



Parshvanath Charitable Trust's  
**A. P. SHAH INSTITUTE OF TECHNOLOGY**  
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(Religious Jain Minority)

## Title: An Intelligent Home Automation System For Specially Abled.

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# Abstract

- In this digital-era, security and automation is one of the utmost requirement for home. This project aims to develop a system to assist specially abled people by providing them with various automation facilities in their home and secure their lifestyle by identifying faces and grant them access using a face detection system
- In recent years considerable progress has been made in the area of face recognition. Through the work of computer science engineers, computers can now outperform humans in many face recognition tasks, particularly those in which large databases of faces must be searched
- Face recognition system is widely used for human identification due to its capability to measure and subsequently identifies human identification especially for security purposes.

# Introduction

- Investing in a System that Secures and Automates a home is desideratum that eases your lifestyle with the smart devices via Internet.
- A smart home is one that is equipped with lighting, heating, and electronic devices that can be controlled remotely by smartphone or via the internet. An internet-based home automation system focuses on controlling home electronic devices whether you are inside or outside your home.
- Home automation gives an individual the ability to remotely or automatically control things around the home.
- The security system of home can be developed by using a face recognition method. The face is used as a key to access home. By using real face, the process of opening the door will be more effective and efficient because it just needs to direct a face on the camera, so the camera can identify whether the person is allowed for entry or not.

# Literature Review

| Sr No | Author   | Methodology   | Merits  | Limitations   |
|-------|--|---|---|---|
| 1     | Matthias Mielke & Rainer Bruck<br>(IEEE Conference, 2016 ) | Mesh-Network to notify over Bluetooth to smart watch & event indication by vibration for people experiencing Hearing Loss | Wireless notification system smartwatch used for Indoor & Outdoor notification using sink node i.e; stationery & mobile sink node for watch or phone. | Low Energy consumption using bluetooth introduces a delay for packet delivery. Also short range because bluetooth coverage is short distance ranging 5-10m. |

| Sr No    | Author   | Methodology   | Merits  | Limitations   |
|----------|--|---|---|---|
| <u>2</u> | <p>Dwi Ana Ratna Wati, Dika Abadianto</p> <p>(International Conferences on Information Technology and Electrical Engineering, 2017 )</p> | MyRIO is used and is connected to computer with wifi<br>Face Detection and Recognition can be implemented using MyRIO as a main controller.   | Wifi Enabled services and intelligent approach towards learning controls.             | To detect face it must be positioned at 240 cm or less than that. Distance more than 240 wont be detected. Various accessories can be difficult to detect face. I.e; slight change in face features.                      |
| <u>3</u> | <p>T Archana, T. Venugopal</p> <p>(International Conference on Green Computing and Internet of Things, 2015 )</p>                        | Comparison between two face recognition approach in PCA & Template. Along with comparison advantages and important factors of two approaches. | With the comparison analysis stated Template matching strategy is efficient than PCA. | <p>On Frontal view recognition is accepted but factors are:</p> <ol style="list-style-type: none"> <li>1. Facial Expression</li> <li>2. Change in plane</li> <li>3. Illumination.</li> <li>4. Rotation of head</li> </ol> |

| Sr No    | Author  | Methodology  | Merits   | Limitations   |
|----------|---|--|--|---|
| <u>4</u> | <p>Shopan Dey,<br/>Sandip Das,<br/>Ayon Roy</p> <p>(IEEE Conference, 2016 )</p>   | <p>Using IOT Control home automation through interconnection software-PHP point to point web socket. Amazon cloud server for socket connection.</p> <p>Equipments used:Pi relay, sensor-humidity &amp; temperature.</p>  | <p>To operate or control various equipments, machinery &amp; other electrical &amp; electronic appliances remotely.</p>  | <p>If maintenance is not taken care of properly software and appliance i.e; hardware synchronization can be influenced.</p> |
| <u>5</u> | <p>Yashwanth Sai,<br/>Vijai Chandra Prasad,<br/>Niveditha,<br/>Sasipraba,<br/>Vigneshwari &amp; S.Gowri</p> <p>(IEEE Conference, 2017 )</p> | <p>PCA algorithm is used for face recognition &amp; take the dimensions of face messages and convert to grayscale. High prevalent CCTV cameras for intruders.Uses Raspberry PI &amp; camera modules and sensors alerting users through email or mobile notification sms 7 generate log of default entry &amp; exits.</p> | <p>Uses simple SMP Pi camera instead of high surveillance camera. Uses wifi adapter for connecting smart system to local computer. Log generation done with simple code when face is detected by the camera.</p> | <p>An authority is required to be present to do surveillance to watch the activities.</p>                                   |

# Problem Statement

- Security has been a serious issue faced by people over the last years. Not only Security but the unavailability of resources to control everything in the house remotely is also a problem.
- Automating and Securing homes using cost efficient equipments and technologies is very complicated.
- With so many Minds developing systems to cover all these constraints none of them are affordable to a specially abled.
- A System is needed to efficiently Automate and Secure the dwelling of such mass at affordable rates.



