ANGELS

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# ML Equipped Writing Machine for Paralyzed and Handicapped Students

SPEECH RECOGNITION

Collected more information about speech recognition technology that can be an assistive technology for physically disabled persons.

https://www.ijcst.org/Volume3/Issue4/p17_3_4.pdf

https://www.researchgate.net/publication/247410180_Speech_Recognition_Technology_and_Students_With_Writing_Difficulties_Improving_Fluency

Developed speech recognition android application using MIT App Inventor.
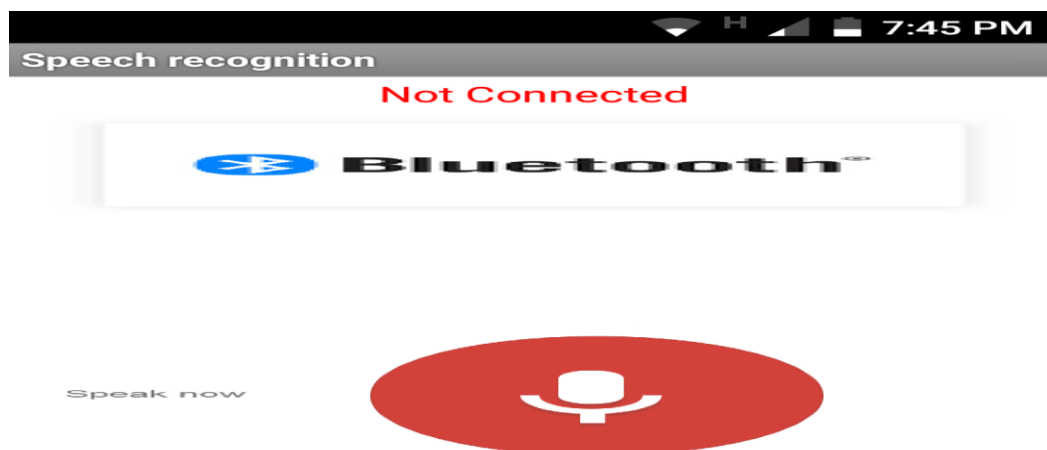
EYEBALL MOVEMENT

We are using eye ball movement for drawing pictures.

The following YouTube link provides how eye tracking works:

https://youtu.be/Y7_f-pR8SBY

Eye tracking

EYE tracking represents detection of an eye position and its movements and has found the application in many academic and commercial research areas, including diagnosis of patients in ophthalmology, neurology and psychology, as well as market, usability, and gaming research, human computer interaction, etc. Eye tracking is one of the major part of this project.
Eye tracking has crucial importance to provide a system that will allow accurate monitoring of the eye and provide information about its trajectory but also about the movements that led to the formation of such eye path.

In this project eye movement is used for drawing which helps the differently abled people to draw their thoughts on a paper. It can be obtained by different methods.
One of this is using illuminators send out Infrared light according to its reflection we can trace the movement of eye. Next one is, using EOG Signals by this we get different voltage levels according to the eye movement and convert it into corresponding figures.
And by using commercial camera based system for detection of eye pupil and it's trajectory then process it and trace the eye movement.

https://www.researchgate.net/publication/221652138_Eyedraw_A_System_for_Drawing_Pictures_with_Eye_Movements

EOG SIGNAL EXTRACTION AND CORRECTION

This project mainly aims to differently abled people to communicate with others using thier eyes movements.
Here we used EOG Signal to get the movement of eye towards different directions.

EOG provide a non-invasive method for recording full range of eye movement. It is an electrical signal generated by polarization of the eye ball and can be measured on the skin around the eye. It's

magnitude varies in accordance to the displacement of eye from its resting location. There are two type of eye movement - horizontal and vertical . Electrooculography is a method for sensing eye movement and is based on recording the standing corneal-retinal potential arising from hyper polarization and depolarization existing

between the cornea and retina, this commonly known as electro- oculogram . This potential is called the resting potential which is generated by an electric dipole . The electric dipole is formed by a positive cornea and a negative cornea. Then, the EOG resulting signal is essentially a record of the difference in electrical voltage between the front and back of the eye that is correlated with eyeball movement and obtained by electrodes placed on the skin near the eye. The electrodes were attached into the horizontal eye movement for detecting the left and right eye movement meanwhile the others electrodes were attached into the vertical eye movement for detecting up and down cornea movements . Then record these signals

then process it and separating these signals and make patterns according to the eye movements . Then by a CNC Machine this patterns can be copy in to a paper . Through this the person can express what in his mind.

ELECTROOCULOGRAPHY

Electrooculography (EOG) is a new technology of placing electrodes on user's forehead around the eyes to record eye movements . This technology is based on the principle of recording the polarization potential or corneal-retinal potential (CRP), which is the resting potential between the cornea and the retina. This potential is commonl y known as electrooculogram.

(EOG) is a very small electrical potential that can be detected using electrodes. The EOG ranges from 0.05 to 3.5 mV in humans and is linearly proportional to eye displacement.

Compared with the electroencelography (EEG), EOG signals have the characteristics as follows:

 The amplitude is relatively the same (15-200uV), the relationship between EOG and eye movements is linear, and the waveform is easy to detect. Considering the characteristics of EOG mentioned above, EOG based HCI is becoming the hotspot of bio-based HCI research in recent years.

Basically EOG is a bio-electrical skin potential measured around the eyes but first we have to understand eye itself:

The electrooculogram (EOG) is the electrical signal produced by the potential

difference between the retina and the cornea of the eye. This difference is due to the large presence of electrically active nerves in the retina compared to the front of the eye. Many experiments show that the corneal part is a positive pole and the retina part is a negative pole in the eyeball. Eye movement will respectively generates voltage up to 16uV and 14uV per 1° in horizontal and vertical way.

Positive or negative pulses will be generated when the eyes rolling upward or downward. The amplitude of pulse will be increased with the increment of rolling angle, and the width of the positive (negative) pulse is proportional to the duration of the eyeball rolling process.

