3D Printer

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ABSTRACT

3D printing is a pioneering technology which has shown immense potential in different area of product design, manufacturing, engineering, and biology. This technology has evolved over the time which has led to the development of high-end 3D printing machines to obtain the product with high resolution. In all cases, the object to be printed is created using computer aided design (CAD) file which is the exported as a file to be printed. Different types of 3D printing techniques have shown enormous application in the area of medicine and surgery. 3D printing equipment's and technology is supposed to revolutionize the pharmaceutical industry by providing personalized and patient oriented products. Advances the in area of high-resolution 3D printing will complement the patient specific diagnostics and personalized medicine. Overall, this technology holds many promises for the future and is expected to advance the healthcare.

INTRODUCTION

Three-dimensional (3D) printing is an additive manufacturing process that creates a physical object from a digital design. The process works by laying down thin layers of material in the form of liquid or powdered plastic, metal or cement, and then fusing the layers together.

3D Printing technology, also known as Additive Manufacturing (AM), refers to processes used to generate a 3D object in which layers of material are successively formed under a computer controlled program to create a physical object. The 3D file source is usually sliced into several layers, each layer generating a set of computer controlled instructions. Both 3D printing and additive manufacturing reflect that the technologies share the theme of sequential-layer material addition or joining throughout a 3D work. 3D printing technologies can be split up into 2 groups: direct and indirect 3D printing. The main difference lies in the fact that the design is directly made from 3D printing (direct) or 3D printing was used in the process of creating your model (indirect).

The objects manufactured through 3D printing processes can be of almost any shape or geometry. They are typically produced using digital model data from a 3D model or another electronic data source such as a Stereo Lithography (STL) file, one of the most common file types that 3D printers can read.

The term 3D printing originally referred to a process that deposited a binder material onto a powder bed with inkjet printer heads layer by layer. More recently, the term 3D printing is being used in popular vernacular to encompass a wider variety of additive manufacturing techniques. For professionals, the additive manufacturing name remains more popular for its broader sense and longer existence. Other terms are also employed, such as desktop manufacturing, rapid manufacturing, direct digital manufacturing, and rapid prototyping.

LITERATURE SURVEY

The research I will be working on is based on 3D printing. Since it is a very young topic in technology all of the sources that I will be using, with the exception of the government's website on patents, will be less than five years old.

