CONTROLLING ELECTRONIC DEVICES USING HAND GESTURES.

A PROJECT REPORT

SUBMITTED IN PARTIAL FULFILMENT OF

THE REQUIREMENTS FOR THE AWARD OF

THE DEGREE OF

BACHELOR OF TECHNOLOGY

SUBMITTED BY

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UNDER THE ESTEEMED GUIDANCE OF

ROSEPREET KAUR BHOGAL

DEPARTMENT OF

ELECTRONICS & COMMUNICATION ENGINEERING

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CERTIFICATE

This is to certify that the project entitled "Controlling Electronic Devices Using Hand Gestures" is a Bonafede work of Makkena leelakrishna (12010708), Akula Balaji (12007498). Under my guidance and supervision in partial fulfillment of the requirement for the award of degree of bachelor of electronics and communication lovely professional university, during the academic year2021-2022 & completed the project within a period of 12weeks.

ROSEPREET KAUR BHOGAL
PROJECT GUIDE

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DECLARATION

"I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text.

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CHAPTER-1

INTRODUCTION

HAND GESTURES: gesture is nothing but a movement that we make with our human body like with hands, face and body postures that especially gives some information which is like a sign language that is mostly used by the deaf and dumb people, in which they pass the information through these hand gestures. So, these are using hand gestures to pass information. They are different hand gestures to pass the information. The hand gestures are taken as inputs to do certain operations according to the gestures that are defined operation to the gestures.

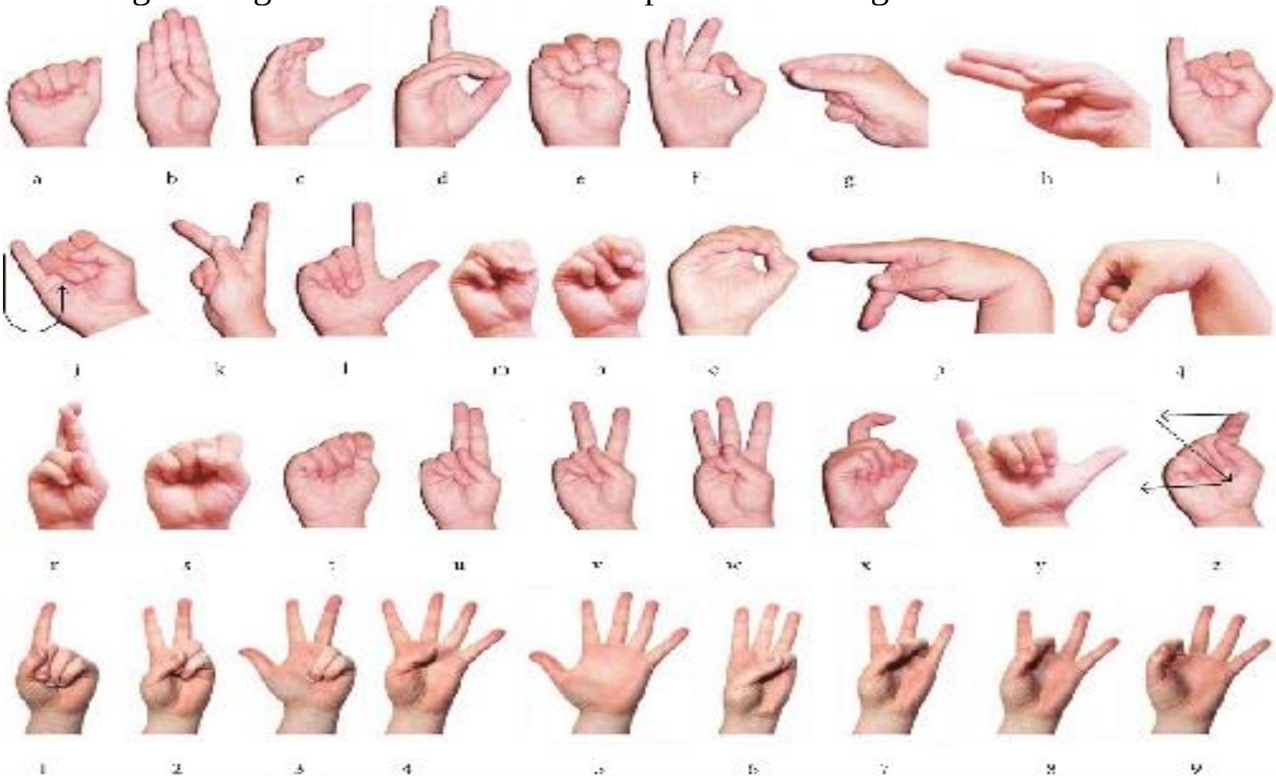

Figure 1:Various Hand Gestures.

. There are many gestures symbols are there accordingly different operation are given to unique gestures. Using the hand gestures, it helps the things to understand with more quickly than speaking.it makes our actions towards an operation faster. But it also decreases the time duration to operate the electronics and respond to system far from it and control the system by inputting these hand gestures. By using a camera these hand gestures are taken as inputs.

MEDIAPIPE HANDS (hand detection module): media pipe hand uses the machine learning pipeline which includes the multiple techniques and models that works together. A hand detection model that works on the full image and returns oriented square box around hand. The hand landmark model that works on the cropped image that was hand detector and gives the high-fidelity 3d hand key points. This is a strategy is like that employed to that media pipe face mesh solutions in which uses a face detector together with a face landmark model.
which provides the accuracy of cropped hand image to the hand landmarks model, which almost reduces the need for data rotations, translation and scale and instead allows the network to be dedicated most of its capacity towards coordinate prediction accuracy. To add to the pipeline the crop can also be created based on the hand gestures identified in the last fps or previous frame, and only when the landmark type could no longer identify hand presence is palm detection that involved locating the hand.

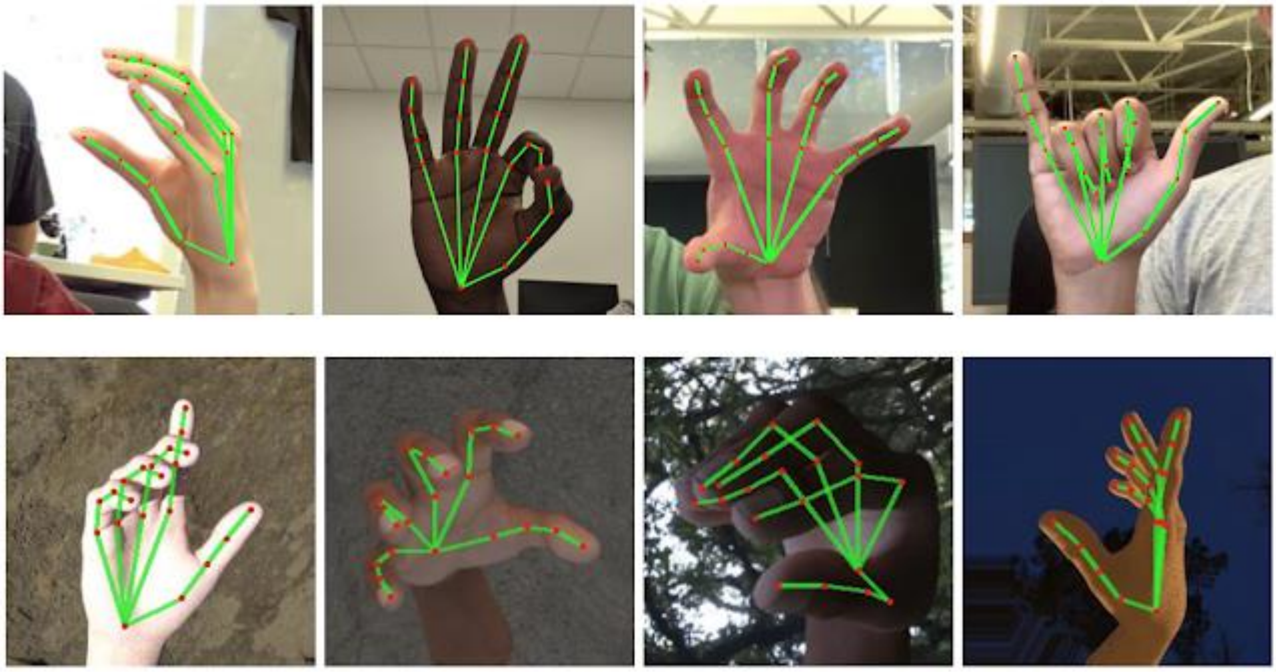

Figure 2:hand detection using media pipe.