When the eyes are stationary or when the eyes are looking straight ahead, there is no considerable change in potential and the amplitude of signal obtained is approximately zero.

When the eyes are made to move upwards, then there results an action potential, which when measured will give a value of -0.06v to +0.06v. Similarly a downward movement of the eyes will give a similar voltage with opposite polarities to that obtained due to the left movement.
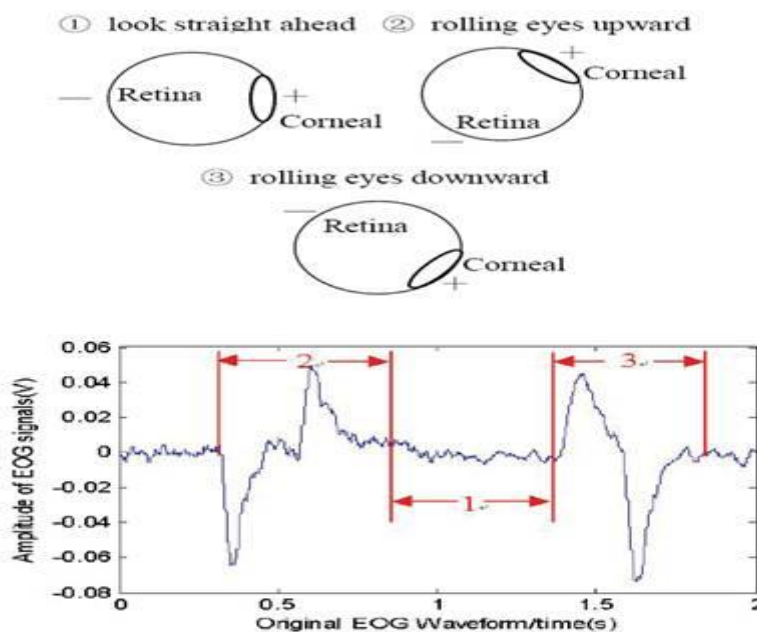
EOG is a classical method, which has been used to detect the eye movement for a long time.

EOG signal can be captured by using Ag/AgCI electrodes. The Ag/ACl is

a type of electrode that can produce the low levels of junction potential, motion artifacts and drift in the direct current signal which is affecting the accuracy of EOG signal. In addition The signal of EOG also is very fast, so that it can be implementation in real time.The human eye is a dipole. The EOG signal can be used to measure the positions of the eyes with respect to the head. The electrical axis of the eye corresponds to its visual axis. Determining orientation of the dipole will determine the orientation of the eye . EOG can measure the eye movements over 70°, with a typical accuracy of approximately +/- 15°to +/- 2°. However, greater resolution is possible by averaging equivalent responses.

Two small electrodes are used for recording contact points around eyes. Disposable electrode with low impedance functioning as reference electrode is located on the midline of the forehead. One pair horizontally placed electrodes are to record the horizontal eye movements. To record one-eye horizontal movements, one electrode needs to be moved to the middle point of the two eyes. The electrodes can easily be fixed in place without causing anydiscomfort to a subject.

The potential difference between the two electrodes is amplified and sent to the computer .

In this experiment, the eye signals were collected from G.USBamp amplifier which designed by G.TEC Medical Engineering GMBH. It is a high performance and high accuracy biosignal amplifier and acquisition/processing system.computer or laptop is generally connected with g.USBamp amplifier. The an array of six 35 mm Ag/AgCl wet electrodes are placed on the user face which are two channels are used: Channel 1 and Channel 2 at port A of gUSBamp amplifier. Inside the g.USBamp block function, there are parameters that can be set including the channels selection, bandpass and notch filters parameters setting. In this experiment, the band pass filter with a range between 0.5 and 30 Hz is applied with a sample rate of 256 Hz. This is because EOG signal information is mainly contained in low frequencies. In addition, the body also need be grounded in
the sense that the hand should touch the g.USBamp to avoid the disturbance and noise.

In order to process the data, the g.USBamp can be configured easily and set via Matlab/Simulink MATLAB Version 7.0.1(R14SP1).

Using this make further filtering and process the signal and detect various voltages for different eye movements . Then set threshold voltage levels for different movement .By using these threshold voltage we can move the plotting points asper the eye movement.

Figure 3: Experimental setup

ML framework for identifying any kind vaguely interpreted text/digits and make it properly understandable

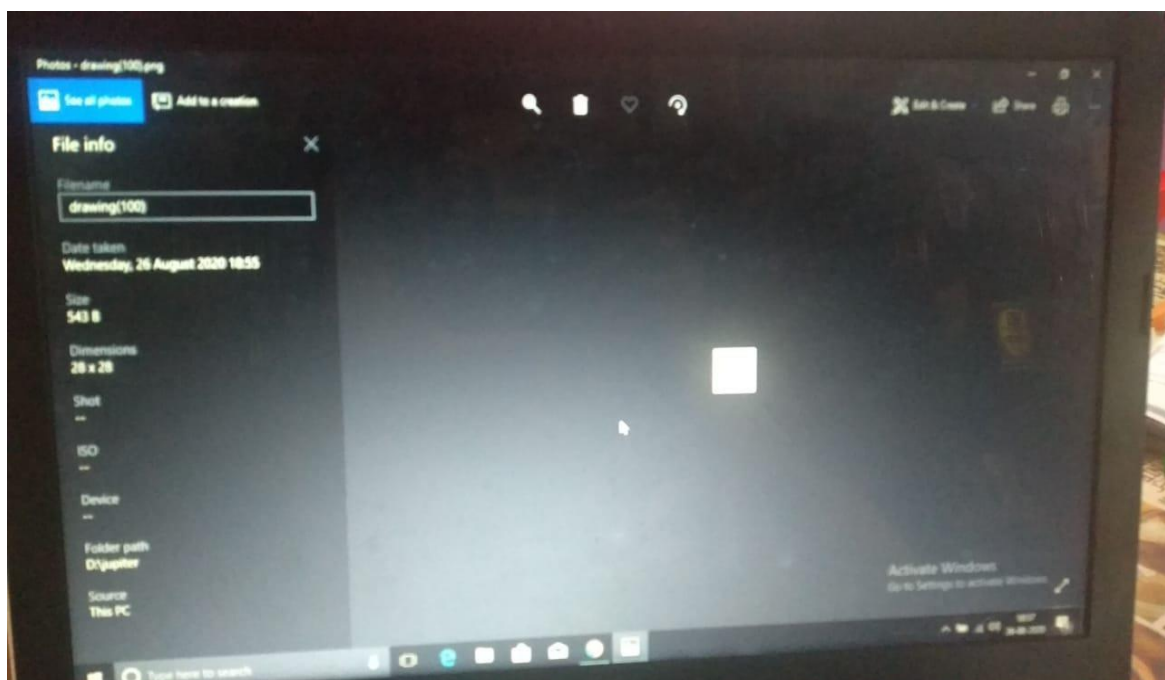https://colab.research.google.com/drive/1NyYH1EPpaJlMBLK0fcKYz4icaD1SNSLK?usp=sharing