# Project Scope

- This Project aims to Automate and Secure home using Smart IOT Components.
  - The Main Door is equipped with a smart security system that works on facial recognition system designed to unlock the door only when a recognized face is detected.
  - Automation System via an app using which he/she can control appliances remotely via Internet by use of Wifi adapters installed in the system which will communicate with a Cloud Server.

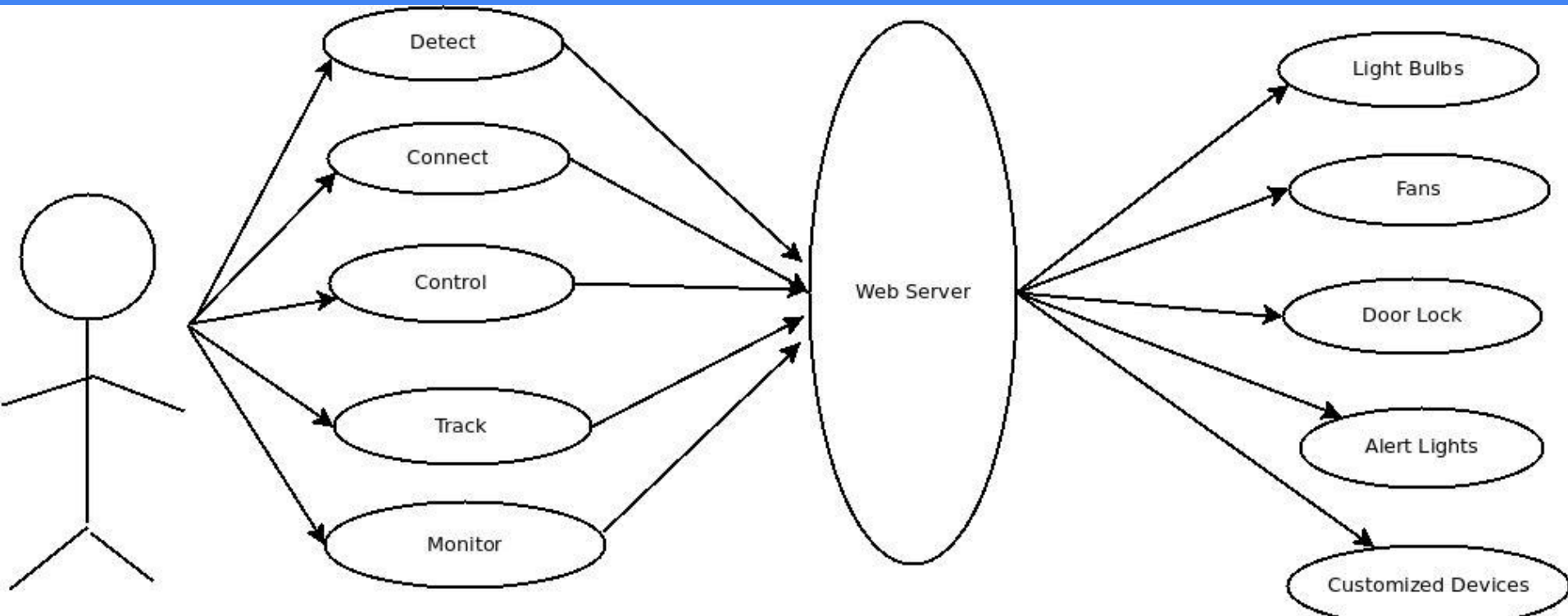
- Logs of main Door will be recorded and user will be notified for each entry on the Application installed on the smartphone.
- In case of fire or gas leak using various sensors and emergency lights so the deaf can see the alert.



#### Limitation:

- The intelligent system can only control Fans, Lights of the room, however it does not promise to control other applications like Refrigerators, Coolers, Televisions etc.