They will be a combination of two articles that I have found on the Stratasys lawsuit, data from an experiment we did from the 3D printer in our university, the terms and conditions provided by iTunes to their customers, the laws and rules cited in the U.S. Patent and Trademark Office, and some data found from the MakerBot website. Because these sources are so different, I will try to cover different aspects of the industry, focusing on its future and its problems with intellectual property rights.
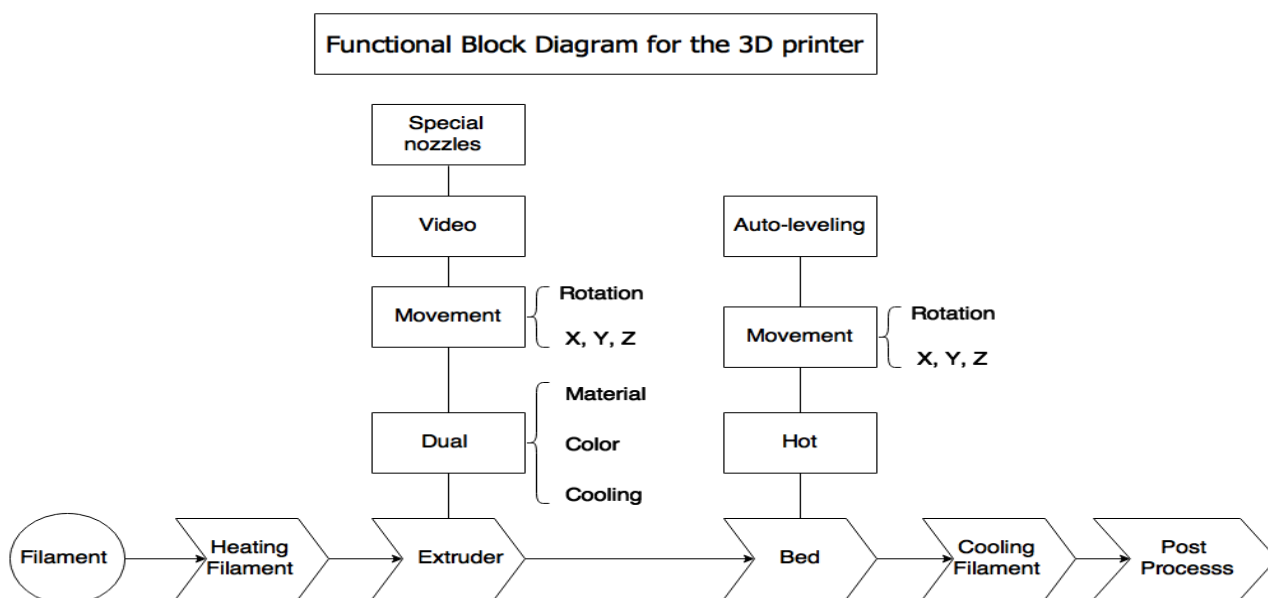
The first sources that I'm going to use for my paper are from the website Make Magazine. Their topics consist of a lawsuit that the company Stratasys is making against Afinia, a smaller 3D printing company. Stratasys is a large corporation of 3D printing that started out making printers specifically for commercial and industrial interests. For a long time the company restrained itself from going public, however earlier last year they bought the company MakerBot for a $403 Million deal.
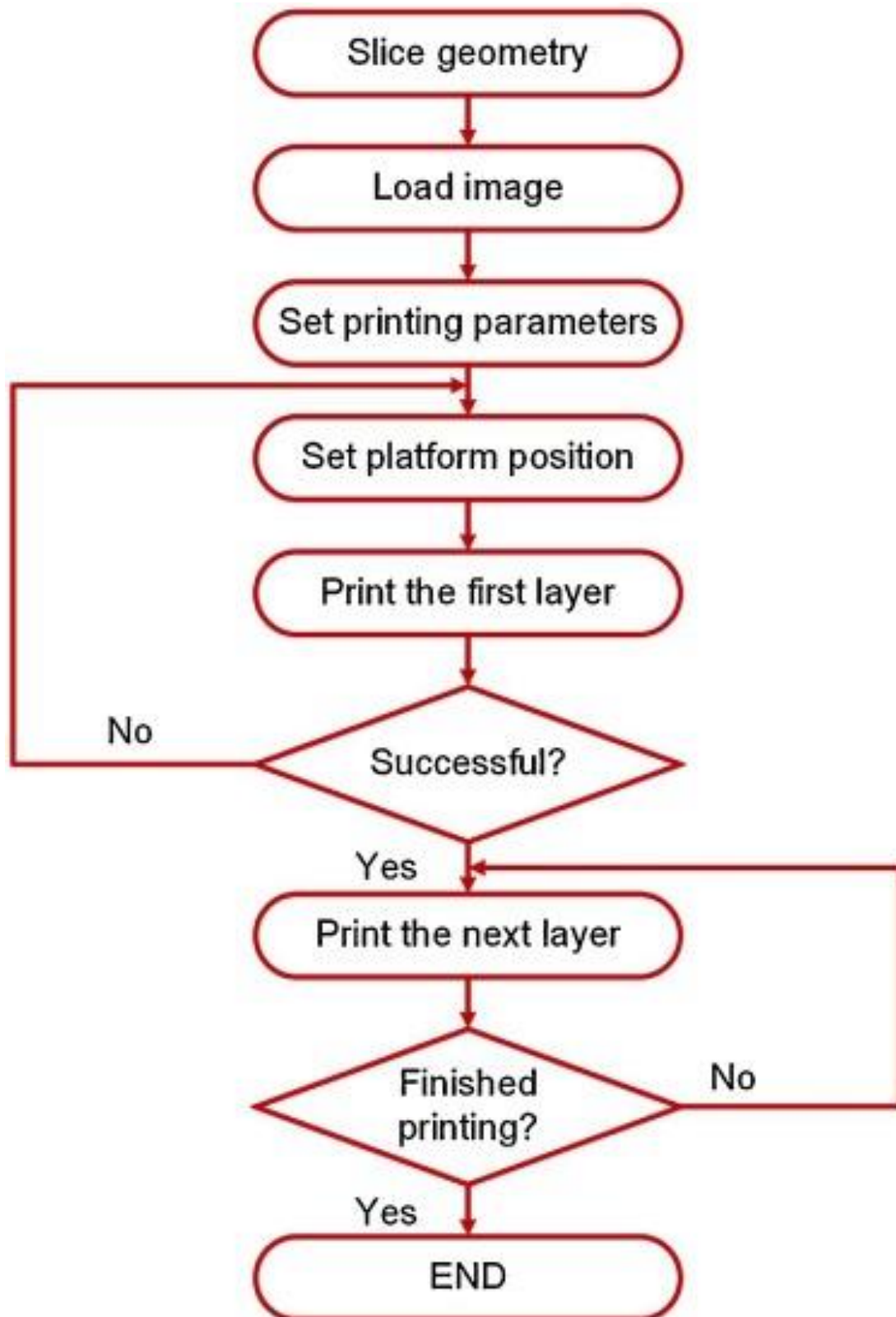
MakerBot compliments Stratasys in that they specialize in making 3D printers for desktop; their goal, along with many other companies like Afinia, is to make 3D printing available for the regular people, stimulating creativity amongst an immense amount of minds across the world.