PLATFORM USED FOR ML PROCESSING

Training on different shapes: Circle/triangle/square.

Test cases done successfully

https://colab.research.google.com/drive/16FycIC4OIoPvpaE8DaEEoF tTiVdFRMoW
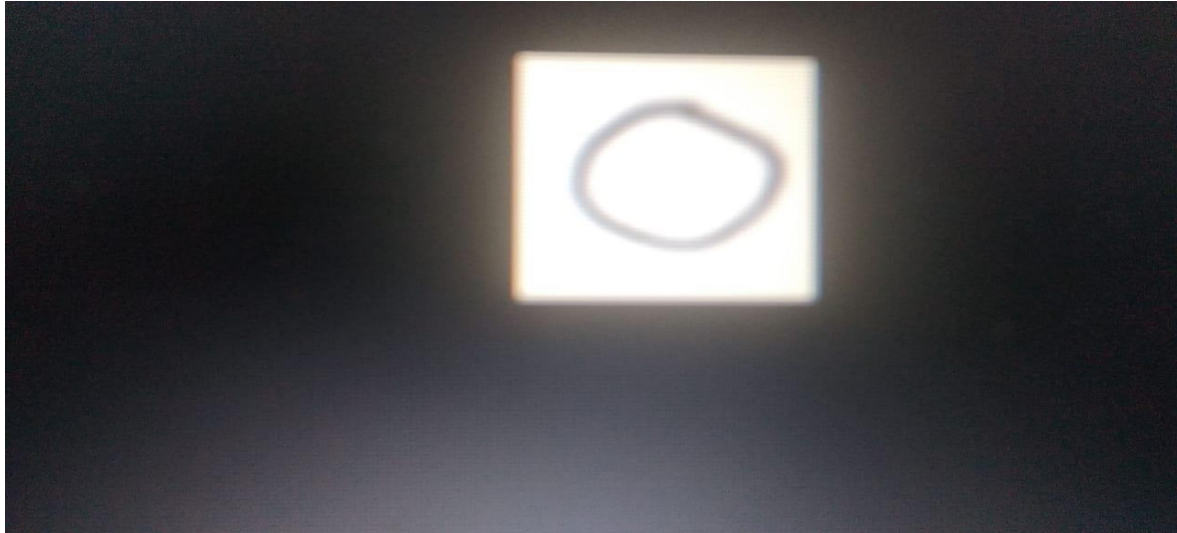
Code to program the neural network to recognise weekly interpreted digits and letters into type text using Google colaboratory

We have imported labelled dataset

called EMNIST

https://arxiv.org/abs/1702.05373v1

EMNIST paper

To built network we have used already built library SKlearn

https://colab.research.google.com/drive/1NyYH1EPpaJlMBLK0f

cKYz4icaD1SNSLK

Link to the colab

+ <> + TT   RAM
             Disk

```
[11] ! python cnn.py

  Found 300 images belonging to 3 clas
  Found 90 images belonging to 3 class
  Epoch 1/25
  2020-08-27 12:57:37.197263: I tensor
  300/300 [===========================
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  300/300 [===========================
  Epoch 4/25
  300/300 [===========================
  Epoch 5/25
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  Epoch 14/25
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  Epoch 15/25
```

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+ <>  + ℸT                    ✓ RAM
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    [7]    /content/shape-classifier-cnn/shapes
    ⊡

    [8]  !ls

    ⊡    circle    square    star    triangle

    [9]  cd /content/shape-classifier-cnn/

    ⊡    /content/shape-classifier-cnn

    [10] !pip install -r requirements.txt

    ⊡    Collecting numpy==1.14.5
           Downloading https://files.pythonho
         Collecting numpydoc==0.8.0
           Downloading https://files.pythonho
         Collecting pandas==0.23.0
           Downloading https://files.pythonho
         Collecting scikit-image==0.13.1
           Downloading https://files.pythonho
         Collecting scikit-learn==0.19.1
           Downloading https://files.pythonho
         Collecting scipy==1.1.0
           Downloading https://files.pythonho
         Collecting tensorboard==1.8.0
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    [11] /content/shape-classifier-cnn/visuli
          'loss']) + 1), len(model_history.h
    ⊡    <Figure size 1500x500 with 2 Axes>

