

**MINI PROJECT  
(2020-21)**  
**“Gesture Home Automation”**  
**Project Report**



**Institute of Engineering & Technology**

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## **DECLARATION**

I/we hereby declare the work presented in the Bachelor of technology. Project **“Gesture Home Automation”**, in partial fulfillment of the requirements for the award of the **Bachelor of Technology** in Computer Science and Engineering and submitted to the Department of Computer Engineering and Applications of GLA University, Mathura, is an authentic record of my/our own work carried under the supervision of **Mohd. Amir Khan, Technical Trainer, Dept. of CEA, GLA University.**

The contents of this project report, in full or in parts, have not been submitted to any other Institute or University for the award of any degree.

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## **CERTIFICATE**

This is to certify that the project entitled “**Gesture Home Automation**”, carried out in Mini Project – II Lab, is a Bonafede work by Sumit Mishra, Yashi Mishra and is submitted in partial fulfillment of the requirements for the award of the degree Bachelor of Technology (Computer Science & Engineering).

### **Signature of Supervisor:**

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**Date:** 28-05-2022



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## **ACKNOWLEDGEMENT**

Presenting the ascribed project paper report in this straightforward and official form, we would like to place my deep gratitude to GLA University for providing us the instructor Mohd. Amir Khan, our technical trainer, and supervisor.

He has been helping us since Day 1 in this project. He provided us with the roadmap, and the basic guidelines explaining how to work on the project. He has been conducting regular meetings to check the progress of the project and providing us with the resources related to the project. Without his help, we wouldn't have been able to complete this project.

And last, but not least we would like to thank our dear parents for helping us to grab this opportunity to get trained and also my colleagues who helped me find resources during the training.

Thank You.

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## ABSTRACT

Our mini-project “Gesture Home Automation” is made for the convenience of those who are old-aged or disabled and can’t walk. And there is no one who is always with them for 24 hours. Gestures play a major role in the daily activities of human life, especially during communication, providing an easy understanding. Gesture recognition refers to recognizing meaningful expressions of motion by a human, involving arms, hands, and head/body. Of all the gestures hand gestures help us to express more in less time. And moreover, in today’s developed Era the Human-machine interface has developed a lot mainly employing hand gestures. At present controlling the home appliances using an infrared remote has been common and moreover, it’s not so different from using a remote to operate the appliances. Here, in our project we propose an application for hand gesture recognition, of a limited set of hand gestures, for operating low voltage appliances used as a replacement for the actual home appliances. As of now, hand gesture recognition is tough in its own form. We have considered a fixed number of gestures and a reasonable environment in order to achieve gesture detection and tried to produce a compelling way for gesture detection. Our approach contains steps for recognizing the hand region, contour extraction, locating the edges and counting the number of edges to recognize the gesture, and finally implementing the corresponding action on the hardware. When we come to the hardware part which consists of a microcontroller that reads the data given by the hand gesture detection software through a communication module and the microcontroller takes the necessary action on the appliances.

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# CHAPTER-1

## INTRODUCTION

### 1.1 CONTEXT

Home automation is the use and control of home appliances remotely or automatically. Home automation satisfies the resident's needs and desires by adjustable light, temperature, ambient music, automatic shading, safety & security, and even arrangement of wires. Home automation technologies are the latest fascination with housing mechanisms. However, with the appearance of new electronic technologies and their combination with older, traditional building technologies, the smart home is, at last, becoming a reality. The basic idea of home automation is to monitor a dwelling place by using sensors and control systems. Through adjustable various mechanisms, users can enjoy customized heat, ventilation, lighting, and other servers in living conditions. The more closely adjusted the entire living mechanical system and loop control system, the intelligent home can provide a safer, more comfortable, and more energy economical living condition.

## 1.2 MOTIVATION

The basic problems faced by disabled people in day-to-day life in their own house turning ON or OFF the equipment like lights, fans, and difficulty in analyzing switches are observed many times. And the major issue being faced by the country is loss of power (power shortage). This power shortage can be solved in two ways majorly; one way is from load shedding & second way is that people should be enlightened to switch OFF the appliances when not needed. Often it is observed that the street lights in cities are usually forgotten to be switched OFF during the day and this can be solved by taking initiatives in order to switch OFF the street lights during day time and to save power. In order to overcome these problems, we design & development a smart home automation system using gestures.