PURPOSE

◈ To understand the advantages and disadvantages of 3D printing.

◈ To promote the knowledge and interest in 3D printing.

◈ To realize the further development of 3D printing.

◈ To understand the concept of ulti-maker cura for slicing and pronterface.

◈ To understand the main materials for 3D printer and their impact on environment.

BLOCK DIAGRAM

Functional Block Diagram for the 3D printer

FLOW CHART OF WORKING

Slice geometry

Load image

Set printing parameters

Set platform position

Print the first layer

Successful?

No

Yes

Print the next layer

Finished printing?

No

Yes

END

MAJOR COMPONENTS

- Arduino Mega
- Ramp Shield
- SMPS Power Supply
- Stepper Motor
- Extruder Kit
- DVD Writer
- Motor Driver
- Hot End
- Jumper Wires
- X/Y end stop
- PLA Filament

1. AURDUINO MEGA

The **Arduino Mega 2560** is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, 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.

MICROCONTROLLER	ATmega2560
OPERATING VOLTAGE	5V
INPUT VOLTAGE (RECOMMENDED)	7-12V
INPUT VOLTAGE (LIMIT)	6-20V
DIGITAL I/O PINS	54 (of which 15 provide PWM output)
ANALOG INPUT PINS	16
DC CURRENT PER I/O PIN	20 mA
DC CURRENT FOR 3.3V PIN	50 mA
FLASH MEMORY	256 KB of which 8 KB used by bootloader
SRAM	8 KB
EEPROM	4 KB
CLOCK SPEED	16 MHz
LED_BUILTIN	13
LENGTH	101.52 mm
WIDTH	53.3 mm
WEIGHT	37 g

2. RAMP SHIELD

This is Mega Pololu Shield or RAMPS for short. The 3D Printer Controller Board RAMPS 1.4 is designed to fit the entire electronics needed for a RepRap in one small package for low cost. RAMPS interfaces an Arduino Mega with the powerful Arduino MEGA platform and has plenty of room for expansion.

RAMPS can only work when connected to its motherboard **Mega 2560** and **A4988**/**DRV8825**. Owning to its stability in operation and great compatibility with the most 3D printer (all RepRap-model such as Prusa i2 and i3). The combination of Ramps1.4 + **MEGA2560** + **A4988**/**DRV8825** is becoming a mainstream of DIY 3D printer control board.