# Use-Case Diagram

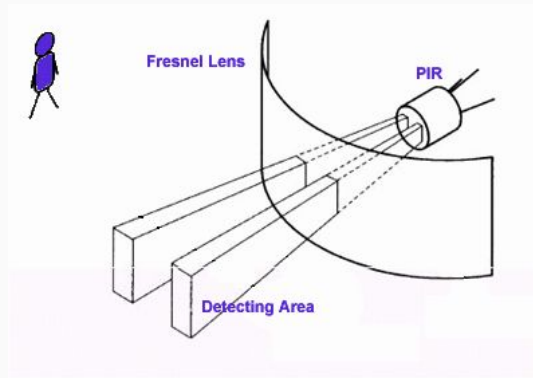


# Technology Stack

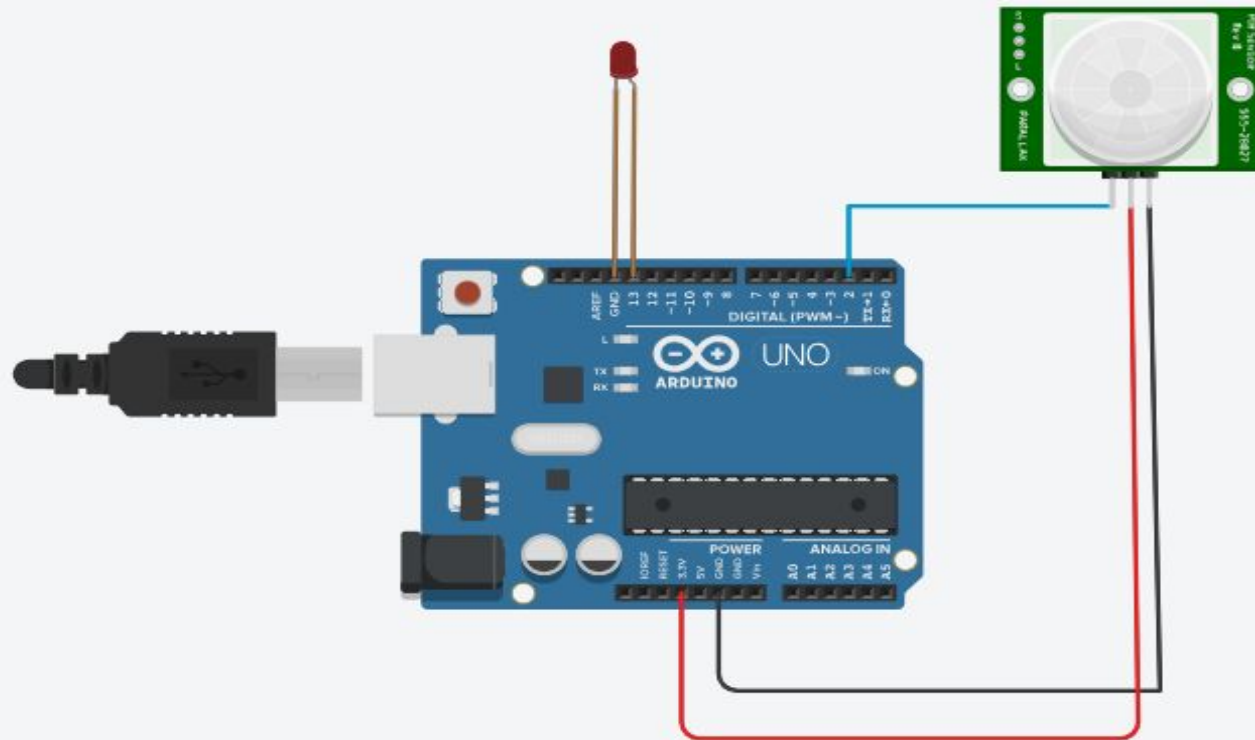
| Hardware                   | Software                  |
|----------------------------|---------------------------|
| PIR Sensor                 | Arduino IDE               |
| Arduino UNO                | ThingSpeak server         |
| NodeMCU                    | Python                    |
| Relay & sensors            | C#                        |
| Wires                      | Android & Xamrin          |
| LEDs                       | Opencv                    |
| Servo motor                | Web Development Languages |
| Tower bolt & Camera sensor | SQLite3                   |