. To detect the initial location of the hand the pipeline has designed a single shot detector model which optimizes for real time uses in such a manner that is similar to the face detection model in media pipe face mesh .for detecting hands is a decidedly complex task our lite model and full model have to work across a different hand sizes with a large scale span relative to the image frame that is sited and that is able to detect self-occluded hands.

whereas faces have high contrast patterns, in which eye and mouth region, the lack of such features and characters in hands makes it comparatively more difficult to detect them reliable from their visual features alone. Instead of providing additional context, like arms, body, or person features, aids accurate hand localization.

This method addresses the problems using different strategies. So, we must train a palm detector instead of a hand gesture detection. Since estimating the square box around the hand and fists is simpler that detecting the hands with articulated fingers.in addition to that palms are smaller objects, the non-maximum suppression algorithm works well even for two-hand self-occasion cases, like handshakes. Moreover, palms can be modelled using square boxes and ignore the aspect ratios, and other reducing the number of anchors by a factor of 3-5.the second was the encoder-decoder feature extracts is used for bigger scene context awareness even for small objects. The last one is minimizing the focal loss during training to support many anchors resulting from the high scale variance. With the above techniques, we achieve an average precision of 95.7% in palm detection. Using a regular cross entropy loss and no decoder gives a baseline of just 86.22%.

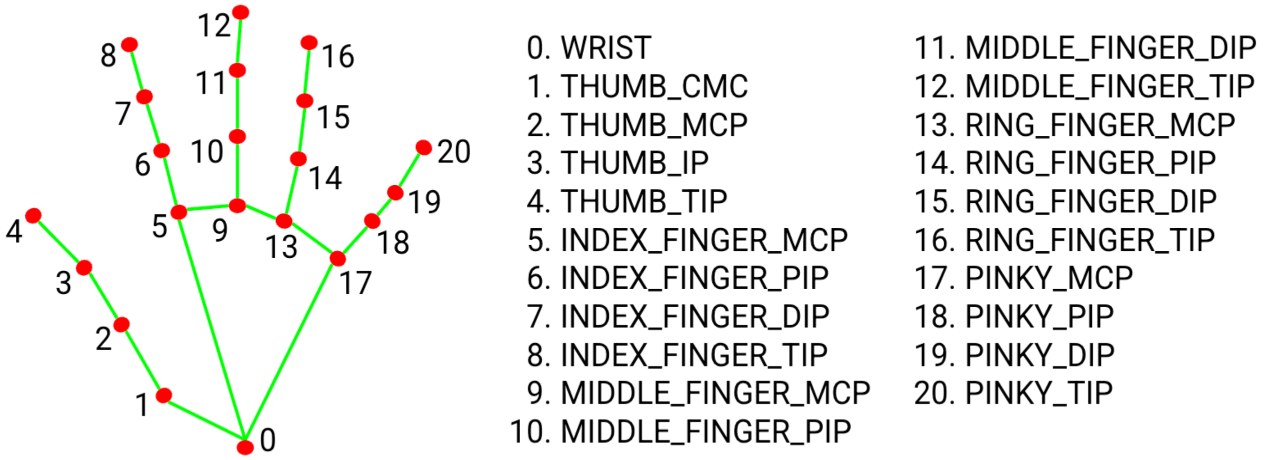

Figure 3:Hand coordinates of Medi pipe.

. After the palm detections over the whole image the subsequent hand landmarks model performs the main points in localization of 21 3d hand-knuckles co-ordinates inside the hand detected from the image those are the co-ordinates that precisely see in image. This model learns a consistent internal hand pose represents the partial visible hands and self-occlusion.

to get ground truth data, there have manually annotated ~30k real world images and with 21 3d coordinates, as shown in diagram to get the better cover the possible hand shapes or gestures and provides additional supervision on the real-world geometry of the hands and give the high-quality synthetic hand model over various background surroundings and map it to the corresponding 3d co-ordinates.

AURDINO: The Arduino uno is a microcontroller board which has controller of ATmega328p.they are 14 digital i/o pins in which six of them are pulse width modulating pins and six analog pins are present which are A0-A5, and a crystal oscillator of 16MHz that oscillates in 12Mhz in some boards and a USB connection to transmit the data to controller ,a power jack an ICSP header and a reset button on the board.it also contains all tools that helps the microcontroller; that easily connect it to a computer through USB cable or power it with the help of ac-to-dc adaptor or a battery(5v) to get started. The uno is, mostly used board around the Arduino family from all preceding boards in that it does not use the FTDI USB-to-serial drive chip. instead features the mostly on ATmega328U2 programmed as USB -to-serial converter.

Microcontroller	: ATmega328
Operating Voltage	:5V
Input Voltage (recommended)	:7-12V
Input Voltage (limits)	:6-20V
Digital I/O Pins	: 14 (of which 6 provide PWM output)
Analog Input Pins	:6
DC Current per I/O Pin	:40 mA
DC Current for 3.3V Pin	:50 mA
Flash Memory	:32 KB of which 0.5 KB used by bootloader
SRAM	:2 KB
EEPROM	:1 KB

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the GND and Vin pin headers of

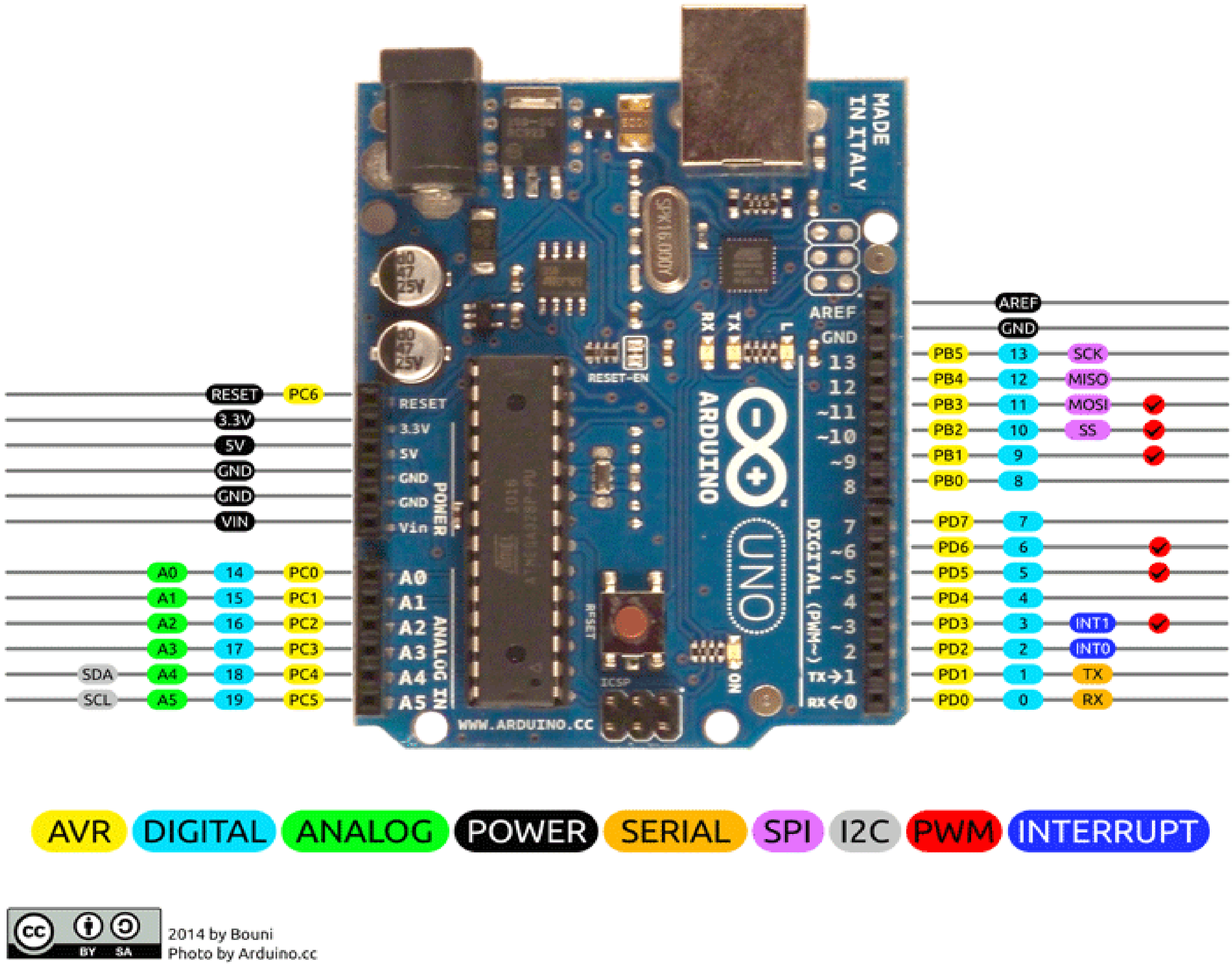

Figure 4:Arduino board uno.