3. SMPS POWER SUPPLY

Like other power supplies, an SMPS transfers power from a DC or AC source (often mains power, see AC adapter) to DC loads, such as a personal computer, while converting voltage and current characteristics. Unlike a linear power supply, the pass transistor of a switching-mode supply continually switches between low-dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy. A hypothetical ideal switched-mode power supply dissipates no power. Voltage regulation is achieved by varying the ratio of on-to-off time (also known as duty cycles). In contrast, a linear power supply regulates the output voltage by continually dissipating power in the pass transistor. This higher power conversion efficiency is an important advantage of a switched-mode power supply.

4. STEPPER MOTOR

A stepper motor, also known as step motor or stepping motor, is a brushless DC electric motor that divides a full rotation into a number of equal steps. The motor's position can 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 correctly sized to the application in respect to torque and speed.

Stepper motors effectively have multiple "toothed" electromagnets arranged as a stator around a central rotor, a gear-shaped piece of iron. The electromagnets are energized by an external driver circuit or a micro controller. To make the motor shaft turn, first, one electromagnet is given power, which magnetically attracts the gear's teeth. When the gear's teeth are aligned to the first electromagnet, they are slightly offset from the next electromagnet. This means that when the next electromagnet is turned on and the first is turned off, the gear rotates slightly to align with the next one. From there the process is repeated. Each of those rotations is called a "step", with an integer number of steps making a full rotation. In that way, the motor can be turned by a precise angle.

5. EXTRUDER KIT

This MK8 extruder has a filament guide tube, all screws, spare drive gear, and upgraded Bowden tube fitting, for CR-10 3D Printer. Our design gives complete support of flexibles from the intake and output ends. We've reduced the price and complexity of printing flexibles. It will also allow to print faster with sustained quality and no risk for grinding the filament.Frankly, it looks amazing, and performs better than the plastic version included in stock printers. It allows you to print flexibles, and regular plastic filaments.Easy and convenient to use.With high quality and durable performance.100% brand new and in good condition.

- Assembled mk8 extruder come with 4 print nozzles; Diameter: 0.4mm defaulted; 0.2mm, 0.3mm, 0.5mm optional.
- It is compatible with most prusa i3 3d printers with some slight modifications when mounting it.
- Filament size: 1.75mm PLA/ABS or other 3d print materials. Flow rate of nozzle:max 100mm/s, support for high speed printing.
- Nema 17 high quality stepper motor with larger torque and less heat buildup.
- Special ceramic insulation cotton ensure the hotend can heat to a high temperature fast and stably.

6. DVD DRIVER

LG data storage products have innovative, state-of-the-art features including BDXL Ultimate Capacity, which lets you store the equivalent of 27 DVDs or 5 Blu-ray discs, a level of disc writing capacity that has never existed until now. You'll also find features designed to optimize your entertainment experience, like Silent Play, Jam less Play Technology, and M-DISC technology, which is setting new standards in optical drives. Features : LG data storage products have innovative, state-of-the-art features including BDXL Ultimate Capacity, which lets you store the equivalent of 27 DVDs or 5 Blu-ray discs, a level of disc writing capacity that has never existed until now. You'll also find features designed to optimize your entertainment experience, like Silent Play, Jam less Play Technology, and M-DISC technology, which is setting new standards in optical drives.

7. MOTOR DRIVER

Drive a 2-phase bipolar stepper motor or two DC motors with the L298 dual H-Bridge chip, mounted on this handy breakout board along with all necessary peripherals It is ideal for robotic applications and well suited for connection to a microcontroller requiring just a couple control lines per motor. It can also be interfaced with simple manual switches, TTL logic gates, relays, etc. Weight: 30 gms can also control the 2-phase stepper motor

8. HOT END

The hot end is one of the most important components on a 3D printer, as it heats the filament and pushes it through the attached nozzle. Hot ends are usually a durable, conductive metal assembly, consisting of a few elements, which include a heating block, throat, PTFE liner (optional), and PTFE coupler.

The hot end is a critical component of a 3D printer, and issues in this area can have significant effects on a print. The most common issue with the hot end is a clog, which can lead to incorrect extrusion or no extrusion at all. And a common cause of hot end clogs is heat creep, where heat climbs beyond the "melt zone" of a hot end, and material melts too early, blocking the filament path.

