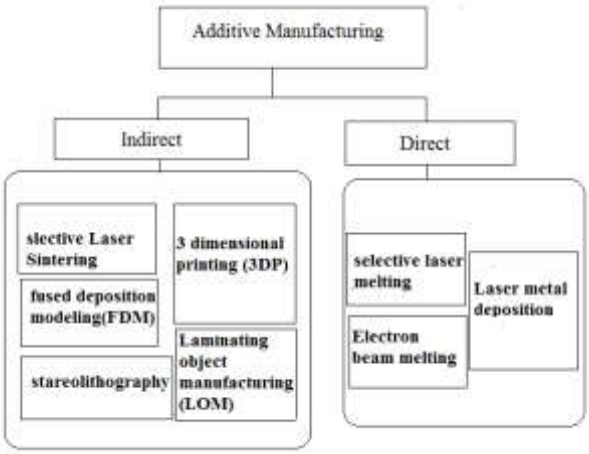

Fig 1: Different Additive Manufacturing Technologies

B: Stereolithography

The primary industrially accessible 3D printer (not got back to a 3D printer then) utilized the Stereolithography (SLA) technique. This was designed in 1986 by Charles Hull, who additionally at the time established the organization, 3D Systems. A SLA 3D printer lives up to expectations by concentrating a bar of ultraviolet light centered onto the surface of a vat loaded with fluid photo curable pitch. The UV laser beam draws out the 3D model one slender layer at once, solidifying that "cut" of the possible 3Dmodel as the light hits the gum. A large number cuts is made, with each one clung to the next, and before you know it you have a full, amazingly high- determination three dimensional model lifted out of the vat. Unused pitch is reusable for the next job.

C: Selective Laser Sintering (SLS)

Selective Laser Sintering (SLS) is an additive rapid prototyping (or 3D Printing) process that builds three dimensional parts by using a laser to selectively sinter (heat and fuse) a powdered material. The printing process begins with a 3D CAD file which is mathematically sliced into 2D cross-sections. The SLS prototype or part is built a layer at a Interfacing Touch and Proximity Control Technology with Barcode Scanners time until completed. Parts can be created from a range of powder materials, including Nylon-11 and Nylon-12 polyamides, or nylons with fillers such as glass beads or carbon fibers (to enhance physical properties). SLS material properties can be comparable to those found with traditional manufacturing methods.

D: Fused Deposition Modeling (FDM)

Fused Deposition Modeling (FDM) was produced by Stratasys in Eden Prairie, Minnesota. In this procedure, a plastic or wax material is expelled through a spout that follows the parts cross sectional geometry layer by layer. The fabricate material is generally supplied in fiber structure, yet a few setups use plastic pellets bolstered from a container. The spout contains resistive radiators that keep the plastic at a temperature simply over its dissolving point so it streams effortlessly through the spout and structures the layer. The plastic solidifies instantly in the wake of spilling out of the spout and bonds to the layer beneath. When a layer is manufactured, the stage brings down, and the expulsion spout stores another layer. The layer thickness and vertical dimensional precision is controlled by the extruder pass on width, which extends from 0.013 to 0.005 inches. In the X-Y plane, 0.001 inch determination is achievable. A scope of materials are accessible including ABS, polyamide, polycarbonate, polyethylene, polypropylene, and venture throwing wax.

E: Subtractive Manufacturing

What the blazes is Subtractive manufacturing? Someday soon enough later on, individuals will look back and see that current manufacturing processes as we today view something such as blacksmithing. What's intriguing about that is quite a bit of today's manufacturing processes are entirely comparable to blacksmithing. Both are what's called "subtractive manufacturing".