    ▶    !python predict.py --testdata

    ⊡    ('circles/drawing(66).png',  0,  0)
         ('circles/drawing(67).png',  0,  0)
         ('circles/drawing(69).png',  0,  0)
         ('circles/drawing(7).png',  0,  0)
         ('circles/drawing(73).png',  0,  0)
         ('circles/drawing(77).png',  0,  0)
         ('circles/drawing(8).png',  0,  0)
         ('circles/drawing(81).png',  0,  0)
         ('circles/drawing(85).png',  0,  0)
         ('circles/drawing(88).png',  0,  0)
         ('circles/drawing(89).png',  0,  0)
         ('circles/drawing(93).png',  0,  0)
         ('circles/drawing(99).png',  0,  0)
         ('squares/drawing(16).png',  1,  1)
         ('squares/drawing(20).png',  1,  1)
         ('squares/drawing(21).png',  1,  1)
         ('squares/drawing(23).png',  1,  1)
         ('squares/drawing(24).png',  1,  1)
         ('squares/drawing(28).png',  1,  1)
         ('squares/drawing(4).png',  1,  1)
         ('squares/drawing(41).png',  1,  1)
         ('squares/drawing(44).png',  1,  1)
         ('squares/drawing(47).png',  1,  1)
         ('squares/drawing(50).png',  1,  1)
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         ('squares/drawing(56).png',  1,  1)
         ('squares/drawing(57).png',  1,  1)
         ('squares/drawing(6).png',  1,  1)
```

Each image is 28 pixels by 28 pixels, 28 pixel wide and 28 pixel high. It flattens to a length 28*28 = 784 vector
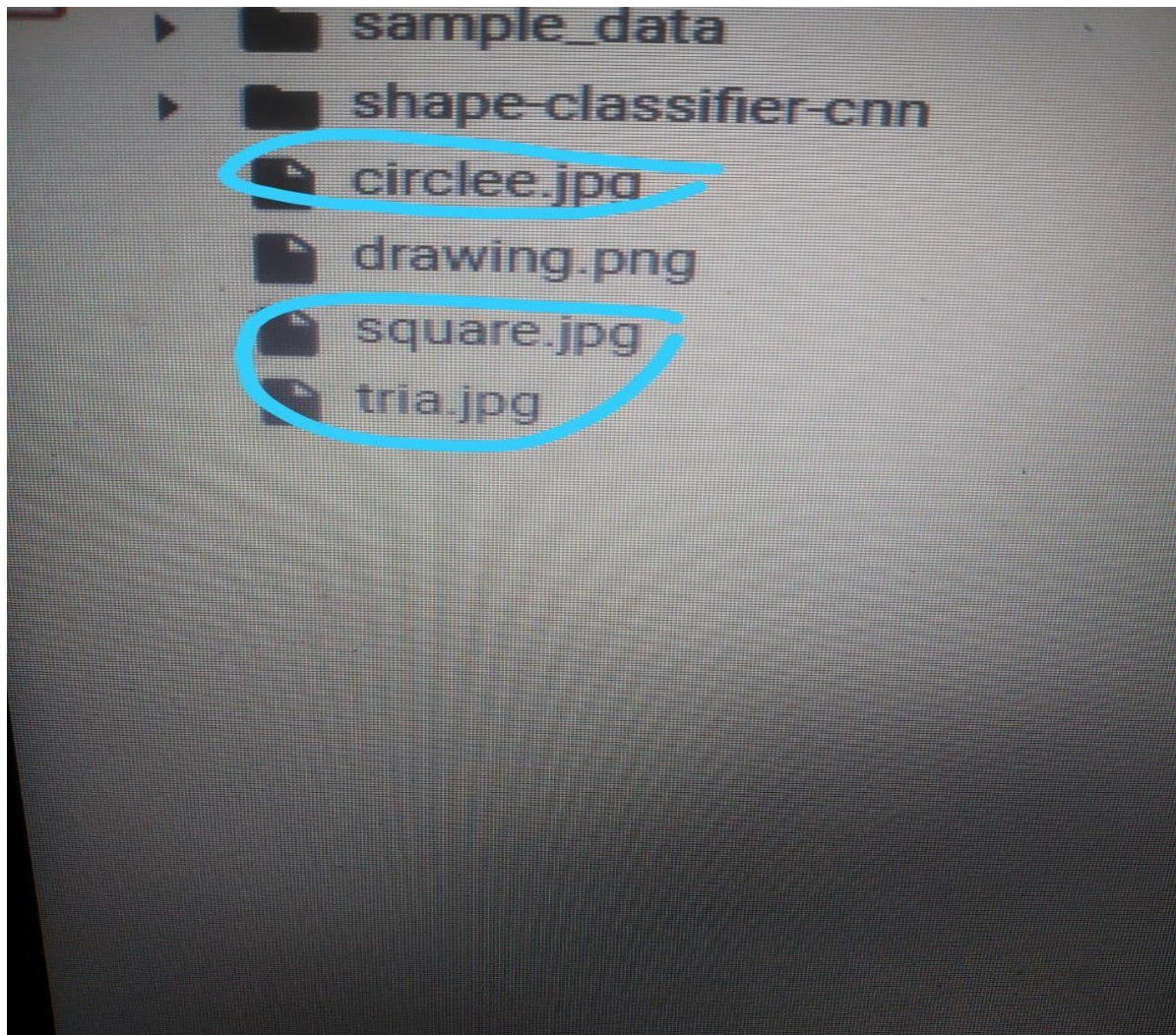
MACHINE LEARNING BASED EYEBALL PATTERN COVERSION TO IMAGES
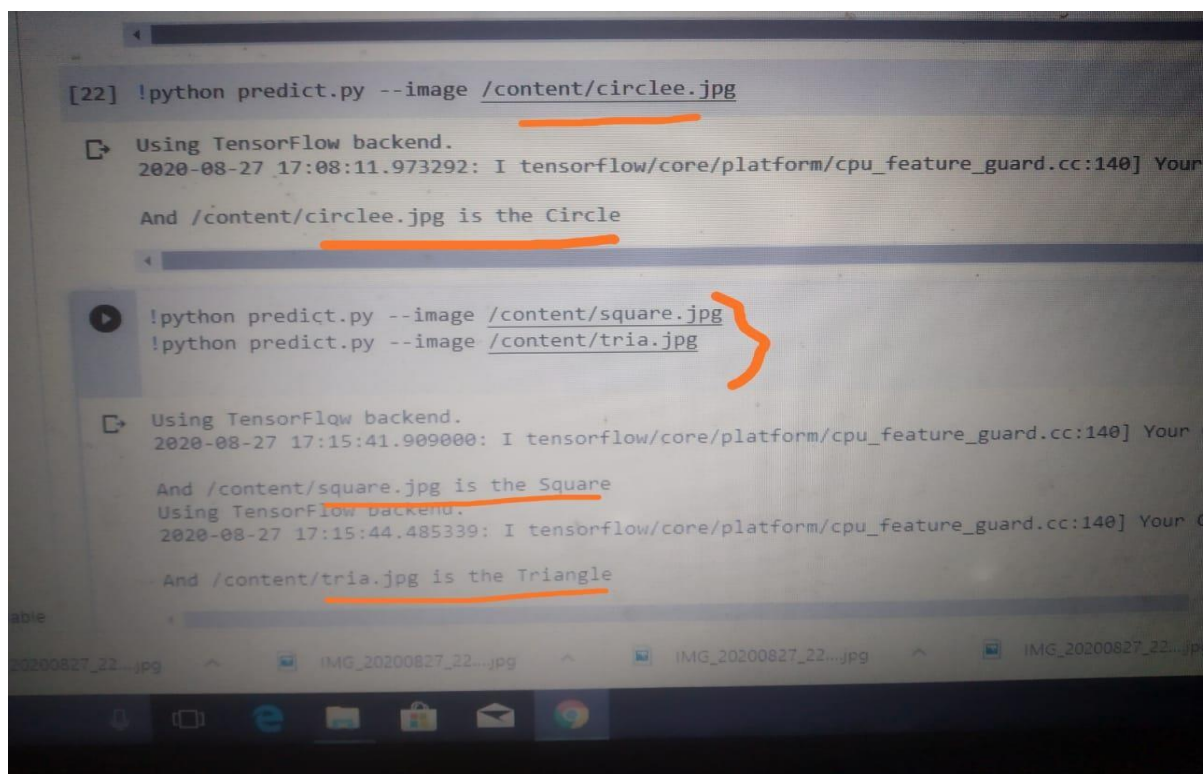
PICTURES WE TOO K TESTING OUR DATA
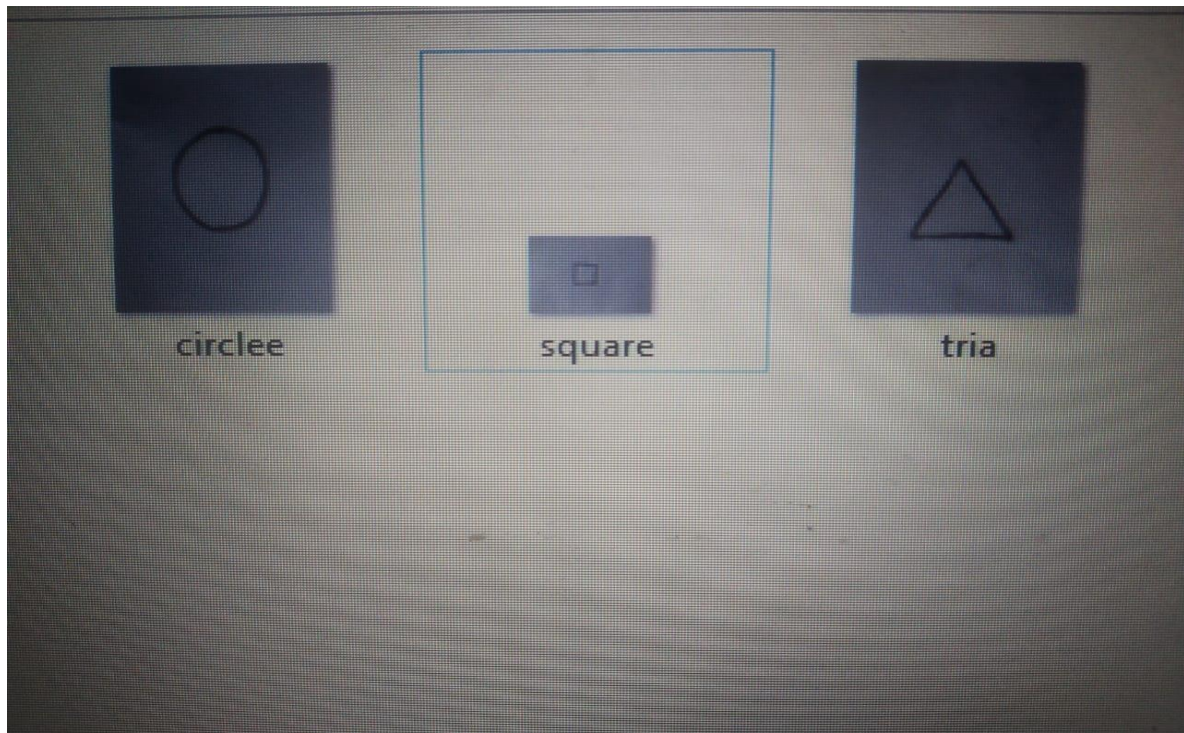
UPLOADED TO COLAB:

SOME ARE CORRECT PREDICTIONS. THERE WERE
SOME WRONG PREDICTIONS TOO WHICH REQUIRE
FURTHER PROCESSING.

Shape detection of imperfect EOG o/p figures using deeplearning

https://colab.research.google.com/drive/16FycIC4OIoPvpaE8DaEEoFtTiVdFRMoW