SOFTWARE DESCRIPTION

1. ARDUINO IDE

The Arduino integrated development environment (IDE) is a cross-platform application written in Java, and is derived from the IDE for the Processing programming language and the Wiring projects. It is designed to introduce programming to artists and other newcomers

unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and is also capable of compiling and uploading programs to the board with a single click. A program or code written for Arduino is called a "sketch".

Arduino programs are written in C or C++. The Arduino IDE comes with a software library called "Wiring" from the original Wiring project, which makes many common input/outputs operations much easier. Users only need define two functions to make a run able cyclic executive program:

- Setup (): a function run once at the start of a program that can initialize settings

- Loop (): a function called repeatedly until the board powers off.

Open the Arduino IDE software and select the board in use. To select the board:

- Go to Tools.

- Select Board.

- Under board, select the board being used, in this case Arduino Uno.

- Go to Tools and to Port and select the port at which the Arduino board is connected.

- Write the code in the space provided and click on compile. Once the code is compiled, click on upload to upload the sketch to the Arduino board.

2. ULTIMAKER CURA

Cura is an open source slicing application for 3D printers.[1] It was created by David Braam who was later employed by Ultimaker, a 3D printer manufacturing company, to maintain the software. Cura is available under LGPLv3 license. Cura was initially released under the open source Affero General Public License version 3, but on 28 September 2017 the license was changed to LGPLv3. This change allowed for more integration with third-party CAD applications. Development is hosted on GitHub. Ultimaker Cura is used by over one million users worldwide and handles 1.4 million print jobs per week. It is the preferred 3D printing software for Ultimaker 3D printers, but it can be used with other printers as well. Ultimaker Cura works by slicing the user's model file into layers and generating a printer-specific g-code. Once finished, the g-code can be sent to the printer for the manufacture of the physical object.

3. PRONTERFACE

Pronterface is a simple graphical user interface that allows you to monitor and control your printer from a USB-connected computer. With it you can directly move stepper motors, control bed and nozzle temperatures, send G-code commands directly via a terminal or console window, and much more.Created by the influential RepRap initiative, Pronterface has been around for a long time, and it's part of the Printrun suite of simple tools for managing and controlling both 3D printers and CNC machines. Updated in early 2021, the program runs on Windows, Mac, and Linux machines. Despite a fairly basic-looking design, with the bare minimum in graphics, it's a very useful tool that retains a strong position in the 3D printing community.

Originally designed to control the end-to-end 3D printing workflow, including slicing (using Slic3r), Pronterface tends to fulfil a simpler role today. Yet, despite other software options, including OctoPrint and various "G-code senders", providing much of the same functionality, Pronterface has several distinct advantages. In addition to running on multiple computer platforms, it's simple to install, easy to learn (at least for the basic functionality), can be quickly customized to automate repetitive tasks, and is written in Python, allowing more technical users to make their own modifications.

Pronterface has a dedicated website and its own section on the RepRap wiki. However, because of its long heritage and various spin off projects, downloading and installing what you need has the potential to be a little confusing.

REFERENCES

[1.] Amruta Patil,Prof. R.M.Khaire, "Establishment of evaluation metric and quality analysis of enamel coating thickness and thermal resistivity of copper wire using arm7 processor" International Journal of Application or Innovation in Engineering & Management (IJAIEM),Volume 3, Issue 1, January 2014, ISSN 2319 – 4847

[2.] Amruta Patil, Prof. R.M.Khaire," Automatic Resistance detection and Abrasion testing of copper wire used in transformer or motor windings by ARM 7 processor", International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), Volume 3, Issue 2, March – April 2014, ISSN 2278-6856

[3.] Amruta Patil, Mistry Tapasvee, Shah Khantil, Himanshu Parashar,"Radio frequency indentification based wireless attendance system" , Volume 2, Issue 3, March 2014, ISSN 2302-2084

[4.] Amruta Patil, Shalvi Patel, Mayank Monga, MuKul Pandey, "GPS based friend tracker and online /offline SMART reminder for android systems" , Volume 2, Issue 3, March 2014, ISSN 2302-2084