Subtractive manufacturing, such as CNC milling and turning, uses a block of material and removes the part that is not required or which is excess, until only the desired shape remains, as shown in fig Subtractive manufacturing must cut out materials from a bigger source. As a result of the cutoff points of cutting and directing innovation they can't make empty parts in a solitary piece, and they are constrained in the measure of subtle element they can make on a solitary machine. We need not to say that subtractive amassing isn't correct - adequately given time, a CNC or a capable machine manager can make to an awesome degree of precision and complex parts. Be that as it may, the time and expense it takes to create these parts, when contrasted with added substance assembling, makes them far less productive. They additionally take numerous more worker hours to create, adding to assembling times and costs of production eventually. Part Function Along with the intricacy of the part you're making, you'll have to consider what the parts

Inevitable capacity will be. When all is said in done, parts that are utilized for checking, presentation models, and for short-utilization for useful testing can be created with added substance assembling, while parts expected for long haul or high-push utilization are best made with subtractive strategies.

“Subtractive assembling requires endless supply of material to make something. The blacksmith pounded away at warmed metal to create an item. Today, a CNC machine cuts and drills and generally expels material from a larger beginning piece of material to make an item. It's wasteful and inefficient. Different manufacturing techniques flourish yet .

However, for projects on a larger scale, subtractive manufacturing becomes more cost-effective. Creating an optimal tooling path for a single part is prohibitively expensive and time consuming, but doing the same for a thousand parts makes perfect sense, since each part should be exactly the same. Tuning is a designing machining process in which a cutting instrument, normally apparatus bit, depicts a helical tool path by moving pretty much directly while the work piece turns.

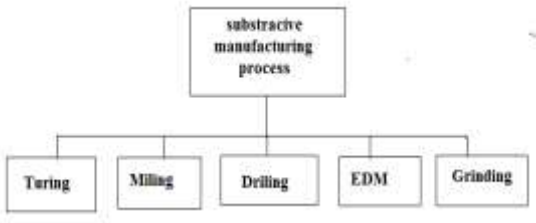

Fig 2: Different Substrative Manufacturing proces

The apparatus required for development may be actually a straight line, or they may be along some arrangement of bends or points, however they are basically direct. Generally the expression "turning" is saved for the era of outer surfaces by this cutting activity, though this same key slicing activity when connected to inside surfaces is called "exhausting". In this way the expression "turning and exhausting" arranges the bigger group of procedures. The cutting of countenances on the work piece, whether with a turning or exhausting device, is called "confronting", and may be lumped into either class as a subset.

F: FDM System Working Principle

There are a few distinct routines for 3D printing, however the most broadly utilized is a procedure known as Fused Deposition Modeling (FDM). FDM printers utilize a thermoplastic fiber, which is warmed to its dissolving point and afterward expelled, layer by layer, to make a three dimensional article.

The innovation behind FDM was created in the 1980s by Scott Crump, fellow benefactor and director of Stratasys Ltd., a main producer of 3D printers. Other 3D printing associations have subsequent to embraced comparative advancements under distinctive names. The Brooklyn-based organization Makerbot (now claimed by Stratasys), was established on an almost indistinguishable innovation known as Fused Filament Fabrication (FFF).

Items made with a FDM printer begin as PC helped configuration (CAD) records. Prior to an item can be printed, its CAD document must be changed over to an arrangement that a 3D printer can comprehend — normally STL position.

FDM printers utilize two sorts of materials, a displaying material, which constitutes the completed item, and a bolster material, which goes about as a platform to bolster the article as its being printed.

During printing, these materials take the type of plastic strings, or fibers, which are loosened up from a curl and encouraged through an extrusion nozzle. The nozzle liquefies the fibers and extrudes them onto a based. Both the spout and the base are controlled by a PC that interprets the measurements of an article into X, Y and Z coordinates for the spout and base to take after amid printing.

In a normal FDM framework, the expulsion spout moves over the manufacture stage on a level plane and vertically, "drawing" a cross segment of an article onto the stage. This slim layer of plastic cools and solidifies, quickly tying to the layer underneath it. When a layer is finished, the base is brought down as a rule by around one-sixteenth of an inch to make space for the following layer of plastic.