### 1.3 OBJECTIVE

In order to overcome the problems encountered, we design & develop a smart home automation system that uses Hand gestures for disabled people to switch ON or OFF fans & lights or equipment in the house, Here in this condition we are using the camera to which live feed of hand gestures are given and from the camera, it goes to Central processor (Video processing system), Control signals from processing units are sent to relay, from relay different appliances can be controlled on given gestures. Power saving capabilities to switch ON lights only in the presence of people, Here in this condition we are detecting when human is IN & OUT of the room from sensors, the signal from sensors is fed to the microcontroller, then the control signal from the microcontroller is given to relay which controls the ON & OFF of the lights of the room respected to IN & OUT of humans. Switch ON exterior lights based on the light intensity, Here in this condition light intensities like dim, and bright, are detected by the sensors & sent to the microcontroller for processing, the processed signal is then fed to the relay which in turn switch ON or OFF the lights based on intensities.

## 1.4 EXISTING SYSTEM

Many existing home automation systems with gesture recognition use hand-crafted techniques like Speeded up Robust Features (SURF), Histogram of Oriented Gradients(HOG), and Local Binary Patterns (LBP) for the purpose of feature extraction.

## 1.5 FUTURE SCOPE

Scope of Gesture Home Automation are:

Hand motions are utilized to control the home machines, for example, fans, lights, and so on. The future headway will be founded on the IoT premise, we can control the home apparatuses in and around the globe with the assistance of the web of things. The appliances use these motions to control volume tuning, TV channels, speed controls, and the controller of a fan can be controlled by the signal. In future progression innovations, motions can be utilized to control autos and even programming applications.

## 1.6 SOURCES

The source of our project (including all the project work, documentation, and presentations) is available at the following link:

<https://github.com/Sumit0730/Gesture-Home-Automation>

## **CHAPTER -2**

# **SOFTWARE REQUIREMENT ANALYSIS**

### **2.1 IMPACT OF HANDWRITING RECOGNITION**

The high variance in handwriting styles across people and poor quality of the handwritten text compared to printed text pose significant hurdles in converting it to machine-readable text. Nevertheless, it's a crucial problem to solve for multiple industries like healthcare, insurance, and banking.

Recent advancements in Deep Learning such as the advent of transformer architectures have fast-tracked our progress in cracking handwritten text recognition. Recognizing handwritten text is termed Intelligent Character Recognition(ICR) due to the fact that the algorithms needed to solve ICR need much more intelligence than solving generic OCR.

In this article we will be learning about the task of handwritten text recognition, its intricacies, and how we can solve it using deep learning techniques.

## 2.2 APPLICATION

1. It can be used by patients suffering from Paralysis.
2. It can be used to play simple video games.
3. It can be used to control various home appliances.
4. It can be used in home theatre systems where Suitable for physically challenged people to operate the devices within room

## **2.3 HARDWARE AND SOFTWARE REQUIREMENTS**

### **Hardware Requirement**

- Processor: intel i5
- Operating System: Any Operating System
- RAM: 8 GB (or higher)
- Hard disk: 256GB

### **Software Requirement**

- Software used: Vs Code
- Language used: HTML, Python, CSS
- User Interface Design: Web Application