CNC RESEARCH

The writing machine is computer numerical controller.which consisting of two stepper motor and a Servo Motor which are used for moving x, y directions and the Servo Motor is used for fan control the pen. Text command appeared in the Raspberry Pi is is then converted into G Code by using software in laptop and this data is applied to this stepper Motors to write and draw the things for the

handicapped students.

The link of the YouTube video is provided below;

WRITING MACHINE:

CNC stands for Computer Numeric Control and typically refers to a machine whose operation is controlled by a computer. The most common usage of CNC, and the one relevant to us, is the name given to devices that, under computer control are able to cut, etch, mill, engrave, build, turn and otherwise perform manufacturing operations on various materials. Typically, a CNC machine has the ability to move a cutting or 3D printing head in 2 to 6 axes, meaning that it can position that tool head at a precise point in or on the material to create the cut or operation desired at that point. By moving the head through multiple points, the cutting head can cut or sculpt the design represented by a data stream of positioning points being sent by the PC. By controlling a CNC machine through a PC it is possible for the user to design a product on-screen, convert it to CNC-readable code and then send that data to the CNC machine for it to produce a physical copy of the item designed.

A Plotter is a special type of printer that uses a pen to draw images on solid surfaces. In Computer Numerical Control (CNC), microprocessor is used which is capable of processing logical instructions interfaced with a computer. The logical instructions are provided by using a computer in the form of code or text or image which is then transformed into a machine language by microprocessor to be executed by the machine.