Printing time relies on upon the measure of the article being produced. Little protests only a couple of cubic inches and tall, flimsy articles print rapidly, while bigger, all the more geometrically complex items take more time to print. Contrasted with other 3D printing systems, for example, stereolithography (SLA) or particular laser sintering (SLS), FDM is a genuinely moderate processed.

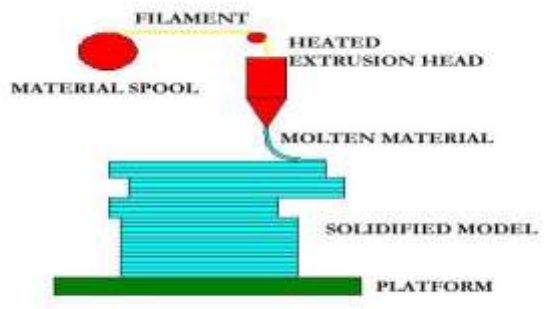

Fig 3: Molten material coming out of nozzle and deposited layer by layer.

Once an object comes off the FDM printer, its support materials are removed either by soaking the object in a water and detergent solution or, in the case of thermoplastic supports, snapping the support material off by hand. Objects may also be sanded, milled, painted or plated to improve their function and appearance.

G: Conventional 3D Printer

Why so much build up and fervor around 3D printing? There are a few reasons, yet the primary fascination is that the innovation empowers clients to make very mind boggling shapes, something that wasn't conceivable before and offers energizing open doors for outline and development.

For organizations, this innovation keeps on being appealing for innovative work, generation and to dispense with the need to make shape or tooling. Accordingly, it can spare organizations a huge number of pounds and weeks of lead-time amid the item plan stage. This makes it exceedingly appealing for prototyping and other little scale assembling needs. But the technology is also evolving to become of interest to general people. The termination of key licenses for material expulsion and some stereo lithography innovations has brought about a flood of machines that are much lower expense than their mechanical partners. This has empowered individuals to bring the tech into their homes. As access to the innovation grows, some conjecture that individuals will soon have the capacity to utilize their customer evaluation printers to alter softened machines or parts up their home The users of the technology evolve from just skilled engineers to include the average Adrian Bowyer tinkering with a 3D printer and invent he Reprap (open source 3D Printer) .

RepRap is mankind's first broadly useful self-replicating assembling machine. RepRap takes the type of a free desktop 3D printer equipped for printing plastic articles. Since numerous parts of RepRap are produced using plastic and RepRap prints those parts, RepRap self-recreates by making a pack of itself - a unit that anybody can amass given time and materials. It likewise implies in the event that you've got a RepRap - you can also print bunches of other helpful stuff, and you can print another RepRap for a companion...RepRap is about making self-recreating machines, and making them openly accessible for the advantage of everybody. We are utilizing 3D printing to do this, however in the event that you have different innovations that can duplicate themselves and that can be made freely available to all, then this is the place for you too.

Reprap.org is a group venture, which implies you are welcome to alter most pages on this site, or exceeding all expectations even further, make new designs you could call your own. Our group entry and New Development pages have more data on the best way to get included. Utilize the connections underneath and on the left to investigate the site substance. You'll locate some substance deciphered into different dialects .RepRap was the first of the minimal effort 3D printers, and the RepRap Project began the open-source 3D printer unrest. It has turn into the most generally utilized 3D printer among the worldwide individuals from the Maker Community. There is another type of 3D printers which work with different principle of opera

III. 3D POTTER

The conventional Cartesian 3D printers suffers from drawback of slow printing in case of circular objects. Which also takes a lot of time to print the object. So the proposed solution is to build a printer which is especially good at printing circular objects. Inspired from Potter's Wheel, so the solution is to make a printer with one of its 3 dimensional motions to be circular like potter's wheel instead of conventional linear motion. This method will help in printing circular objects.