# CHAPTER- 3

## SOFTWARE DESIGN

### 3.1 USE-CASE DIAGRAM:

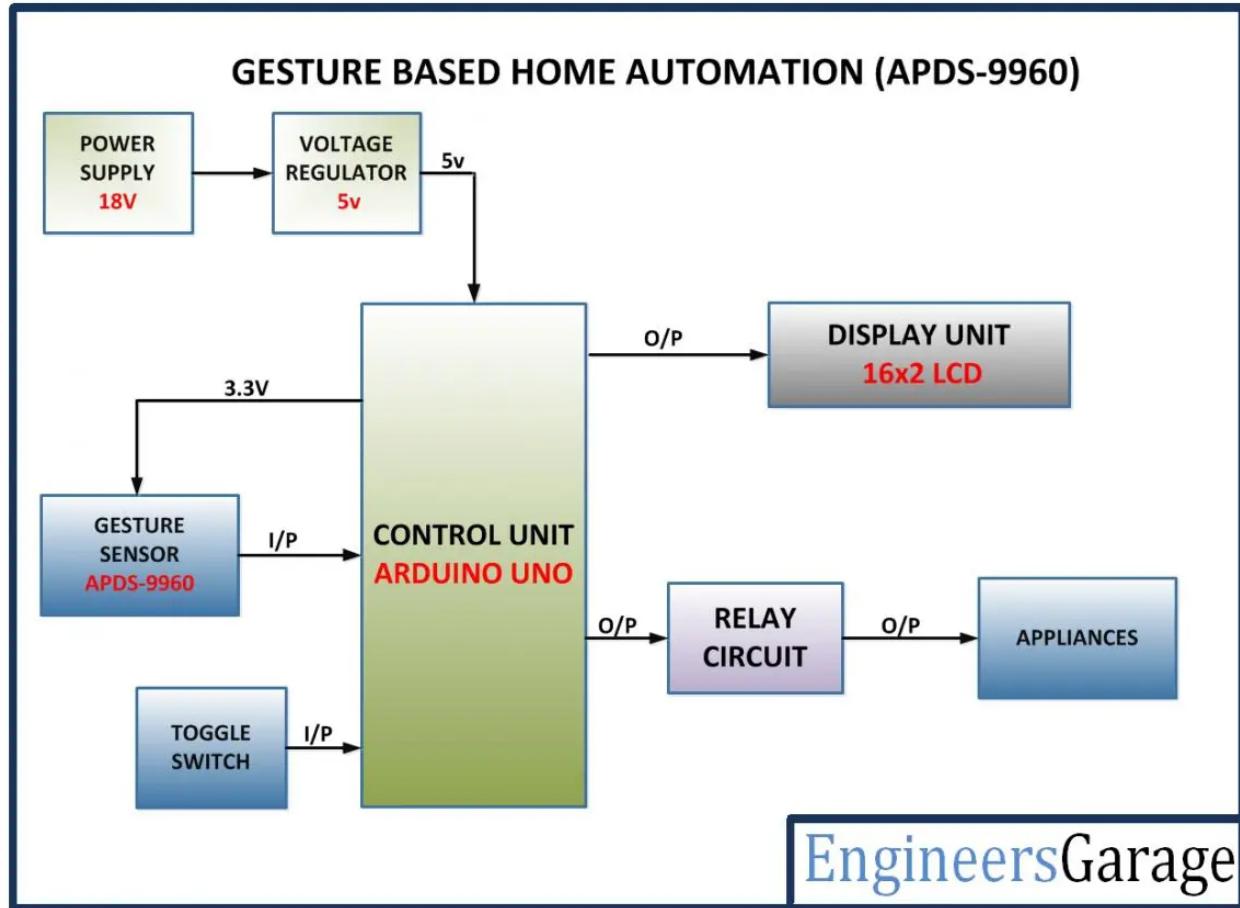
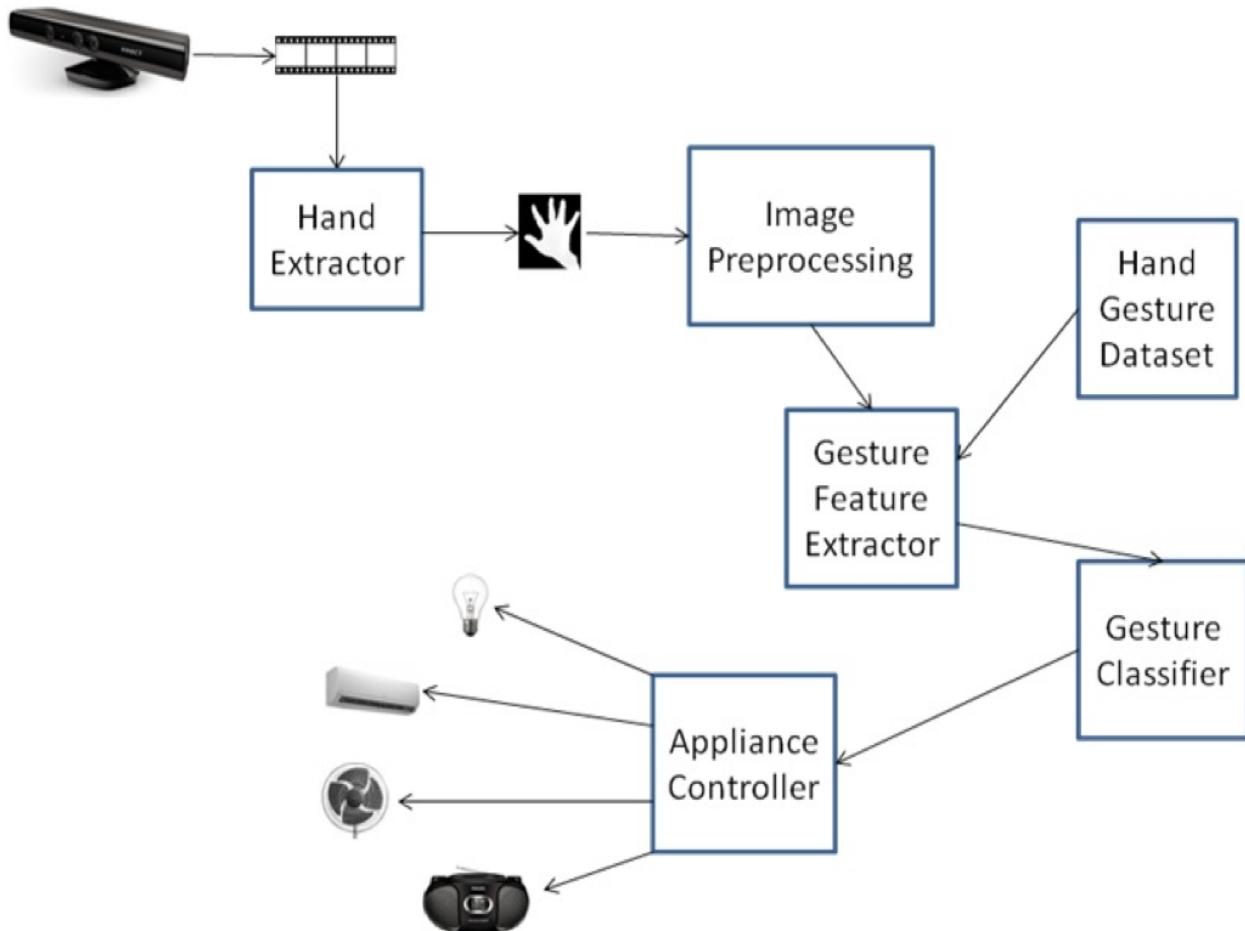