the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. The power pins are as follows:

• VIN. The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

• 5V. The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator or be supplied by USB or another regulated 5V supply.

• 3V3. A 3.3-volt supply generated by the on-board regulator. Maximum current draw is 50 mA.

• GND. Ground pins.

. The Atmega328 has 32 KB of flash memory for storing code (of which 0,5 KB is used for the bootloader); It has also 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

Each of the 14 digital pins on the Uno can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 Koh’s. In addition, some pins have specialized functions:

• Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.

• External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach Interrupt () function for details.

• PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() function.

• SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.

• LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH LOGIC 0 value, the LED is on LOGIC 1, when the pin is LOW, it's off

The Uno has 6 analog inputs, each of which provide 10 bits of resolution (i.e., 1024 different values). By default, they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analog Reference () function. Additionally, some pins have specialized functionality:

• I 2C: 4 (SDA) and 5 (SCL). Support I2C (TWI) communication using the Wire library.

There are a couple of other pins on the board:

• AREF. Reference voltage for the analog inputs. Used with analog Reference ().

• Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

The Arduino Uno has several facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V)

serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega8U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '8U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, an *.inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-tonsorial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

For programming we write the code in the Arduino software that is Arduino IDE there will be window that opens in such a way that the function like void setup () and void loop () where we must write the code according to the default commands of the Arduino IDE the window will be like this as shown in the figure.

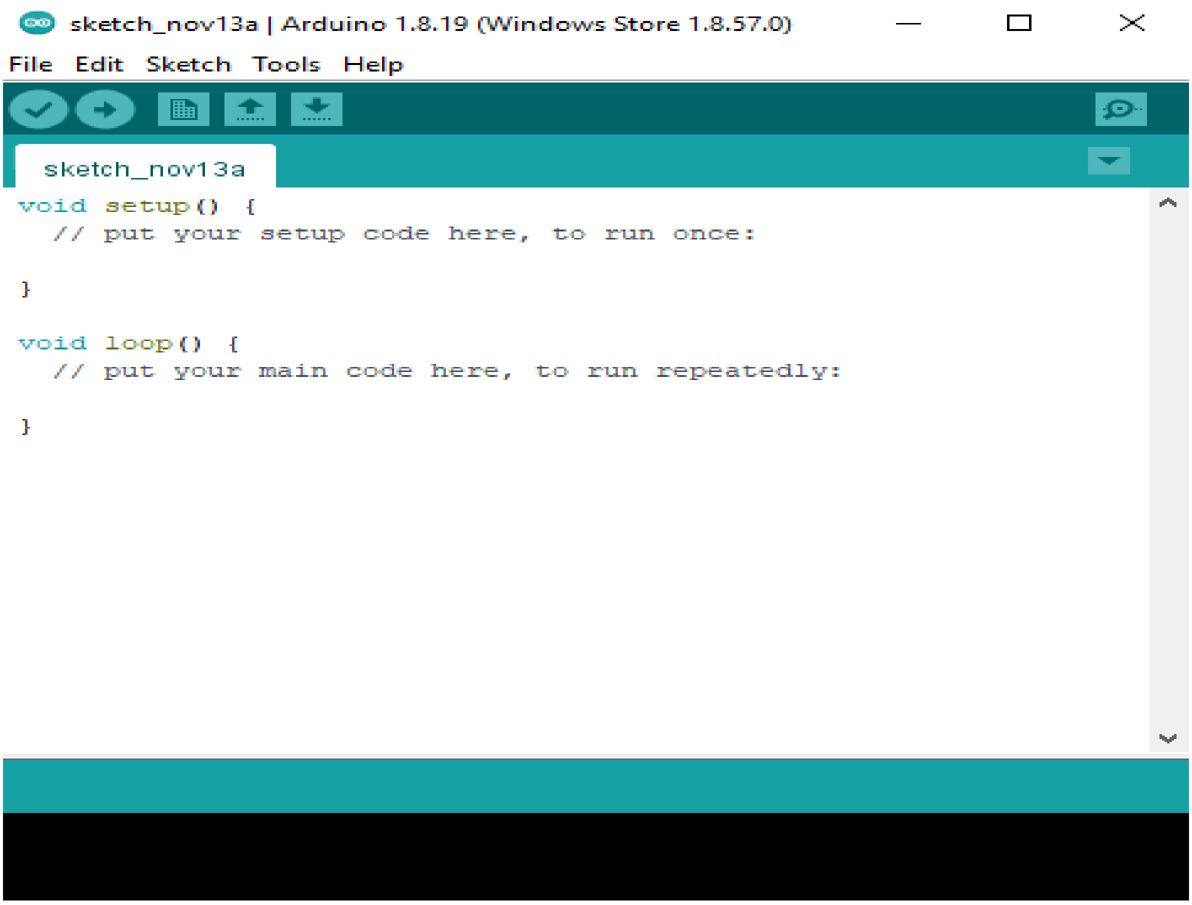

Figure 5:Ardino IDE.

FIRMATA: Firmata is the essential protocol that transfers commands from host software running on a computer to the Arduino Uno microcontroller. It is a firmata that facilitates controlling the Arduino from PyCharm, enabling the execution of Python instructions on the Arduino IDE.