# Implementation

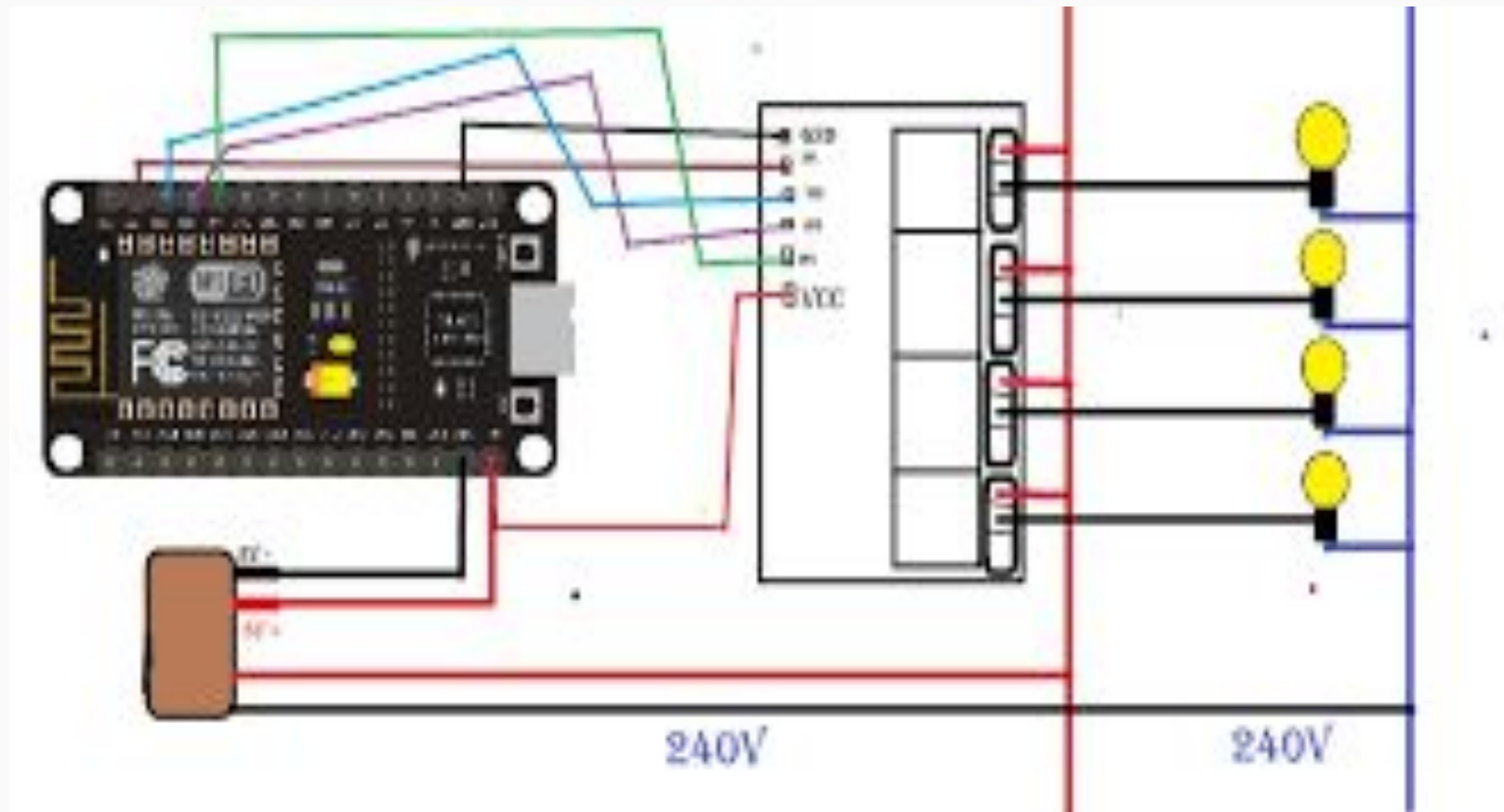
- A **passive infrared sensor (PIR sensor)** is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view.
- We are using pir sensor to automate the room's light without switching it on or off.