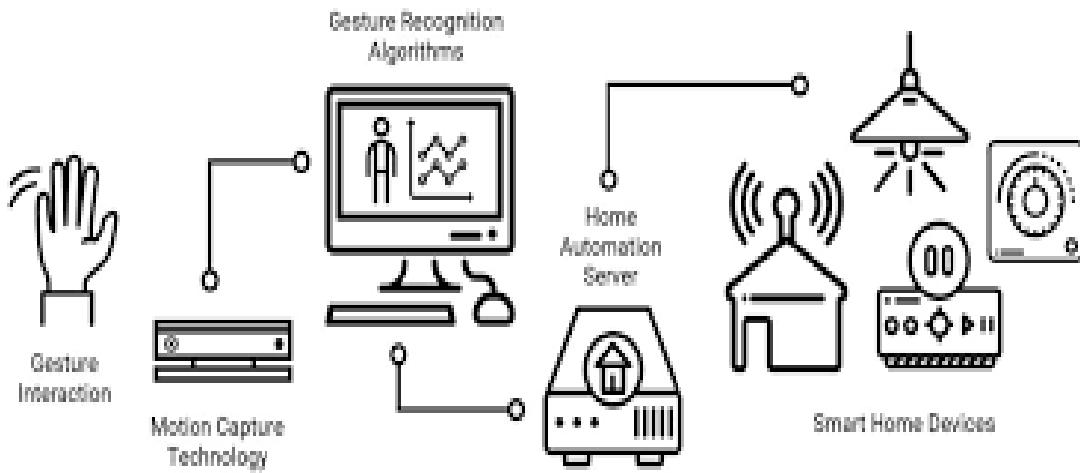
Figure-1: Use-Case Diagram

### 3.2 DATA FLOW DIAGRAM



**Figure-2: Data Flow Diagram**

### 3.3 SEQUENCE DIAGRAM



**Figure-3: Sequence Diagram**

## CHAPTER-4

# TECHNOLOGY USED

### 4.1 Computer Vision with IoT

OpenCV made the hard work and calculations needed for computer vision and image processing somewhat easier, mainly it decreased the learning curve dramatically. With IoT interfacing, we can communicate with the appliances and sensors without much hustle.