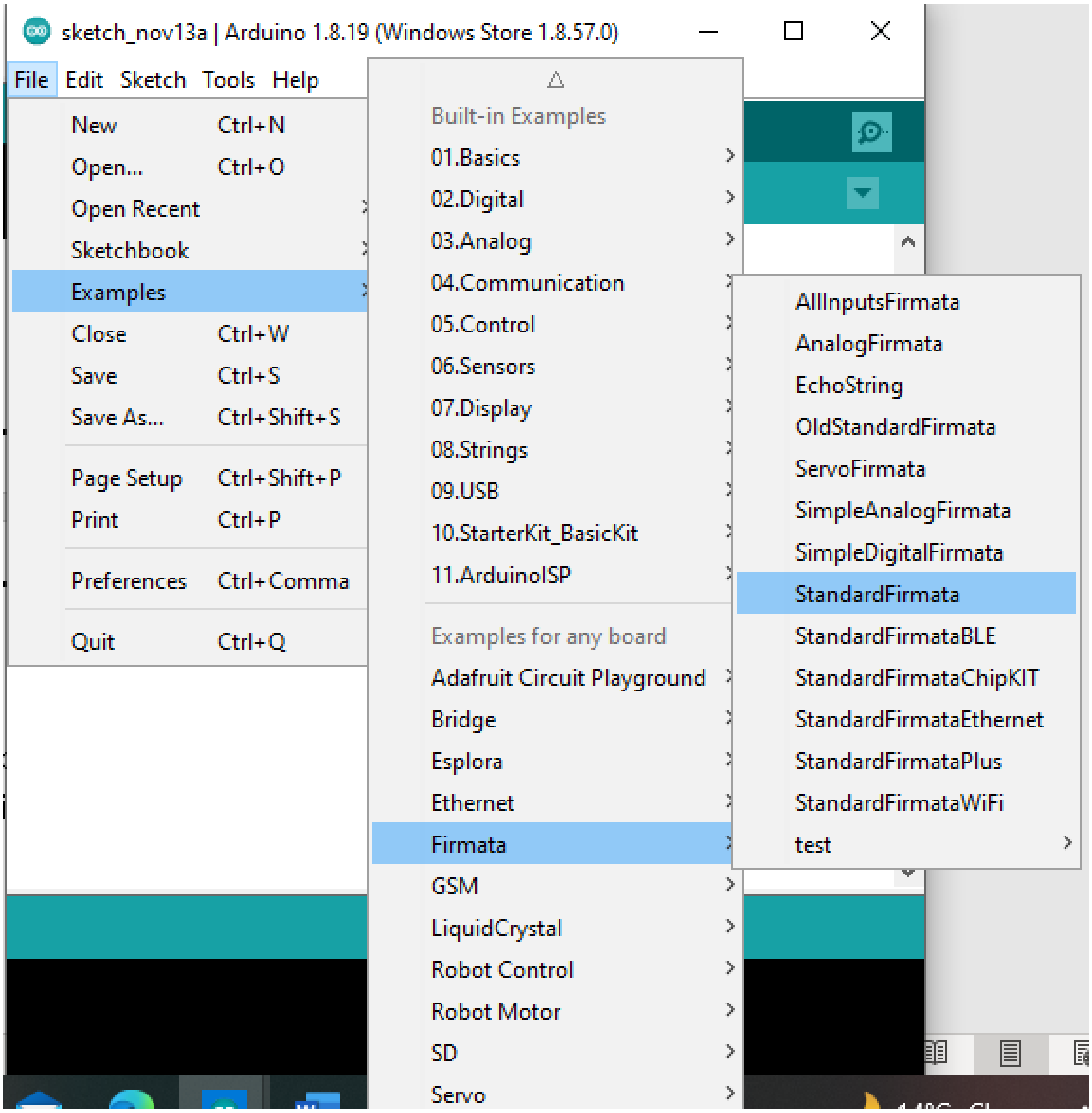

Figure 6:Firmata.

Chapter-2

LITERATURE SURVEY

Deaf Mute Communication Interpreter- [5]: the main aims to cover the various prevailing methods of deaf-mute communication interpreter system. The two broad classification of the communication methodologies used by the deaf –mute people are - Wearable Communication Device and Online Learning System. Under Wearable communication method, there are Glove based system, Keypad method and Handy come Touchscreen. All the above mentioned three sub-divided methods make use of various sensors, accelerometer, a suitable micro-controller, a text to speech conversion module, a keypad, and a touchscreen. The need for an external device to interpret the message between a deaf –mute and non-deaf-mute people can be overcome by the second method i.e., online learning system. The Online Learning System has different methods. The five subdivided methods are- SLIM module, TESSA, Wi-See Technology, S

WI_PELE System and Web-Sign Technology.

An Efficient Framework for Indian Sign Language Recognition Using Wavelet Transform [6]: The proposed ISLR system is considered as a pattern recognition technique that has two important modules: feature extraction and classification. The joint use of Discrete Wavelet Transform (DWT) based feature extraction and nearest neighbor classifier is used to recognize the sign language. The experimental results show that the proposed hand gesture recognition system achieves maximum 99.23% classification accuracy while using cosine distance classifier.

Hand Gesture Recognition Using PCA in [7]: it had presented a scheme using a database driven hand gesture recognition based upon skin color model approach and thresholding approach along with an effective template matching with can be effectively used for human robotics applications and similar other applications. Initially, hand region is segmented by applying skin color model in YCbCr color space. In the next stage thresholding is applied to separate foreground and background. Finally, template based matching technique is developed using Principal Component Analysis (PCA) for recognition.

Hand Gesture Recognition System for Dumb People [8]: it presented the static hand gesture recognition system using digital image processing. For hand gesture feature vector SIFT algorithm is used. The SIFT features have been computed at the edges which are invariant to scaling, rotation, addition of noise.

An Automated System for Indian Sign Language Recognition [9]: this method for automatic recognition of signs based on shape-based features is presented. For segmentation of hand region from the images, Otsu's thresholding algorithm is used, that chooses an optimal threshold to minimize the within-class variance of thresholder black and white pixels. Features of segmented hand region are calculated using Hu's invariant moments that are fed to Artificial Neural Network for classification. Performance of the system is evaluated based on Accuracy, Sensitivity and Specificity.

Hand Gesture Recognition for Sign Language Recognition [10]: the method had presented various methods of hand gesture and sign language recognition proposed in the past by various researchers. For deaf and dumb people, Sign language is the only way of communication. With the help of sign language, these physical impaired people express their emotions and thoughts to another person.

Design Issue and Proposed Implementation of Communication Aid for Deaf & Dumb People in [11]: the method had proposed a system to aid communication of deaf and dumb people communication using Indian sign language (ISL) with normal people where hand gestures will be converted into appropriate text message. Main objective is to design an algorithm to convert dynamic gesture to text at real time. Finally, after testing is done the system will be implemented on android platform and will be available as an application for smart phone and tablet pc.

Real Time Detection and Recognition of Indian And American Sign Language Using Sift In [12]: it had proposed a real time vision based system for hand gesture recognition for human computer interaction in many applications. The system can recognize 35 different hand gestures given by Indian and American Sign Language or ISL and ASL at faster rate with virtuous accuracy. RGB-to-GRAY segmentation technique was used to minimize the chances of false detection. Authors proposed a method of improvised Scale Invariant Feature Transform (SIFT) and same was used to extract features. The system is model using MATLAB. To design and efficient user-friendly hand gesture recognition system, a GUI model has been implemented.

A Review on Feature Extraction for Indian and American Sign Language.[13]: It had presented the recent research and development of sign language based on manual communication and body language. Sign language recognition system typically elaborate three steps preprocessing, feature extraction and classification. Classification methods used for recognition are Neural Network (NN), Support Vector Machine (SVM), Hidden Markov Models (HMM), Scale Invariant Feature Transform (SIFT), etc.

SignPro-an Application Suite for Deaf and Dumb. [14]:it had presented application that helps the deaf and dumb person to communicate with the rest of the world using sign language. The key feature in this system is the real time gesture to text conversion. The processing steps include gesture extraction, gesture matching and conversion to speech. Gesture extraction involves use of various image processing techniques such as.

Chapter-3

RESEARCH METHODOLOGY.

VOLUME CONTROLLER:

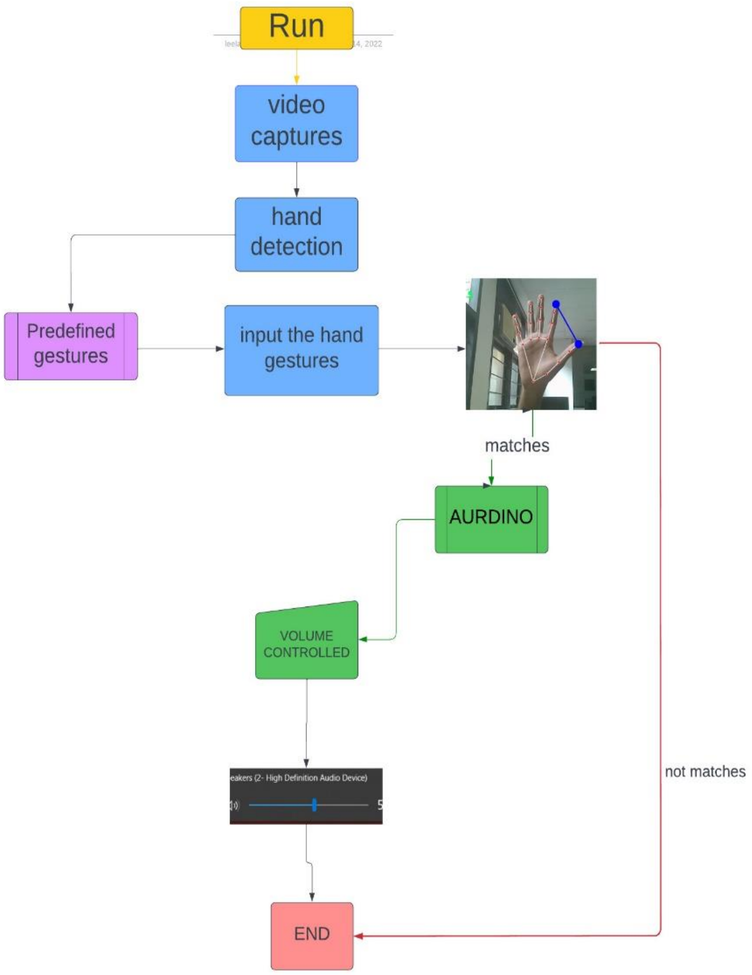

Figure 7:flowchart for volume control.

first we give declare gestures that is has to be declared based on the mediapipe library and after that we run the program and then the system starts takeing the video capture of the image through camera .after that input hand gestures and and it detects the hand wheter it hand or not after that it will try to detect the gesture that we give as input and after that if the gesture matches it will work accordingly processeds the control to controller aurdino and from that we get the output by increasing or decreasing in the volume.after that it will get set the volume when we remove the hand from the sight of the camera or change the gessture that does not matches the predefined gestures.