A CNC plotter machine is a 3D controlled 2D plotting machines which uses a pen to draw text or image on any given solid surface. It can be used for the purposes such as PCB Design, logo design, etc. This project is based on CNC

plotter machine. With the increasing demand for the use of CNC plotters in universities and laboratories, a cheap and less complex design is an absolute need.

BLOCK DIAGRAM
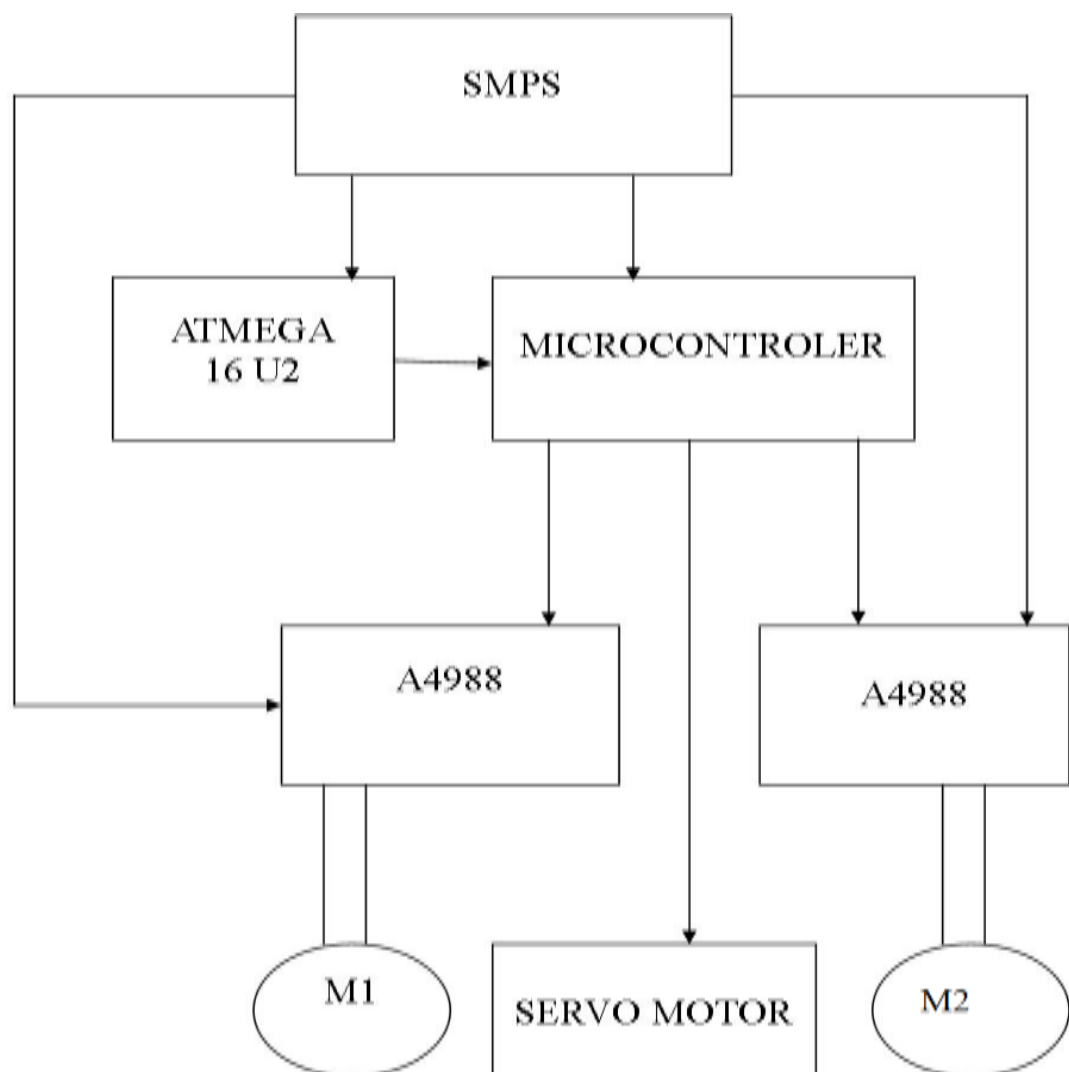
SMPS

The purpose of the document is to specify a Single phase AC input, single output switching power supply. This specification is suitable for: EADP-60FBA. This product is AC to DC switching power transfer device, it can provide for a 12V/ 5.0A , 60W Max. DC output with constant voltage source. This Specification defines the input, output, performance characteristics, environment, noise and safety requirement for a power supply.


AURDUINO DEVELOPMENT BOARD

The Arduino microcontroller is an easy to use yet powerful single board computer that has gained considerable traction in the hobby and professional market. The Arduinis open-source, which means hardware is reasonably priced and development software free. Arduino is a single-board microcontroller to make using electronics in multidisciplinary projects more accessible. The hardware consists of a simple open source hardware board designed around an 8-bit Atmel AVR microcontroller, or a 32-bit Atmel ARM. The software consists of a standard programming language compiler and a

boot loader that executes on the microcontroller.

A4988 DRIVER

The A4988 stepper motor driver module is a breakout board for Allegro's easy-to-use A4988 microstepping bipolar stepper motor driver and is a drop-in replacement for the A4983 stepper motor driver module. The driver features adjustable current limiting, overcurrent protection, and five different microstep resolutions. It operates from 8 – 35 V and can deliver up to 2 A per coil.