The networks of IoT devices can control lights, regulate indoor temperature, and water plants, and turn on the TV. Whereas, computer vision is one of the technologies that make homes intelligent—for example, a smart fridge can use cameras to check food supplies. Developers can leverage a large variety of computer vision algorithms and tools available in the OpenCV library to create smart home projects.

## 4.3 TOOLS AND LANGUAGES

- **VS CODE:** Visual Studio Code is a lightweight but powerful source code editor which runs on your desktop and is available for Windows, macOS and Linux. It comes with built-in support for JavaScript, TypeScript and Node.js and has a rich ecosystem of extensions for other languages (such as C++, C#, Java, Python, PHP, Go) and runtimes (such as .NET and Unity).
- **Python:** Python is a computer programming language often used to build websites and software, automate tasks, and conduct data analysis. Python is a general-purpose language, meaning it can be used to create a variety of different programs and isn't specialized for any specific problems.
- **OpenCV:** OpenCV (Open Source Computer Vision Library) is a library of programming functions mainly aimed at real-time computer vision, developed by Intel, and now supported by Willow Garage and Itseez. It is free for use under the open-source BSD license. The library is cross-platform. It focuses mainly on real-time image processing.
- **Mediapipe:** MediaPipe Hands is a high-fidelity hand and finger tracking solution. It employs machine learning (ML) to infer 21 3D landmarks of a hand from just a single frame. Whereas current state-of-the-art approaches rely primarily on powerful desktop environments for inference, our method

achieves real-time performance on a mobile phone, and even scales to multiple hands.

- **IoT:** The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.
- **Arduino:** Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board.

## 4.4 BASIC TERMINOLOGY

- **Hand Gesture:-** Instead of using a handheld remote by making hand gestures, like moving hands or by making **gestures** with a finger which will detect the angles.
- **Image Segmentation Module:-** To reduce the computational time needed for the processing of the image and only the outline of the sign gesture has to be processed. After the conversion of the image into binary, the outline of the vector (x,y) coordinators, assuming that the hand gesture covers the left corner of the image.
- **Interfacing software and Hardware:-** Detected gesture angle is computed and sent to the Arduino and it is connected to the Relay which acts as a switch depending on the angle the electronic gadgets are controlled. vectors should be of the same dimensionality for a single recognition system. In multiple classifier methods, the classification results of multiple classifiers are combined to reorder the classes.
- **Electronic Gadgets:-** Depends on the angle detected, the function of the gadgets takes place, and different gadgets have different functions and angles.

## CHAPTER -5

# IMPLEMENTATION AND USER INTERFACE

It can be seen as a way for computers to begin to understand human body language, thus building a richer bridge between machines and humans than primitive text user interfaces or even GUIs (graphical user interfaces), which still limit the majority of input to keyboard and mouse. How can we realize hand gesture recognition with OpenCV and python?

First, we will extract ROI(region of interest ) from the input frames in our case hand palm. Then find the contour, draw the convex hull and find the convexity defects depending upon the number of defects find the gestures.

Too many technical terms, we will go step by step

**Platform:** Python 2.7

**Libraries:** OpenCV (any version), Mediapipe, Numpy, math, serial (from pyserial module)

**Hardware Requirements:** Camera/Webcam, Relays, Loads (like a fan, bulb, etc), Arduino and Connecting wires (male and female).