Control of led using hand gesture:

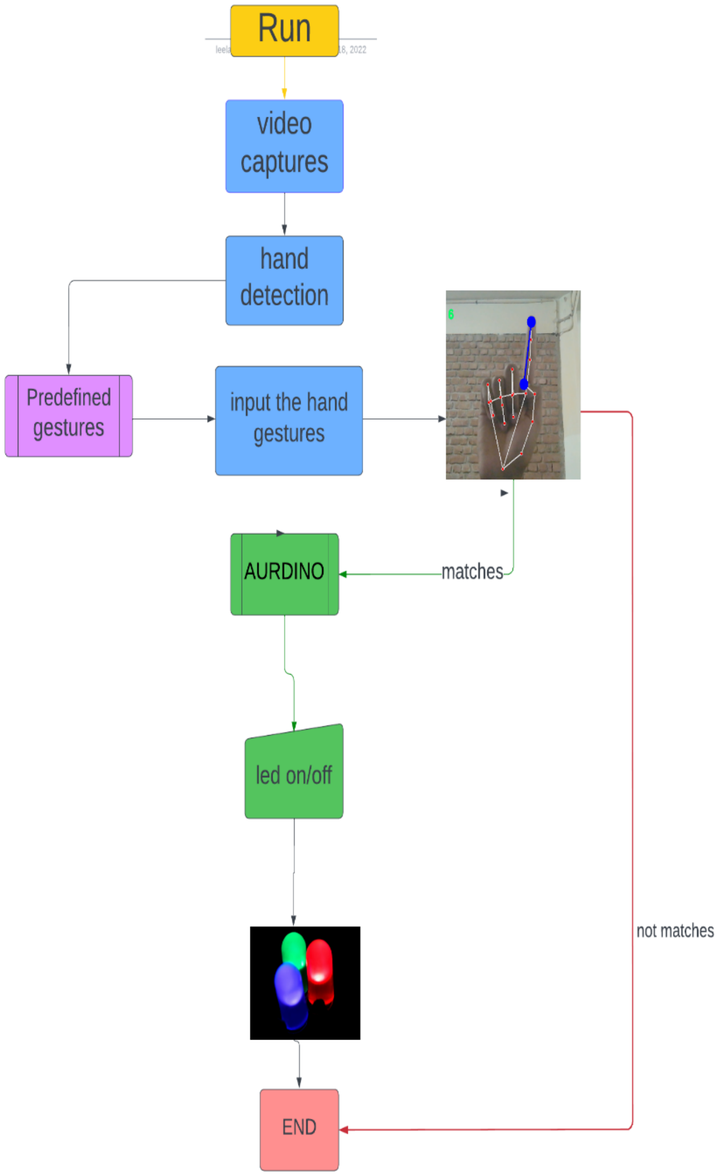

Figure 8:flowchart for led control.

After detection the gestures based on that it sends commands to controller whether To on or off the led and from fermata the command goes to the Arduino and then. We will get the output on and off.

Control of lock using hand gesture:

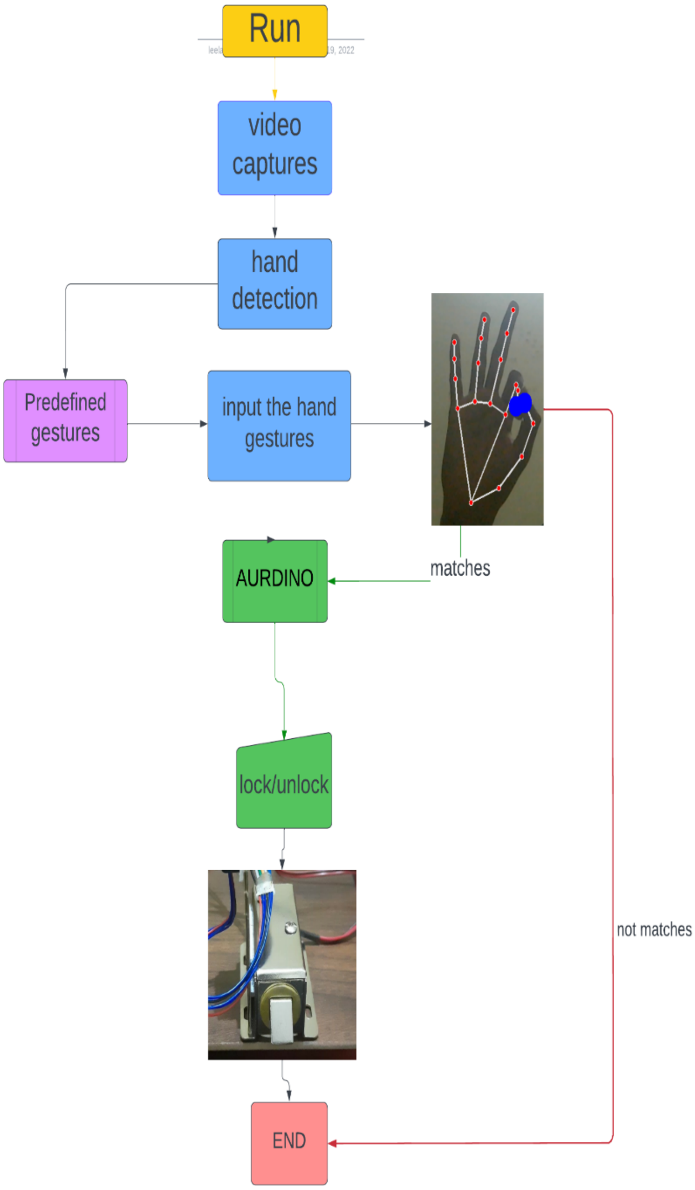

Figure 9:flowchart for door lock control.

After detection the gestures based on that it sends commands to controller whether to lock and unlock the door and from fermata the command goes to the Arduino and then. We will get the output lock and unlock.

Control of lock using hand gesture:

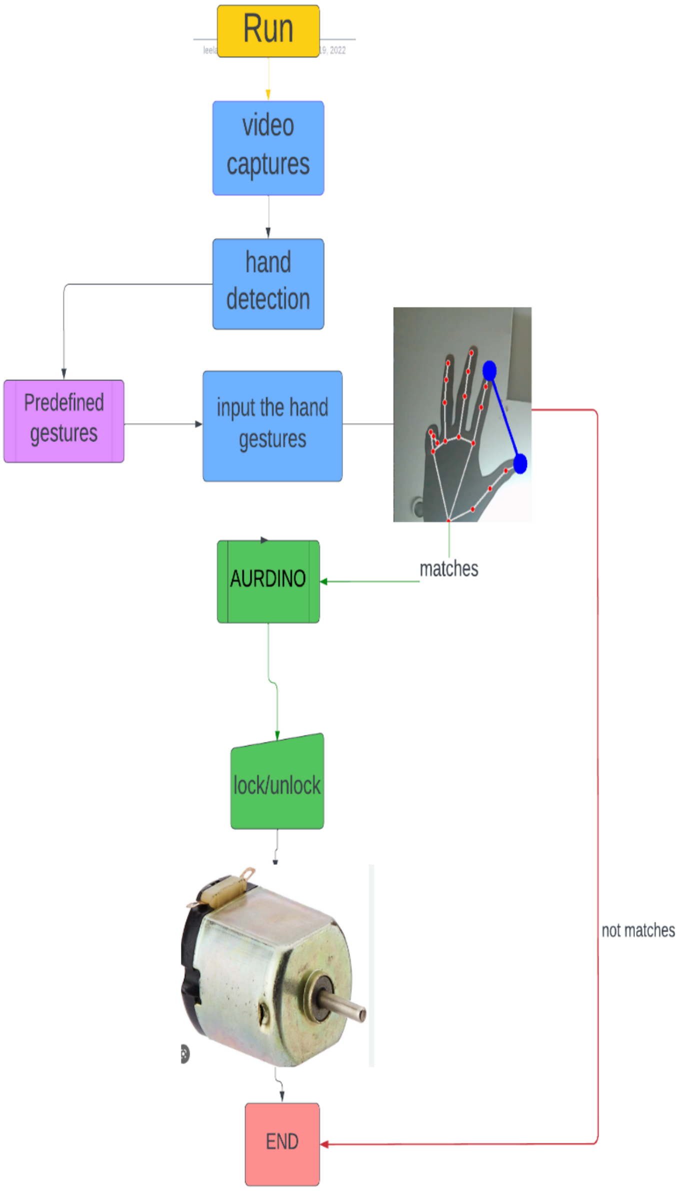

Figure 10:flowchart for dc motor control.

After detection the gestures based on that it sends commands to controller whether to switch off and on the fan and from fermata the command goes to the Arduino and then. We will get the output on and off.

Control of Air conditioner using hand gesture:

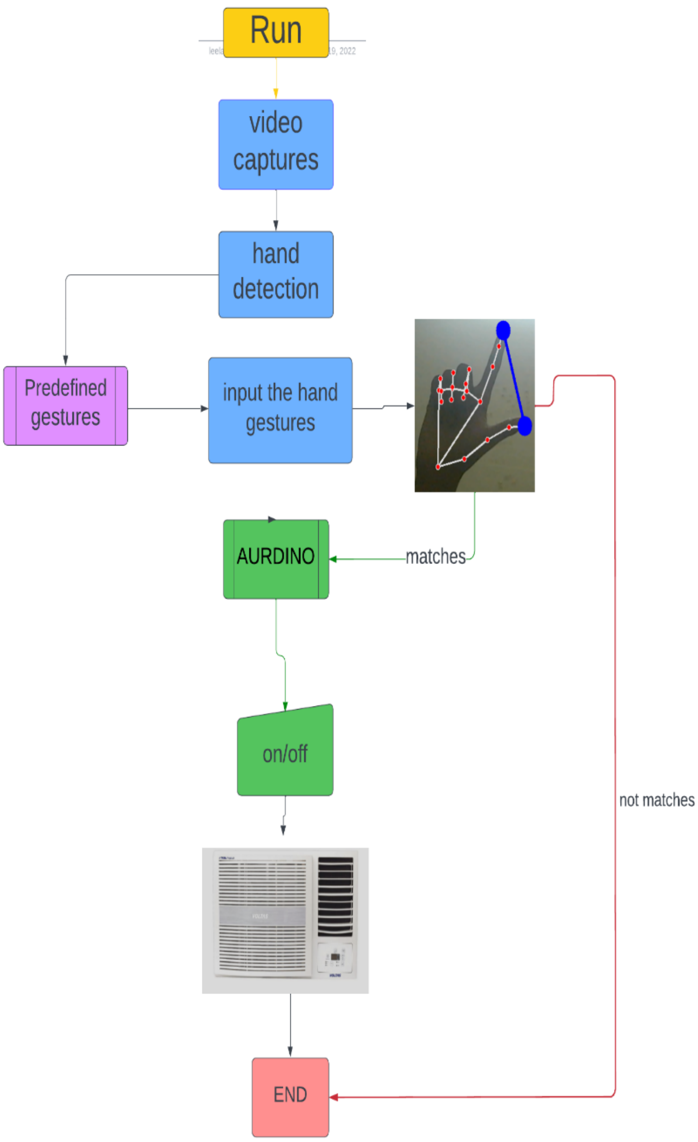

Figure 11:flowchart for air conditioner control.

After detecting the gestures based on that it sends commands to controller whether to switch off and on the air conditioner and from fermata the command goes to the Arduino and then. We will get the output on and off.

CHAPTER-4

EXPERIMENTAL RESULTS

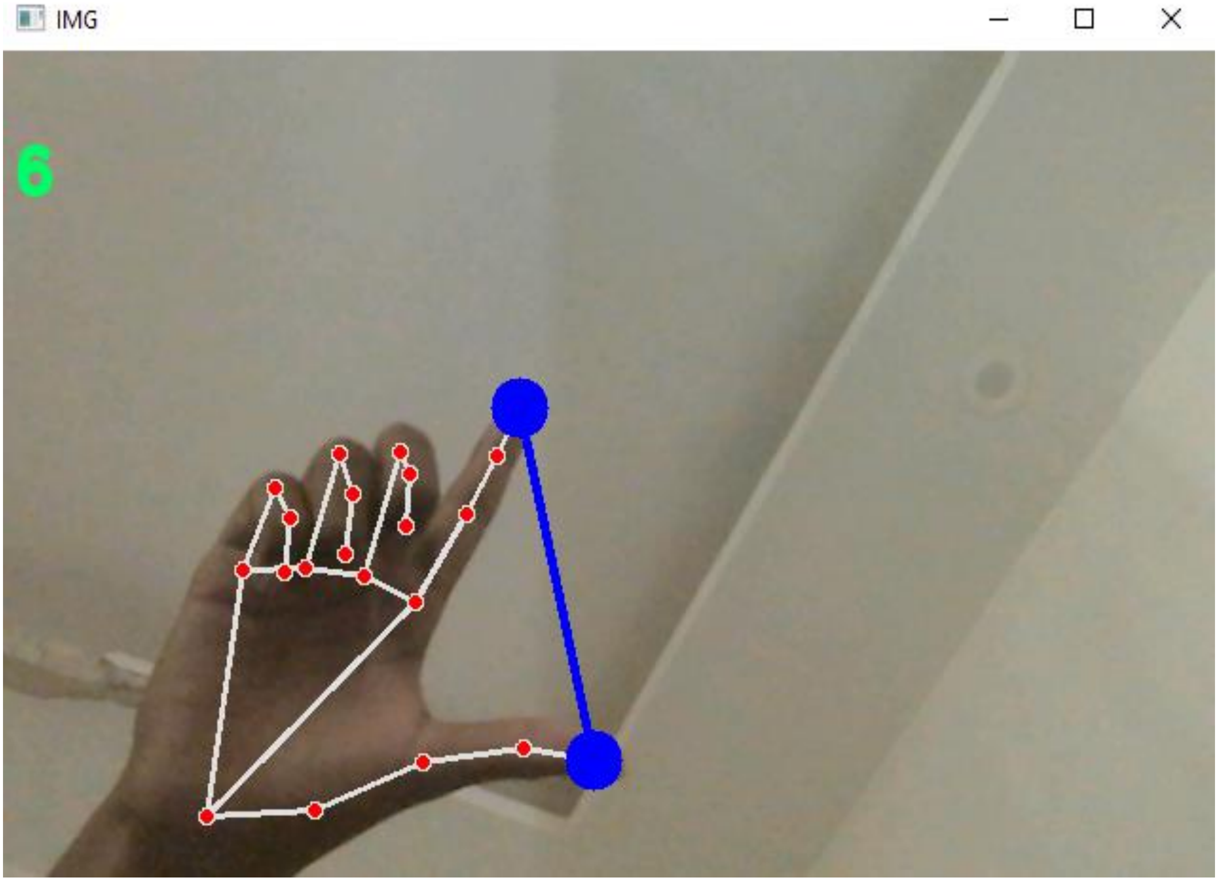

Figure 12:volume detected hand gesture.