[5.] Mrs.A.B.Patil,Mrudul Ramesh, Himanshu Mishra, GovinKumar,"automated railway track crossing and monitoring system using atmega 16 microcontroller", International journal of enhanced research in science technology & engineering, Volume 5, Issue 3,March 2016,ISSN 2319-7463

[6.] Prof. Amruta Patil Siddharth Ojha, Akshay Kapoor, "Soil Moisture and Sunlight Monitoring-Controlling using Raspberry Pi for Greenhouse" international journal of innovative trends in engineering (ijite) issn: 2395-2946 issue: 43, volume 27, number 01, 2017

[7.] A.B.Patil, Anshuman Kumar, DemitruS Cletus, Diptanshu Pathak, "Smart parking management system", International Journal of Industrial Electronics and Electrical Engineering,2018, ISSN(p): 2347-6982, volume 6,issue 3,March2018

[8.] Prof.A.B. Patil Abhishek Sachan, Kushal Khanna, Shobhit Srivastava, Priority Based Traffic Signal System using Google Maps, SSRG International Journal of Electronics and Communication Engineering (SSRG-IJECE), ISSN: 2348 – 8549, volume7, issue 1, pp. 20-24,Jan2020

[9.] Kaushal Puri, Devasheesh Tripathi, Yashvi Sudan, Prof. A.B Patil, 'Feature Extraction Technique for Emotion Detection using Machine Learning, SSRG International Journal of Electronics and Communication Engineering (SSRG-IJECE) -2020/6', ISSN: 2348 – 8549, Volume7, Issue5, pp. 41-46, May2020

[10.] Singh, G., Srivastsva, S., Gupta, G., & Patil, A. B., "Arduino Uno based Smart Cane for Osteoarthritis patients", International Journal of Scientific Research and Engineering Development, ISSN: 2581-7175, volume 3, issue 2, pp. 1150-1155, May2020

[11.] Shih-Hsuan Chiu, Che-Yen Wen and Wei-Chieh Kao, "An effective surveillance video retrieval method based upon motion detection," 2008 IEEE International Conference on Intelligence and Security Informatics, Taipei, Taiwan, 2008, pp. 261-262, doi: 10.1109/ISI.2008.4565075.

[12.] D. S. Y. Kartika and D. Herumurti, "Koi fish classification based on HSV color space," 2016 International Conference on Information & Communication Technology and Systems (ICTS), Surabaya, Indonesia, 2016, pp. 96-100, doi: 10.1109/ICTS.2016.7910280.

[13.] L. Zhang, Z. Li and S. Lan, "Athlete Number Localization Based on Edge Detection and Color Features," 2015 Fifth International Conference on Instrumentation and Measurement, Computer, Communication and Control (IMCCC), Qinhuangdao, China, 2015, pp. 523-526, doi: 10.1109/IMCCC.2015.116.

[14.] Rishabh Mishra Prof. N.K. Shinde,Sweta Tripathi, Aprajita Jha "SSRG International Journal of Electronics and Communication Engineering (SSRG-IJECE)"Volume 7,Issue 1 April 2020 I SSN: 2348-8549

[15.] Aman Dixit Prof. Namita Kalyan Shinde,Shubham Srivastava, Himanshu Bhardwaj, "ECG Pattern Analysis Using Artificial Neural Network",SSRG International Journal of Electronics and Communication Engineering, Volume 7,Issue 5,May 2020 ISSN: 2348-8549

[16.] Ms. Payal S. Kadam, Prof. S.S.Belsare "FPGA Implementation of Reconfigurable Processor for Image Processing" IJSER Volume 8, Issue4, April 2017 Edition (ISSN 2229-5518).

[17.] Vikrant Sangwan Prof. Chetan More, Prapti Chauhan, Shivam Sahu "Advanced communication display using Rasberry Pi" International Research Journal of Engineering and Technology IRJETVolume 7 Issue6, May2020, (ISSN: 395-0056)

[18.] Rajat Prof. Chetan More, Mukul Taneja, Sajal Pandey "Rear Windshield LED Display using Arduino" IJSRD - International Journal for Scientific Research & Development, Volume 8 Issue 1, April 2020, ISSN:604-609

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