## 5.1 ALGORITHM

**Step 1:** Start and run the process by executing the code.

**Step 2:** Make a hand gesture.

**Step 3:** Check the gesture angle value.

**Step 4:** Computed value is sent to the Arduino which acts as interface b/w software and hardware.

**Step 5:** Depending on the angle value, a signal is sent to the relay.

**Step 6:** Relay which acts as a switch.

**Step 7:** Depending on the angle value the home appliances are controlled

**Step 8:** Stop

## 5.2 USER INTERFACE

- When Finger count is 0
  - ALL OFF

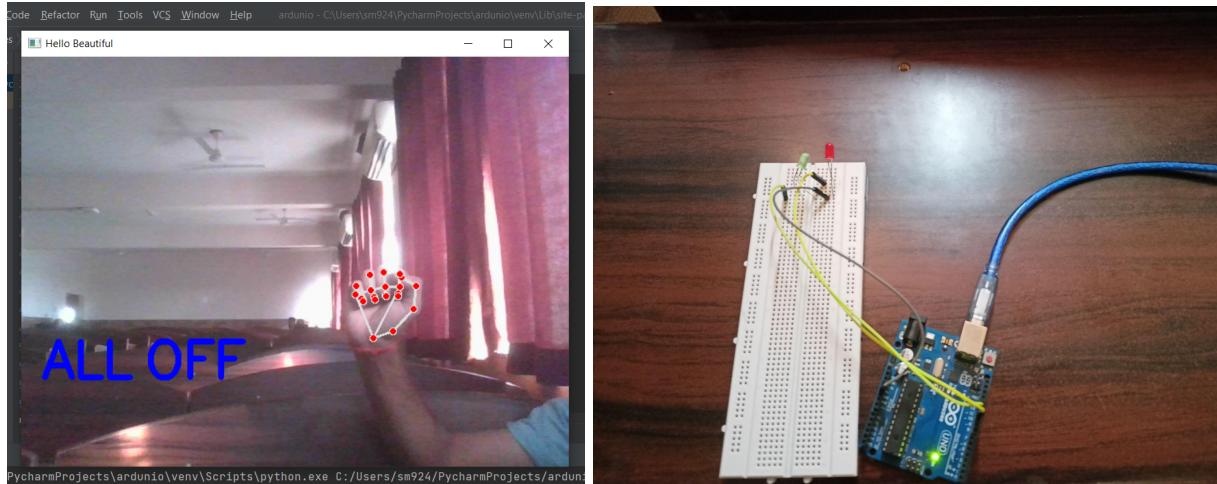


Figure-26: ALL OFF

- When Finger count is 1
  - LED turns On

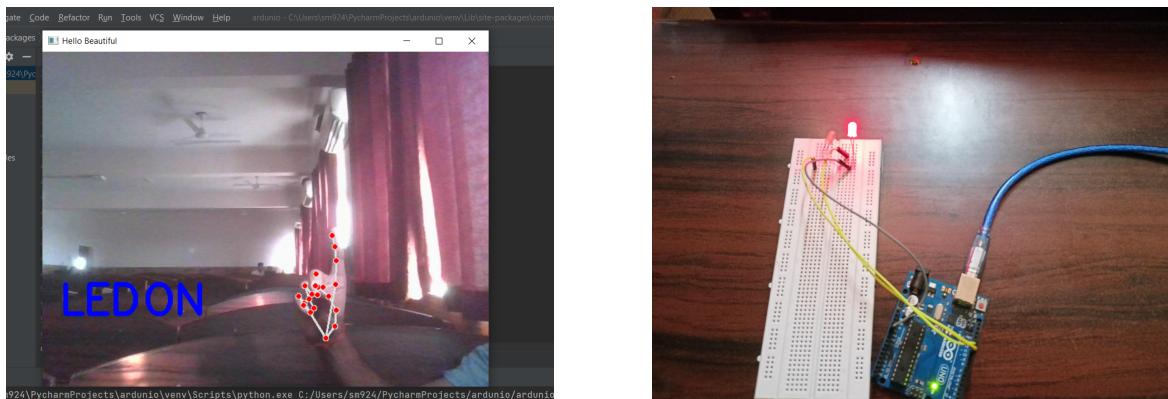
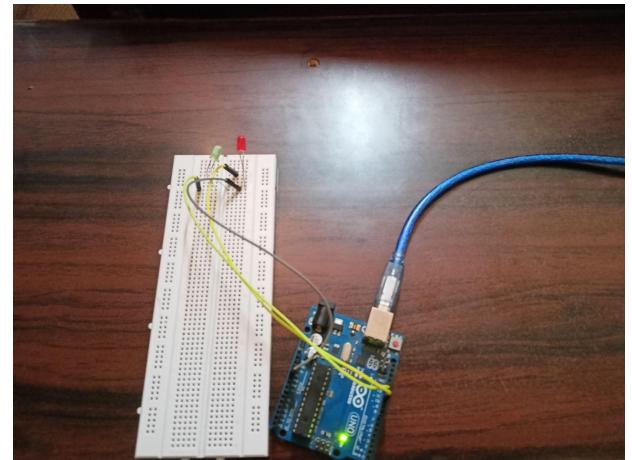
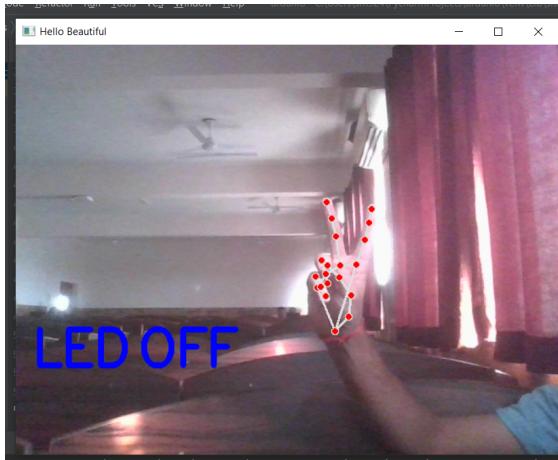