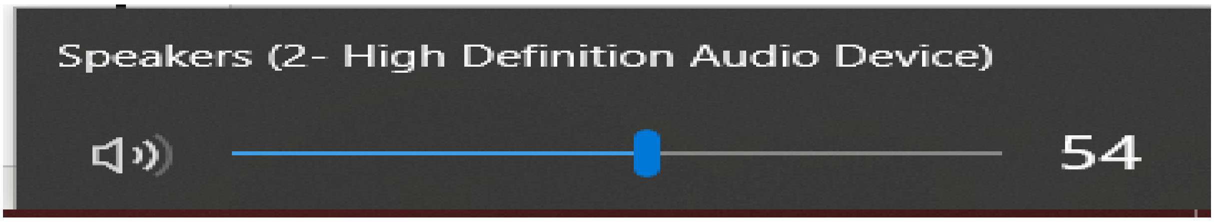

Figure 13:voliume is controlled.

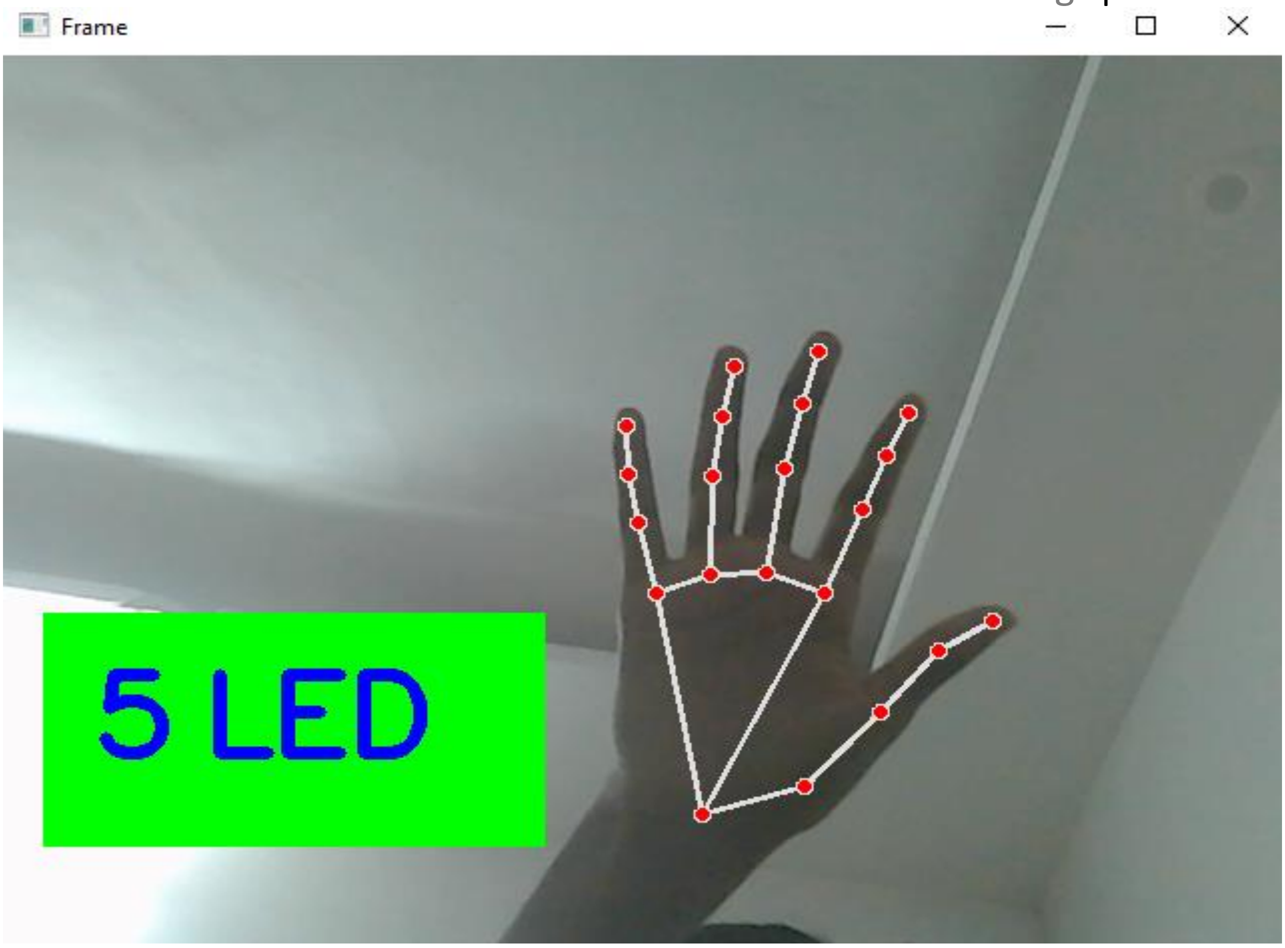

Figure 14:hand gesture to on the 5 LEDs.

Figure 15:hand gesture for 4 LEDs to work.

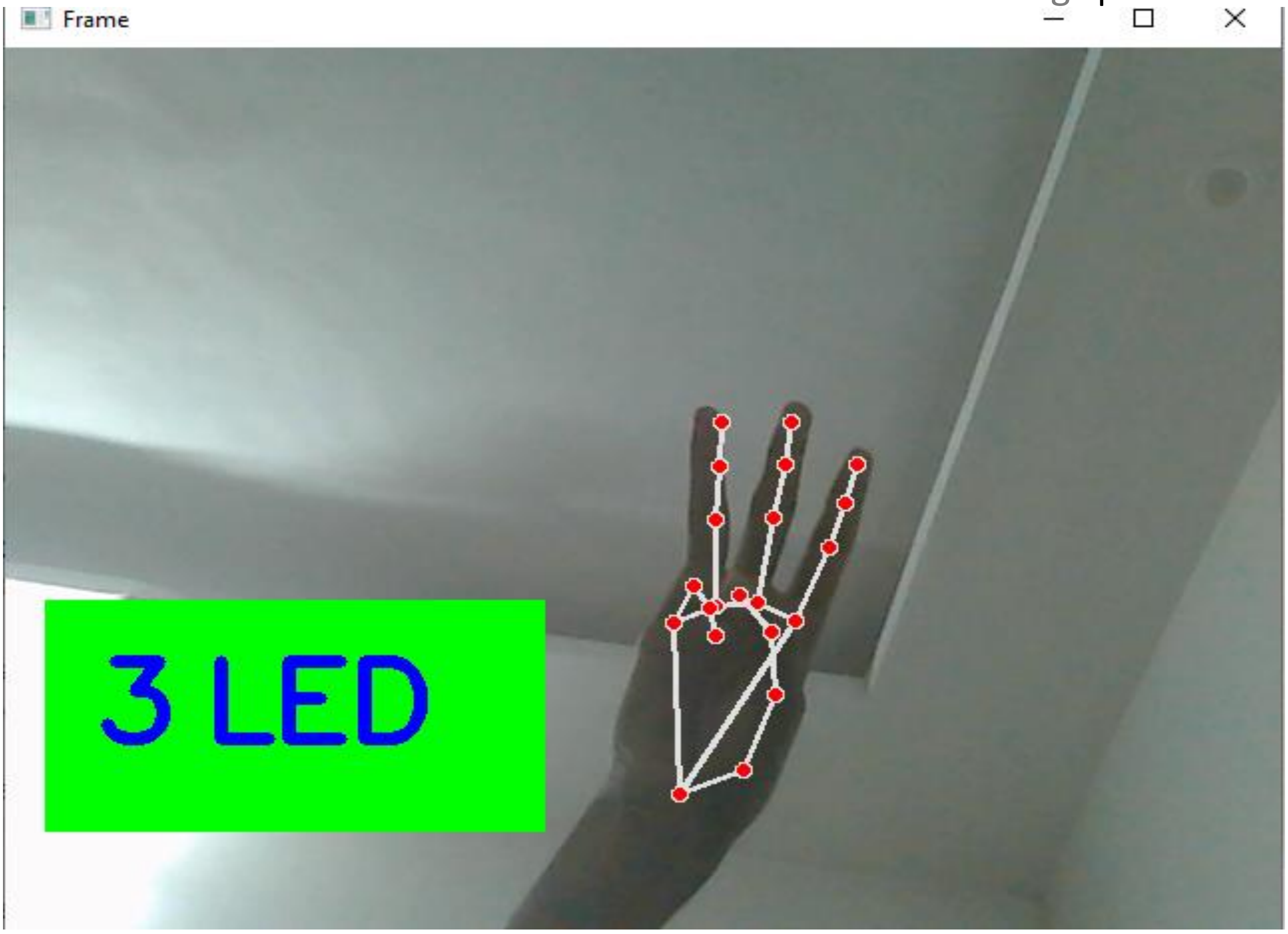

Figure 16:hand gesture for 3 LEDs to work.