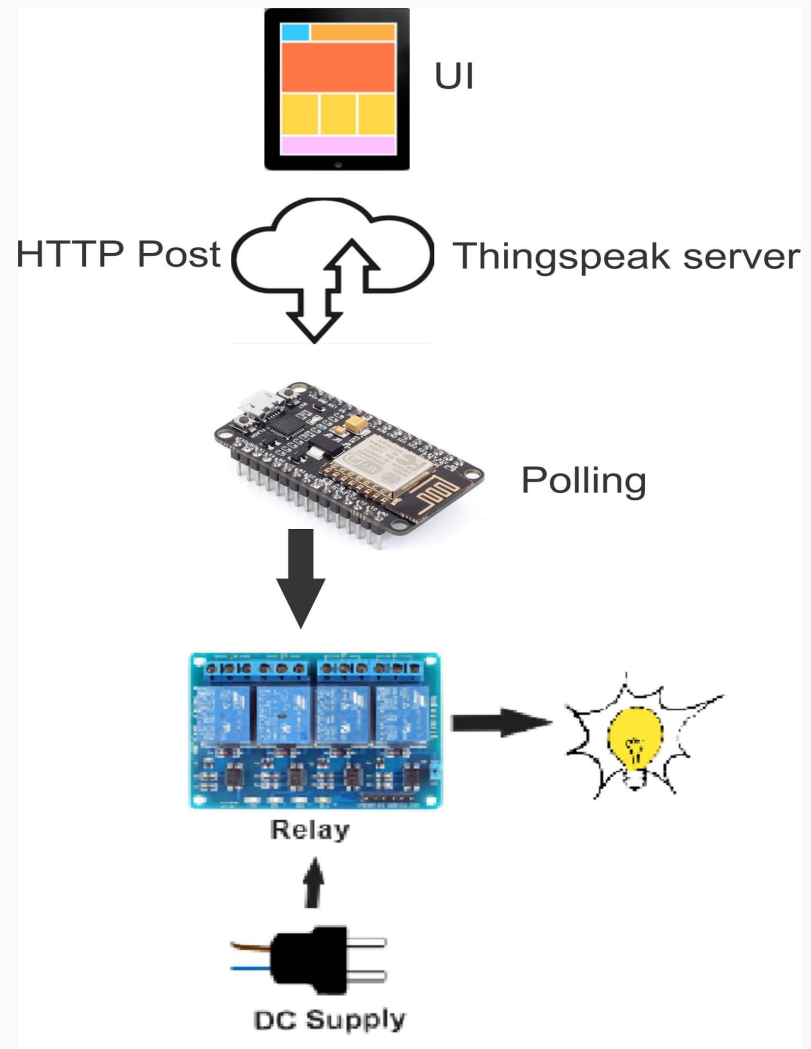
# PIR Circuit diagram



## Node MCU and Relay Connectivity circuit diagram



# Architecture





# Face Recognition

- **Local Binary Pattern Histogram** (LBPH) is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number.
- LBPH is the most accurate and efficient face recognition algorithm available in OpenCV to identify people and generate log regarding the information of detected face.
- The key feature of using LBPH algorithm is that it can enhance to neural network architecture. Along with feature based approach could be implemented along with the existing system in which orientation of the faces will be determined and then the most suitable recognition method i.e. LBPH

# Face Recognition

- Divide the examined window into cells ##(e.g. 16x16 pixels for each cell).
- For each pixel in a cell, compare the pixel to each of its 8 neighbors (on its left-top, left-middle, left-bottom, right-top, etc.). Follow the pixels along a circle, i.e. clockwise or counter-clockwise.
- Where the center pixel's value is greater than the neighbor's value, write "0". Otherwise, write "1". This gives an 8-digit binary number (which is usually converted to decimal for convenience).
- The recognizer creates a histogram for that new image. The new histogram is compared with the histogram it already has. It matches with the result and the best match results are returned giving the output of face recognized.