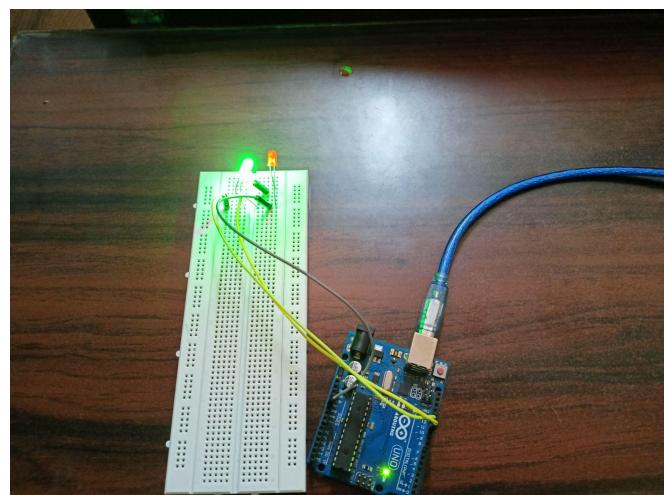
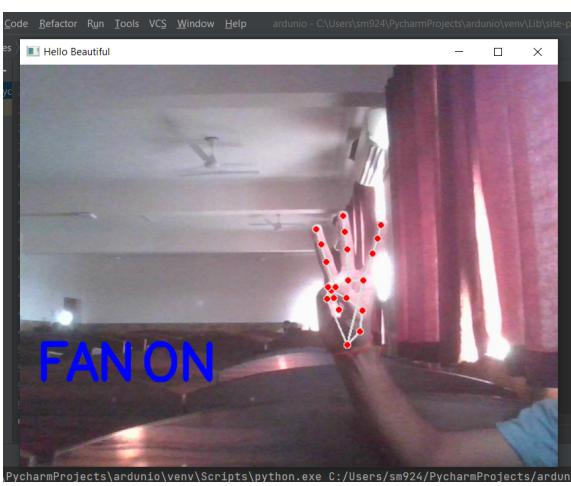
Figure-4: LED On

- When Finger count is 2
  - LED turns OFF



**Figure-2: LED OFF**

- When Finger count is 3
  - FAN turns On



**Figure-2: FAN ON**

- When Finger count is 4
  - FAN turns OFF

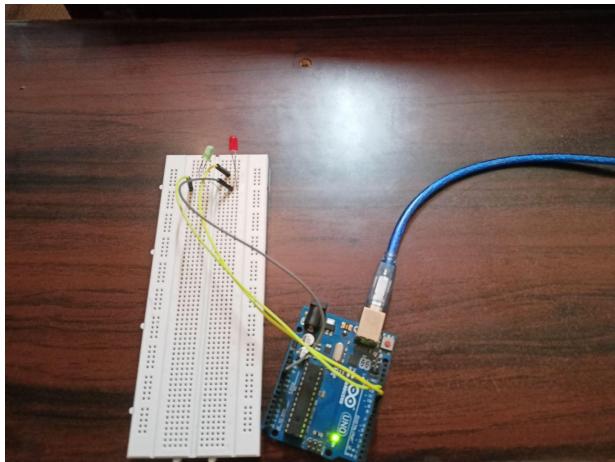
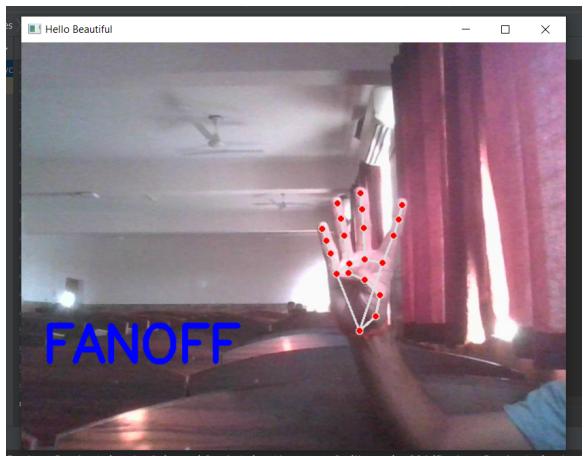