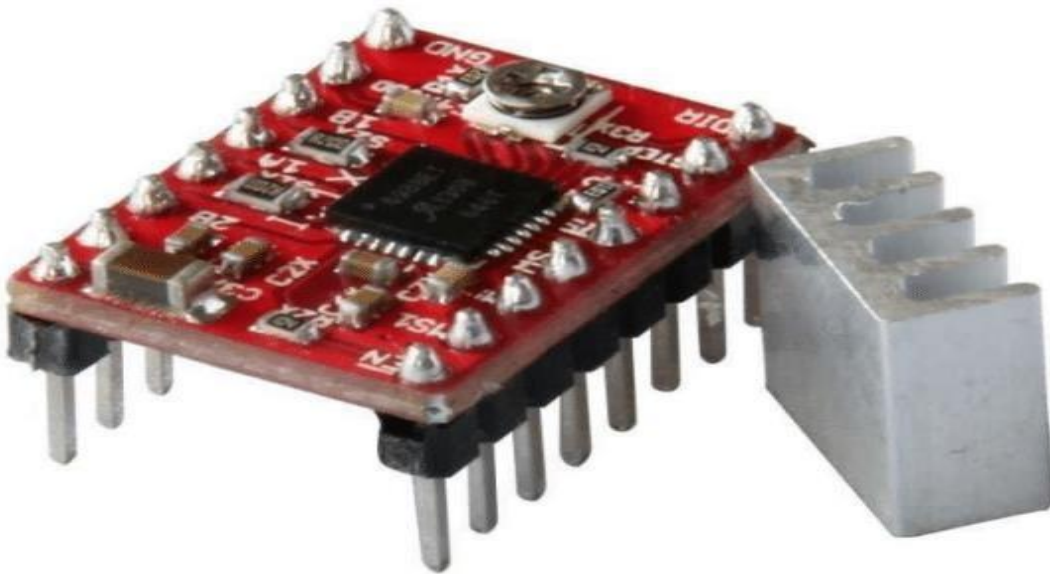
NEMA17 STEPPER MOTOR

A **NEMA 17 stepper motor** is a [stepper motor](#) with a 1.7 x 1.7 inch (43.2 x 43.2 mm) faceplate. The NEMA 17 is larger and generally heavier than for example a NEMA 14, but this also means it has more room to put a higher torque. However, its size is *not* an indication of its power.

SERVO MOTOR

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the dev kits. The

firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson, spiffs.

APPLICATION

- *Educational purpose*
- company offices
- marketing and ad purpose

1.2. REQUIREMENTS

➢ operates in two axes of motion ("X" and "Y") in order to draw continuous vector graphics.

➢ a plotter draws a continuous line, much like a pen on paper, while inkjet and laser printers use a very fine matrix of dots to form images

➢ Automatic machine handling.

WORKING

First step to start building this cnc machine is to disassemble two dvd/cd

drives and take off them the stepper motors. Use the screwdriver to open them and take off them the rails. The outer metallic cover of cd drive is welded perpendicularly to make the stand holding the x and y axis. Attach the cd drive stepper motor setup as x and y axis. And make sure that the Y axis is straight to CNC base and the X axis vertically to it. 4. Z axis (pen setup) is attached to the x axis.

The pen setup is made up of HDF, the servo motor is attached

to it and the pen is setup inside the fiber using screw and spring.

5. A metallic base is attached to the Y axis for using as paper base. Then a paper is put above it with the help some magnets.The printing area is 4x4cm. Step 2-Arduino and Stepper Motor Setup .