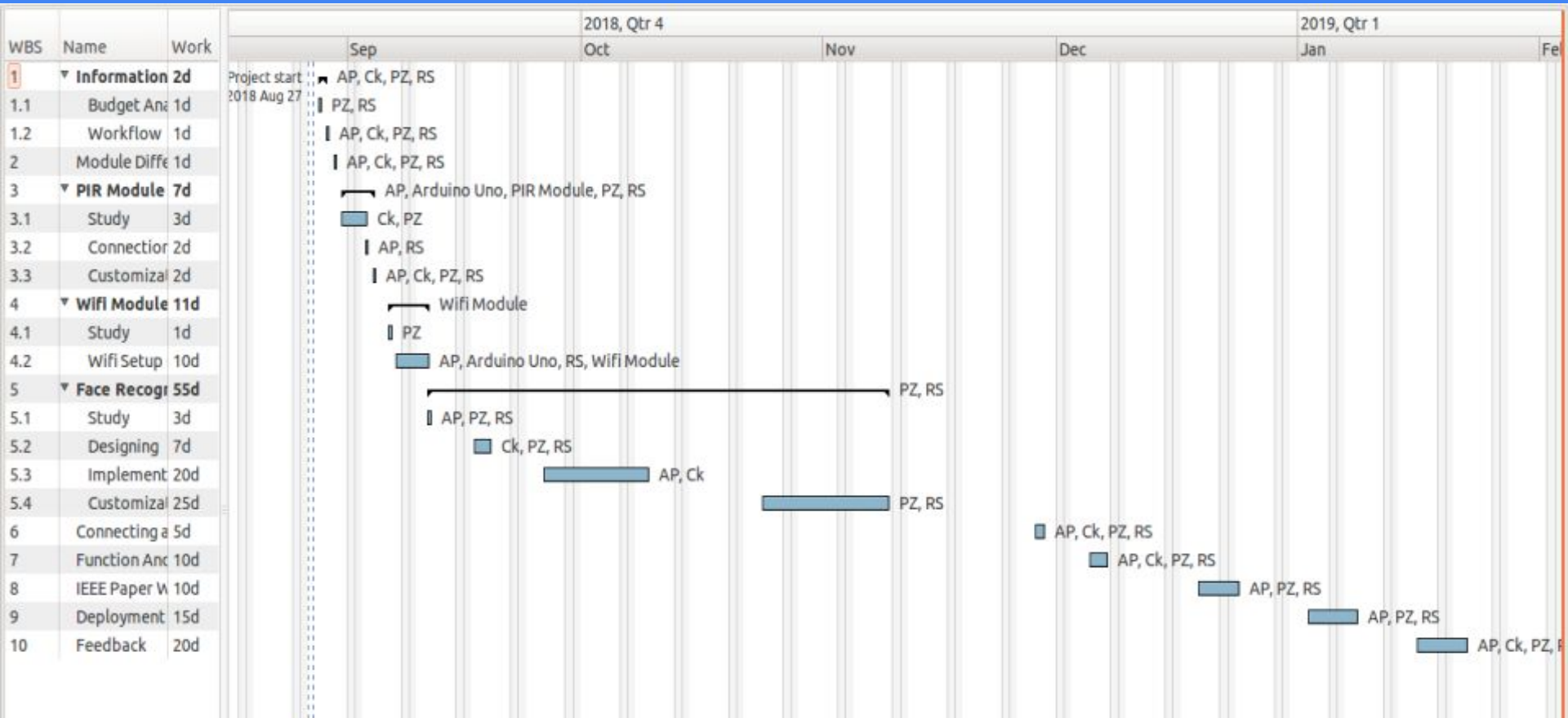
# Motion Detection Lights, Health and Fire Safety Module Test cases

| Sr no | Input to sensor                         | Expected output  | Actual output  | Remark                                      |
|-------|---|--|--|---|
| 1     | Motion detected by PIR sensor           | Toggle Lights  | Toggle Lights  | PIR takes over a minute to initialize       |
| 2     | No Motion Detected by PIR Sensor        | Waits for 30 sec<br>And then toggle lights OFF                                   | Waits for 30 sec<br>And then toggle lights OFF           | Waiting time ranges between 30 - 35 seconds |
| 3     | Continuous motion detected by PIR       | Lights remain ON   | Lights remain ON   |   |
| 4     | Gas sensor detects smoke/butane/methane | If gas density exceeds threshold value, emergency lights and buzzer is triggered | Emergency lights and buzzer triggered if gas is detected | Threshold value varies from place to place. |
| 5     | No Gas detected                         | No actuation   | No actuation   |   |