The idea is to design a 3D printer which can print circular objects easily. Based on Potter's Wheel Principle, the proposed solution is to change the design to print circular objects

Principle: Proposed solution is to make Y bed assembly motion to be circular like potter's wheel instead of conventional linear motion as shown in fig 4 below. So is the name 3D Potter

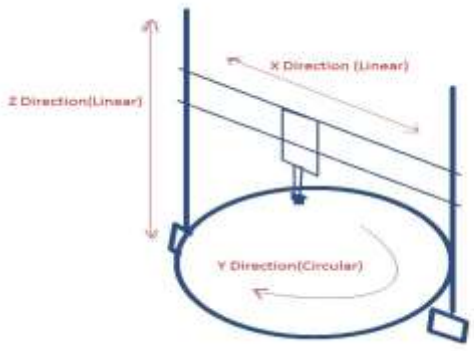

Fig 4. 3D Potter Idea

As we are using two linear and one circular motion which corresponds to cylindrical co –ordinate systems we say this is a cylindrical 3D Printer. In conventional Cartesian printers while printing circular objects both X axis and Y axis always moves to adjust the coordinates of point to be printed. But in case of Potter to print one whole layer of circle you have to move in X axis only once to adjust the radius (r). Once radius is fixed to plot all points on circle potter has to move 360 degrees in Y axis, which is one rotation. So Potter can reduce movement required for printing, which ultimately reduces efforts required. This reduction in motion results in increased speed and hence reduction in printing time.

A.Mechanical Structure and Stepper Motors

Mechanical structure is main building block of 3D potter. It gives printer the main stability. The design of Mechanical structure is very important because it will mainly decide Interfacing Touch and Proximity Control Technology with Barcode Scanners the cost of printer. Some of available printers in market uses Metal frame structure but this increases cost. Some of manufacturers use 3D printed plastics parts and multiple rods which is again is costly affair and also difficult for production. Some of them use wood material to reduce cost. We are also using MDF (wood) material to reduce cost. For designing CAD model of mechanical structure, Siemens Unigraphics Nx 6.0 tool has been used and then laser cut in MDF material. Once laser cutting is done the laser cut parts are assembled to form mechanical structure. Stepper motors are used for moving the printer head in all 3 dimensions. We are using NEMA 17 stepper motors

B. Host Application

Lot of open source applications are freely available in market today. The widely used applications are Repetier, Up etc. Repetier host has been used for 3D Potter, because it is simple to use and has inbuilt slicing tool.

Host application is software which resides in computer and interacts with printer using USB cable. Host application takes 3D CAD model of an object to be printed and slices to G-Code which is given to MCU through USB.

Host application will have following control features:

1) Feed Rate
2) Flow Rate
3) Fan Control
4) Bed Temperature Control
5) Extruder Temperature Control
6) Individual Stepper Motor Precise control

C. Firmware

Firmware is program written inside MCU which is mainly responsible for driving motors in precise amount defined by G-Code. Firmware decides which motor to rotate at what point of time and in what angle. It operates stepper drivers accordingly. There are numerous firmwares readily available in market which works perfectly for Cartesian 3D printers. The proposed 3D Potter is new kind of printer, which is a cylindrical type of 3D printer, so the firmware needs to be changed accordingly.

IV. SOFTWARE INSTALLATIONS AND SETUP

The Software used for the project are as follows:

1. Repetier Host:

Repetier Host is software which is needed to control 3D printer. It is also called a host Application. Repetier is open source hence we can download and install in our computer. So we have downloaded and installed latest version of Repetier host.

2. Slic3r:

Slic3r is slicing software tool required to create guide path for 3D printer, fortunately Repetier host has this software tool in built in it. So we don't have to manually install it again.

3. Arduino:

Arduino is required to write firmware for MCU. We have downloaded Repetier firmware which is again open source. We have modified it for 3D printer.

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4. Lua Code:

Lua is first and foremost an embedded language a tool for creating software. Lua is a programming language is also a functioning software system. To install Lua, you can download a package that has been compiled for your particular operating system platform or download the source the source code and compile it yourself.