The adafruit L293D motor driver sheild compatible with the Arduino board is mounted on it. The Arduino is connected the computer port.

Check the stepper motors and the servo motor. The stepper motors and the servo motor are connected to the motor shield. The external power is connected. (Trainer Kit 12v,3A) Step 3 Burning of Program and Gcode take in.The mini cnc plotting sketch is burned to the Arduino microprocessor (ATmega 328) by using Arduino IDE. Gcode is made by Inkscape program. Then use the gctrl.pde processing program. This program sends 'gcode' images to the cnc plotter.

Plotting of the image is done.

PCB LAY OUT
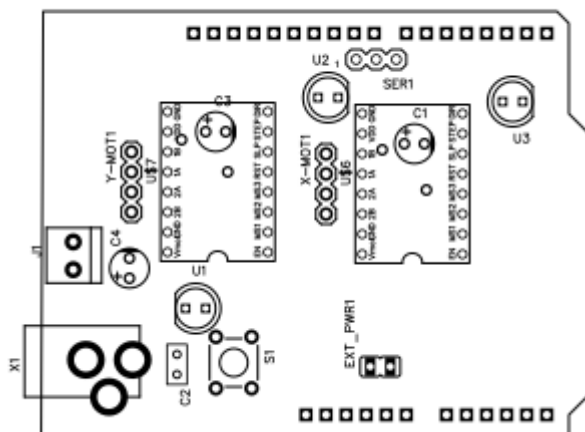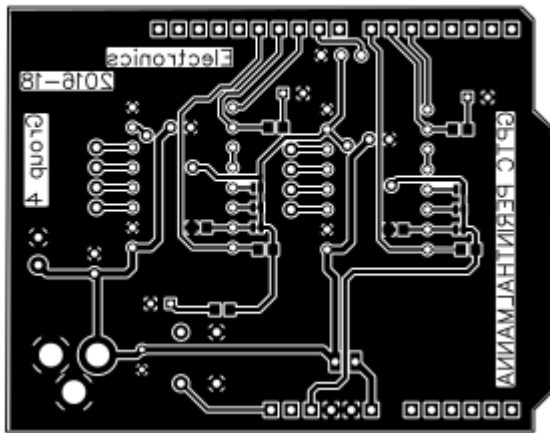
ALGORITHM

1. Process Starts

2. print the welcome

3. Enrol new fingerprint .

4. Compare with database

5. If nothing is selected it scans for the wifi network and joins if new known network.

6. If none of the known networks are present than it displays all the available networks.

7. Any of the new network can be selected and joined by entering the password.

8. Once the connection is established it starts scanning for the fingerprints.

9. When a teacher scans his/her fingerprint it asks for the class and lecture for which attendance is being taken.

10. Whenever it recognizes any student it send their fingerprint ID to the server through packet data transmission.

11. When a server receives the data from the system it updates the attendance of the student.

12. .Stop.

1.1. <u>FLOW CHART</u>

SOFTWARE SIDE   MACHINE SIDE
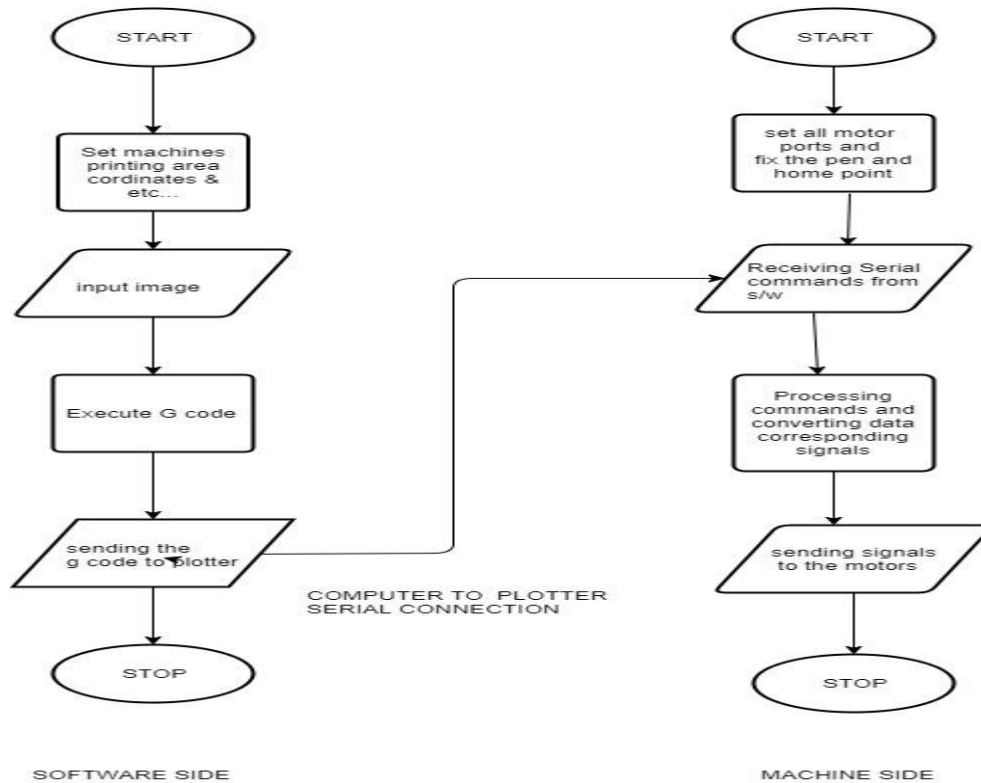
<u>FIRMWARE and SOFTWARE</u>
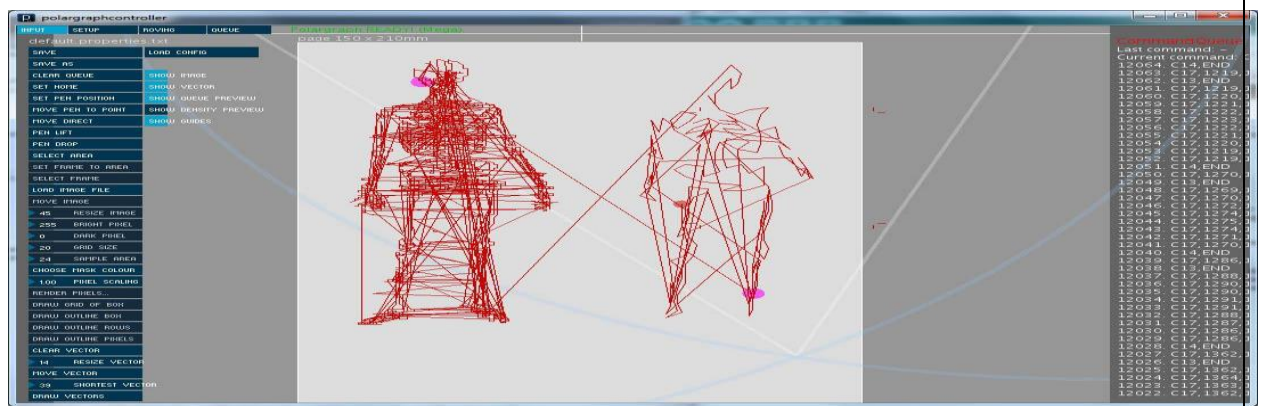
The Screen Shot of the software shown above the firmware is little bit longer so we adding a link bellow that we uploaded on google drive u can download any time

https://drive.google.com/open?id=1-gLiNRYeJ0hkGnWf1AuV87qFL9UkZIJJ