# Project-Plan

| WBS | Name                    | Start  | Finish | Work | Duration | Slack   | Cost   | Assigned to                         | % Complete |
|-----|-------------------------|--------|--------|------|----------|---------|--------|-------------------------------------|------------|
| 1   | ▼ Information Gathering | Aug 28 | Aug 29 | 2d   | 1d 2h    | 104d 6h | 0      | AP, Ck, PZ, RS                      | 10         |
| 1.1 | Budget Analysis         | Aug 28 | Aug 28 | 1d   | 4h       | 105d 4h | 0      | PZ, RS                              | 0          |
| 1.2 | Workflow                | Aug 29 | Aug 29 | 1d   | 2h       | 104d 6h | 0      | AP, Ck, PZ, RS                      | 0          |
| 2   | Module Differentiating  | Aug 30 | Aug 30 | 1d   | 2h       | 103d 6h | 0      | AP, Ck, PZ, RS                      | 0          |
| 3   | ▼ PIR Module            | Aug 31 | Sep 4  | 7d   | 2d 4h    | 100d 4h | 0      | AP, Arduino Uno, PIR Module, PZ, RS | 70         |
| 3.1 | Study                   | Aug 31 | Sep 3  | 3d   | 1d 4h    | 101d 4h | 0      | Ck, PZ                              | 0          |
| 3.2 | Connections             | Sep 3  | Sep 3  | 2d   | 1d       | 101d    | 0      | AP, RS                              | 35         |
| 3.3 | Customization and Imp   | Sep 4  | Sep 4  | 2d   | 4h       | 100d 4h | 0      | AP, Ck, PZ, RS                      | 35         |
| 4   | ▼ Wifi Module           | Sep 6  | Sep 11 | 11d  | 3d 4h    | 95d 4h  | 22,000 | Wifi Module                         | 0          |
| 4.1 | Study                   | Sep 6  | Sep 6  | 1d   | 1d       | 98d     | 0      | PZ                                  | 0          |
| 4.2 | Wifi Setup Connection   | Sep 7  | Sep 11 | 10d  | 2d 4h    | 95d 4h  | 22,000 | AP, Arduino Uno, RS, Wifi Module    | 0          |
| 5   | ▼ Face Recognition      | Sep 11 | Nov 9  | 55d  | 43d 4h   | 52d 4h  | 0      | PZ, RS                              | 0          |
| 5.1 | Study                   | Sep 11 | Sep 11 | 3d   | 1d       | 95d     | 0      | AP, PZ, RS                          | 0          |
| 5.2 | Designing               | Sep 17 | Sep 19 | 7d   | 2d 2h    | 89d 5h  | 0      | Ck, PZ, RS                          | 0          |
| 5.3 | Implementation          | Sep 26 | Oct 9  | 20d  | 10d      | 75d     | 0      | AP, Ck                              | 0          |
| 5.4 | Customization           | Oct 24 | Nov 9  | 25d  | 12d 4h   | 52d 4h  | 0      | PZ, RS                              | 0          |
| 6   | Connecting all Modules  | Nov 28 | Nov 29 | 5d   | 1d 2h    | 38d 6h  | 0      | AP, Ck, PZ, RS                      | 0          |
| 7   | Function And Security   | Dec 5  | Dec 7  | 10d  | 2d 4h    | 32d 4h  | 0      | AP, Ck, PZ, RS                      | 0          |
| 8   | IEEE Paper Work         | Dec 19 | Dec 24 | 10d  | 3d 2h    | 21d 5h  | 0      | AP, PZ, RS                          | 0          |
| 9   | Deployment and Patent   | Jan 2  | Jan 8  | 15d  | 5d       | 10d     | 0      | AP, PZ, RS                          | 0          |
| 10  | Feedback                | Jan 16 | Jan 22 | 20d  | 5d       |         | 0      | AP, Ck, PZ, RS                      | 0          |

# Project Plan(Gantt Chart)



# Results

The Proposed System's main objective was to help Specially Abled people by helping them to control and secure their home appliances and also making them aware of their environments by alerting them in case of emergencies.



Google Chrome browser window displaying a video recording interface. The address bar shows the URL: `https://www.google.com/`. The page title is "Google". The interface displays a grid of video thumbnails, each with a timestamp and a date. The thumbnails are arranged in three columns and eight rows. The first column contains thumbnails from 00:04:00 to 00:04:16. The second column contains thumbnails from 00:04:17 to 00:04:33. The third column contains thumbnails from 00:04:34 to 00:04:50. The thumbnails show a person's face, likely a video recording of a person. The interface also includes a search bar at the top and a taskbar at the bottom.