Figure 17:hand gesture for 2 led to glow.

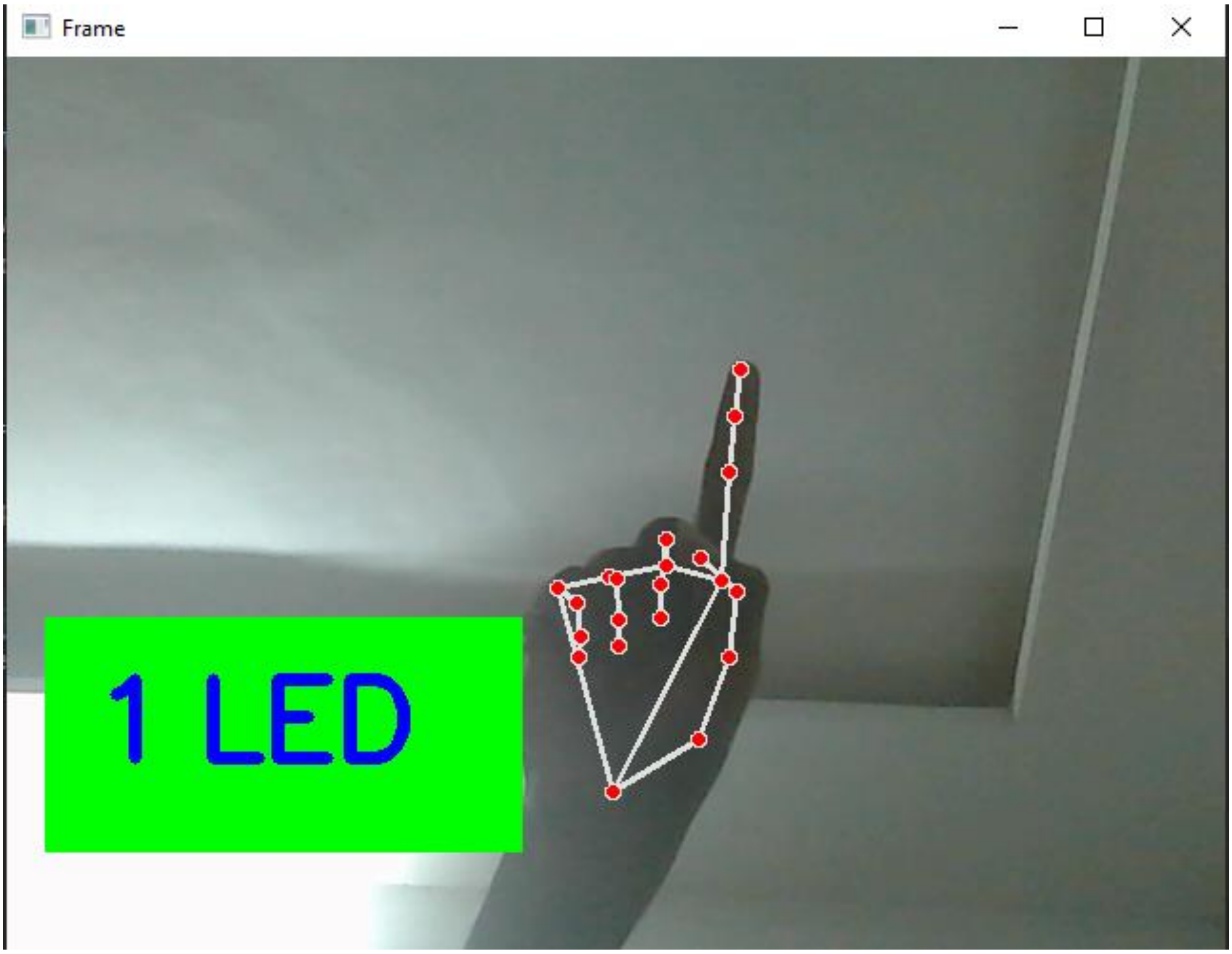

Figure 18:hand gesture for 1led to glow.

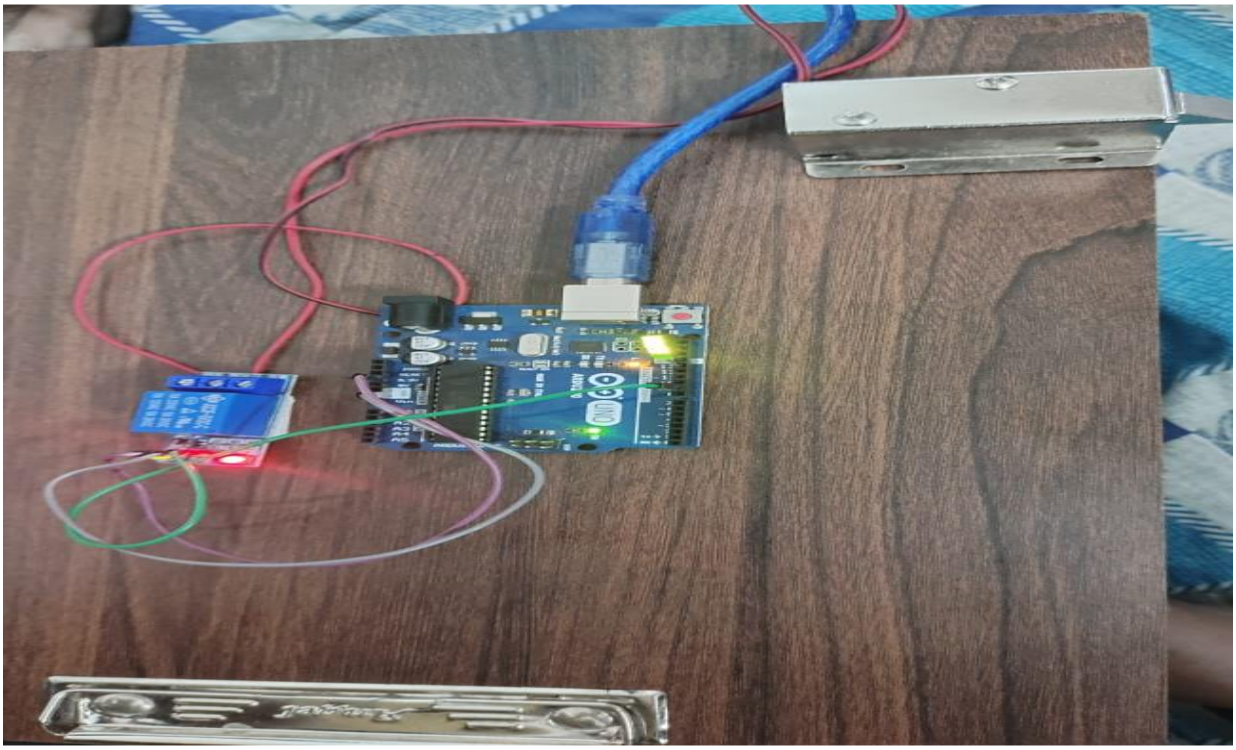

Figure 19:ardino outputs the data.

Conclusion:

The proposed model involves dynamic user defined gestures to control electronic equipment like laptop, TV, etc. The software used for performing the control is PyCharm. The main problem during implementation of the code is that more time is taken for PyCharm to recognize the gesture. The proposed model is sensitive to light intensity and rough background. Overcoming these difficulties is suggested as future work. The use of static gestures for the same can also be implemented in the whole body and gestures and make model like controlling robots using the gestures of human body. There are some of the applications models.

- Acquiring Data and Processing Signals
- Instrument Control
- Automating Test and Validation Systems
- Embedded Monitoring and Control Systems
- Academic Teaching

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