Figure-26: FAN OFF

- When Finger count is 5
  - ALL On

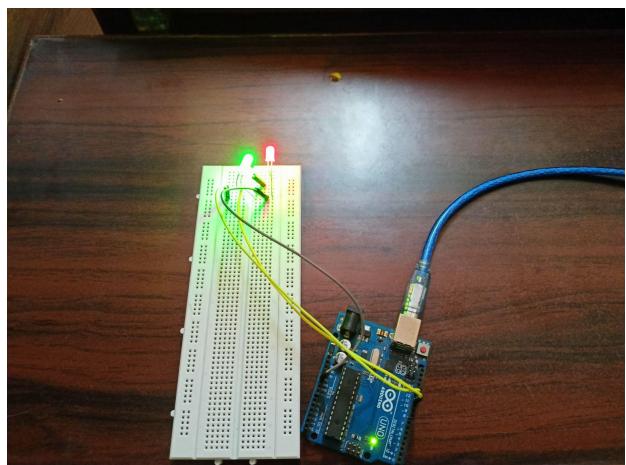
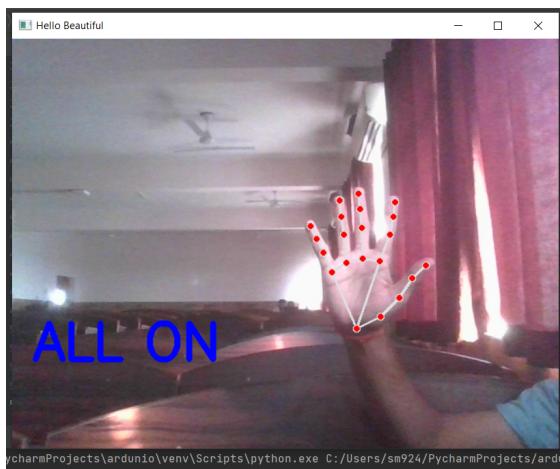


Figure-26: ALL On

## **CHAPTER -6**

## **CONCLUSION**

Our proposed system is to help the physically impaired control home appliances by hand gestures. Our proposed system provides comfort and convenience for the common as well, especially in the home theatre. This technology is also used for home automation for the physically impaired. The scope for future study is without using a handheld remote or IR remote. By using only hand gestures we can control the home appliances which will help a lot the person who is suffering from being physically disabled. The person who is physically disabled instead of going to the nearest switch or pressing the button can easily control the things by sitting there only by hand gesture.

## DISCUSSION

This project is to develop a system that will help the physically impaired or anyone to control home appliances by hand gestures using a webcam. This provides comfort and convenience for common users as well, especially in-home systems. Wireless technology is used for home automation for the physically impaired. In this system, physically impaired people use the home appliances very easily or they are comfortable with using the devices. This system is simple for operating the devices, this will be replaced by the remote-control instead of pushing the button there for this system will be very suitable for operating the home appliances.

## REFERENCES

- [1] Shiguo Lian, Wei Hu, Kai Wang, “Automatic User State Recognition for Hand Gesture Based Low-Cost Television Control System”, IEEE Transactions on Consumer Electronics, Vol. 60, Issue: 1, February 2014
- [2] Ahmad Akl. Chen Feng and Shahrokh Valaei, “A Novel Accelerometer-Based Gesture Recognition System”, IEEE Transactions On Signal Processing, Vol.59, Issue: 12, Dec. 2011
- [3] Matthias Rehm, Nikolaus Bee, Elisabeth André, Wave Like an Egyptian - Accelerometer Based Gesture Recognition for Culture Specific Interactions, British Computer Society, 2007
- [4] Gang Pan, Jiahui Wu, Daqing Zhang, Zhaohui Wu, Yingchun Yang, Shijian Li, “GeeAir: A universal multimodal remote control device for home appliances”, Springer-Verlag London Limited 2010, 10 March 2010.
- [5] M. Ebrahim Al-Ahdal & Nooritawati MdTahir, “Review in Sign Language Recognition Systems” Symposium on Computer & Informatics(ISC), pp:52-57, IEEE ,2012.