| Thumbnail | Time          | Date       |
|-----------|---------------|------------|
| 00:04:00  | 00:04:00 A.M. | 2019-03-19 |
| 00:04:01  | 00:04:01 A.M. | 2019-03-19 |
| 00:04:02  | 00:04:02 A.M. | 2019-03-19 |
| 00:04:03  | 00:04:03 A.M. | 2019-03-19 |
| 00:04:04  | 00:04:04 A.M. | 2019-03-19 |
| 00:04:05  | 00:04:05 A.M. | 2019-03-19 |
| 00:04:06  | 00:04:06 A.M. | 2019-03-19 |
| 00:04:07  | 00:04:07 A.M. | 2019-03-19 |
| 00:04:08  | 00:04:08 A.M. | 2019-03-19 |
| 00:04:09  | 00:04:09 A.M. | 2019-03-19 |
| 00:04:10  | 00:04:10 A.M. | 2019-03-19 |
| 00:04:11  | 00:04:11 A.M. | 2019-03-19 |
| 00:04:12  | 00:04:12 A.M. | 2019-03-19 |
| 00:04:13  | 00:04:13 A.M. | 2019-03-19 |
| 00:04:14  | 00:04:14 A.M. | 2019-03-19 |
| 00:04:15  | 00:04:15 A.M. | 2019-03-19 |
| 00:04:16  | 00:04:16 A.M. | 2019-03-19 |
| 00:04:17  | 00:04:17 A.M. | 2019-03-19 |
| 00:04:18  | 00:04:18 A.M. | 2019-03-19 |
| 00:04:19  | 00:04:19 A.M. | 2019-03-19 |
| 00:04:20  | 00:04:20 A.M. | 2019-03-19 |
| 00:04:21  | 00:04:21 A.M. | 2019-03-19 |
| 00:04:22  | 00:04:22 A.M. | 2019-03-19 |
| 00:04:23  | 00:04:23 A.M. | 2019-03-19 |
| 00:04:24  | 00:04:24 A.M. | 2019-03-19 |
| 00:04:25  | 00:04:25 A.M. | 2019-03-19 |
| 00:04:26  | 00:04:26 A.M. | 2019-03-19 |
| 00:04:27  | 00:04:27 A.M. | 2019-03-19 |
| 00:04:28  | 00:04:28 A.M. | 2019-03-19 |
| 00:04:29  | 00:04:29 A.M. | 2019-03-19 |
| 00:04:30  | 00:04:30 A.M. | 2019-03-19 |
| 00:04:31  | 00:04:31 A.M. | 2019-03-19 |
| 00:04:32  | 00:04:32 A.M. | 2019-03-19 |
| 00:04:33  | 00:04:33 A.M. | 2019-03-19 |
| 00:04:34  | 00:04:34 A.M. | 2019-03-19 |
| 00:04:35  | 00:04:35 A.M. | 2019-03-19 |
| 00:04:36  | 00:04:36 A.M. | 2019-03-19 |
| 00:04:37  | 00:04:37 A.M. | 2019-03-19 |
| 00:04:38  | 00:04:38 A.M. | 2019-03-19 |
| 00:04:39  | 00:04:39 A.M. | 2019-03-19 |
| 00:04:40  | 00:04:40 A.M. | 2019-03-19 |
| 00:04:41  | 00:04:41 A.M. | 2019-03-19 |
| 00:04:42  | 00:04:42 A.M. | 2019-03-19 |
| 00:04:43  | 00:04:43 A.M. | 2019-03-19 |
| 00:04:44  | 00:04:44 A.M. | 2019-03-19 |
| 00:04:45  | 00:04:45 A.M. | 2019-03-19 |
| 00:04:46  | 00:04:46 A.M. | 2019-03-19 |
| 00:04:47  | 00:04:47 A.M. | 2019-03-19 |
| 00:04:48  | 00:04:48 A.M. | 2019-03-19 |
| 00:04:49  | 00:04:49 A.M. | 2019-03-19 |
| 00:04:50  | 00:04:50 A.M. | 2019-03-19 |

Taskbar: 10:00 AM, 3/19/2019

# Conclusion

In this project the main focus is on controlling and processing the operation of various electrical appliances, Indication and Alert lights aiming to help the specially abled people.

The working model focuses on Automating the home ie; making it Smart, and providing it Security features at economical and efficient rates.



# References (Home Automation)

- [1] Matthias Mielke & Rainer Bruck "A home automation based environmental sound alert for people experiencing hearing loss." IEEE Conference 2016.
- [2] A.K.Gnanaseker, P.Jayavelu & V.Nagarajan "Speech recognition based wireless automation of home load with fault identification for physically challenged" IEEE Conference 2012.
- [3] Li Jiang, Da-You Liu, Bo Yang "Smart Home Research" IEEE Conference 2004.
- [4]Shopan Dey, Sandip Das, Ayon Roy "Home Automation Using Internet Of Things" IEEE Conference 2016.
- [5]Muhammad Asadullah, IEEE student member, Khalil Ullah, IEEE member "Smart Home Automation System Using Bluetooth Technology" IEEE 2017.

# References (Face recognition)

- [7] Dwi Ana Ratna Wati, Dika Abadianto “Design of Face Detection & Recognition System for Smart Home Security Application” IEEE 2017.
- [8] Ayman Ben Thabet, Nidhal Ben Amor “Advanced Smart Doorbell System Based on Face Recognition” IEEE 2015.
- [9] T Archana, T. Venugopal “Face Recognition:A Template Based Approach” IEEE 2015.
- [10] Mohammadjaved R. Mulla, Rohita P. Patil, Dr.S.K.Shah “Facial Image Based Security System Using PCA” IEEE 2015.
- [11] Yashwanth Sai, Vijai Chandra Prasad, Niveditha, Sasipraba, Vigneshwari & S.Gowri “Low cost automated Facial Recognition system” IEEE 2017