V. WI-FI MODULE

ESP8266 is an impressive, low cost Wi-Fi module suitable for adding Wi-Fi functionality to an existing microcontroller project via a UART serial connection. The module can even be reprogrammed to act as a standalone Wi-Fi connected device. The feature list is impressive and includes:

- 802.11 b/g/n protocol
- Wi-Fi Direct (P2P) soft-AP
- Integrated TCP/IP protocol stack

ESP8266 is a chip with which manufacturers are making wirelessly networkable micro-controller modules. More specifically, ESP8266 is a system-on-a-chip (SOC) with capabilities for 2.4 GHz Wi-Fi, general-purpose input/output (16 GPIO), Inter-Integrated Circuit (I^2C), analog-to-digital conversion (10-bit ADC), Serial Peripheral Interface (SPI), I^2S interfaces with DMA (sharing pins with

GPIO), UART (on dedicated pins, plus a transmit-only UART can be enabled on GPIO2), and pulse-width modulation (PWM). It has a 64 KB boot ROM, 64 KB instruction RAM and 96 KB data RAM. External flash memory can be accessed through SPI (Serial Peripheral Interface).

- The ESP8266 requires 3.3V power and should not be powered with 5 volts.
- The ESP8266 needs to communicate via serial at 3.3V and does not have 5V tolerant inputs, so you need level conversion to communicate with a 5V microcontroller like most Arduino use.

In order to connect the data into the cloud that is the internet we are using ESP8266 Wi-Fi module. This is done by interfacing Wi-Fi module with the Arduino Uno board along with the necessary cloud computing program.

VI. RESULTS

Experimental setup:

The complete experimental setup of Wireless 3D Printer prototype

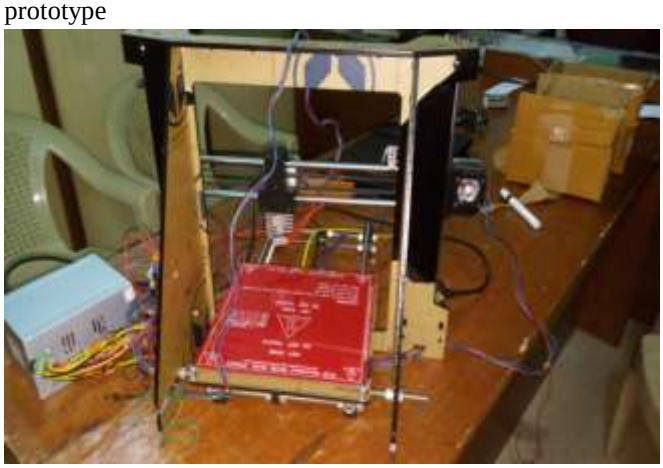

Figure 5 Experimental setup of Wireless 3D Printer prototype

Figure 5 shows the complete setup for Wireless 3D Printer which includes mechanical structure, stepper motors and electronics printer control board. In the above experimental setup on Graphics LCD is also used if you want to use SD card instead of using computer. The setup also includes power supply and whole unit is made standalone structure so that it can be easy to carry anywhere.

Working Procedure:

The 3D printing process consists of following steps

a. 3D CAD Modeling

b. Firmware Uploading

c. Connecting printer to host Application

d. Slicing the 3D model and start Printing

Our outcome result as show below, it is our first result

VII. CONCLUSION

The overall mechanical structure designed after rigorous testing and iteration is up and running as expected. The portable suitcase design also works perfectly where we can fold the printer after use and fit inside small space.

3D Potter was assembled and run for testing which did work but the results were not as expected. The object printed was not proper and had lot of discontinuity in structure. The firmware design changes needs some re-engineering to get perfect output. After addressing all the complications and challenges involved, the 3D Potter technique can really work and cut down the print time of 3D printer by 15-25 % depending on the curvature of the model to be printed.

FUTURE WORK

Our future work includes following ideas to be implemented

1. Fixing the problem and get 3D potter working to obtain intended result.
2. Redesigning the 3D potter with industry standards and commercialize it.
3. Designing extruder which is compatible with all types and sizes of filament material.

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