

A Synopsis On

An Intelligent Home Automation System For Specially Abled

Submitted in partial fulfillment of the requirements
of the degree of

Bachelor of Engineering

in

Information Technology

by

Rohan Shah (15104024)
Prasad Zende (15104023)
Aishwarya Panhale (15104012)
Chinmay Karnik (15104009)

Guide & Co-Guide

Prof.Rahul Ambekar
Prof.Selvin Furtado
& Prof.Vishal Badgujar



Department of Information Technology
A.P. Shah Institute of Technology
G.B.Road,Kasarvadavli, Thane(W), Mumbai-400615
UNIVERSITY OF MUMBAI
2018-2019

CERTIFICATE

This is to certify that the project Synopsis entitled “*An Intelligent Home Automation System For Specially Abled*” is a bonafide work of “*Rohan Shah(15104024),Prasad Zende(15104023),Aishwarya Panhale(15104012),Chinmay Karnik(15104009)*” submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of *Bachelor of Engineering* in *Information Technology*.

Prof. Vishal Badgajar
Co-Guide

Prof. Rahul Ambekar
Prof. Selvin Furtado
Guides

External Examiner

Prof.Kiran B. Deshpande
Head Of Department

Dr. Uttam. D. Kolekar
Principal

Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Rohan Shah (15104024)

Prasad Zende (15104023)

Aishwarya Panhale(15104012)

Chinmay Karnik(15104009)

Date:

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 at cheaper rates.

Though various techniques have been proposed and are available currently, most of them are not user friendly for the specially abled people and thus a friendly system has been developed for them. To demonstrate the feasibility and effectiveness of this system, devices such as light switches, power plug, gas sensor and motion sensors have been integrated with the proposed home control system. These devices can be controlled through a web application or via android based smart phone application.

Unlike most of available home automation system in the market the proposed system is scalable that one server can manage many hardware interface modules as long as it exists on WiFi network coverage. System supports a wide range of home automation devices and security components.

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. This system presents the development of Graphical User Interface (GUI) based on face recognition system and NodeMCU microcontroller as an input/output carrier to switch on/off magnetic lock for door lock security system. The development is implemented by interfacing GUI built in HTML with microcontroller to auto-switching magnetic lock for door lock security system. Thingspeak server is used to interface between GUI and NodeMCU microcontroller that allows input data transmission from GUI to microcontroller. The developed system shows that the auto-switching mode transmission being implemented via NodeMCU microcontroller. It was also found that GUI can successfully switch on and off the magnetic lock when an authorized image from GUI database is identified.

The proposed system is better from the scalability, cost efficiency and flexibility point of view than the commercially available home automation systems.

Introduction

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.

A home appliance is a device or instrument designed to perform a specific function, especially an electrical device, such as a refrigerator, for household use. The words appliance and devices are used interchangeably. Automation is today's fact, where things are being controlled automatically, usually the basic tasks of turning ON/OFF certain devices and beyond, either remotely or in close proximity. Automation lowers the human judgment to the lowest degree possible but does not completely eliminate it.

The concept of remote management of household devices over the internet from anywhere, any time in the world today can be a reality. Assume a system where from the office desk, the user could view the status of the devices and decides to take control by tuning his TV set to his favourite channel, turns on the cooling system, say the air conditioner, and switches on or off some of the lights. This user could walk back home and only find a very comfortable, pleasant home.

Degradation or loss of sensory perception can limit the quality of life of an affected person. This is especially the case for people experiencing hearing loss or loss of vision. To provide specially abled (i.e. hard-of-hearing, deaf, deafened) with information about sound, different assistive technologies were developed to support them in various situations and ways.

The arguably best-known technologies are hearing aids and cochlear-implants. This kind of assistive technology aims to improve or restore hearing. However, different other devices are available that indicate when an acoustic event has happened. A selection of such indicating devices is available at the marketplace for many years. But, despite the technological progress in the last years, the basic principles and offered functionality have not changed considerably. They are bound to indoor environments and are targeted to specific events, e.g. the ringing of the doorbell or telephone.

For each new sound a new detector has to be bought. Either the detector indicates an event directly, usually by a flashing light, or it sends a message to a receiver using a wireless connection. When receiving the message the receiver indicates the sound by visual signal (flashing light or illuminating an icon) and/or by vibration.

The recent developments in technology which permit the use of Bluetooth and WiFi have enabled different devices to have capabilities of connecting with each other. With this in mind, an internet based home automation system for remote control of home appliances is designed.

Objectives

The objective of this project is to build a smart home system for specially abled people which can be used to control the home appliances via internet. As technology is advancing so houses are also getting smarter. The home automation device that you build can be integrated with almost all the home appliances.

To facilitate the wireless connectivity with the system, the microcontroller will be embedded with a WiFi module. This establishes the internet connection to the system and all the home appliances can in turn be connected and controlled by internet. It helps to automate the switches to centralized system unlike traditional conventional switches

Android controlled smart home automation should be able to control the home appliances using wireless network with effectively and efficiently. The Proposed Systems main objective helps 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. Additional features which help specially abled people with notification system of door bell with alert lights and security provided by face recognition system.

Key Points of the project are as follows:

1. To make Cost-Effective System for Differently abled.
2. To Provide Security.
3. To Make Smart Home.
4. Minimize The Human Effort.

Literature Review

The base paper referred for the project was conducted by Matthias Mielke and Rainer Bruck on Home automation system for people experiencing hearing loss. This research produced a system that helps deaf people to get notified regarding the changes and alert in the house through wireless smartwatch with the help of bluetooth technology.

Study by Dwi Ana Ratna Wati and Dika Abadianto based on design of face detection and recognition system for smart home security. The methodology used was MyRIO connected to computer through wireless services. MyRIO provides educators with an embedded, WiFi-enabled solution to deliver an engaging approach to learning controls, investigating mechatronics, and designing imaginative capstone projects. The Table below consist of methodology merit and limitations of some IEEE papers studied for this project:

Sr No	Author	Methodology	Merits	Limitations
1	Matthias Mielke & Rainer Bruck (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.
2	Dwi Ana Ratna Wati, Dika Abadianto (International Conferences on Information Technology and Electrical Engineering, 2017)	MyRIO is used and is connected to computer with wifi 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.
3	T Archana, T. Venugopal (International Conference on Green Computing and Internet of Things, 2015)	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.	On Frontal view recognition is accepted but factors are: 1. Facial Expression 2. Change in plane 3. Illumination. 4. Rotation of head

<u>4</u>	Shopan Dey, Sandip Das, Ayon Roy (IEEE Conference, 2016)	Using IOT Control home automation through interconnection software-PHP point to point web socket. Amazon cloud server for socket connection. Equipments used:Pi relay, sensor-humidity & temperature.	To operate or control various equipments, machinery & other electrical & electronic appliances remotely.	If maintenance is not taken care of properly software and appliance i.e; hardware synchronization can be influenced.
<u>5</u>	Yashwanth Sai, Vijai Chandra Prasad, Niveditha, Sasipraba, Vigneshwari & S.Gowri (IEEE Conference, 2017)	PCA algorithm is used for face recognition & take the dimensions of face messages and convert to grayscale. High prevalent CCTV cameras for intruders.Uses Raspberry PI & camera modules and sensors alerting users through email or mobile notification sms 7 generate log of default entry & exits.	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.	An authority is required to be present to do surveillance to watch the activities.

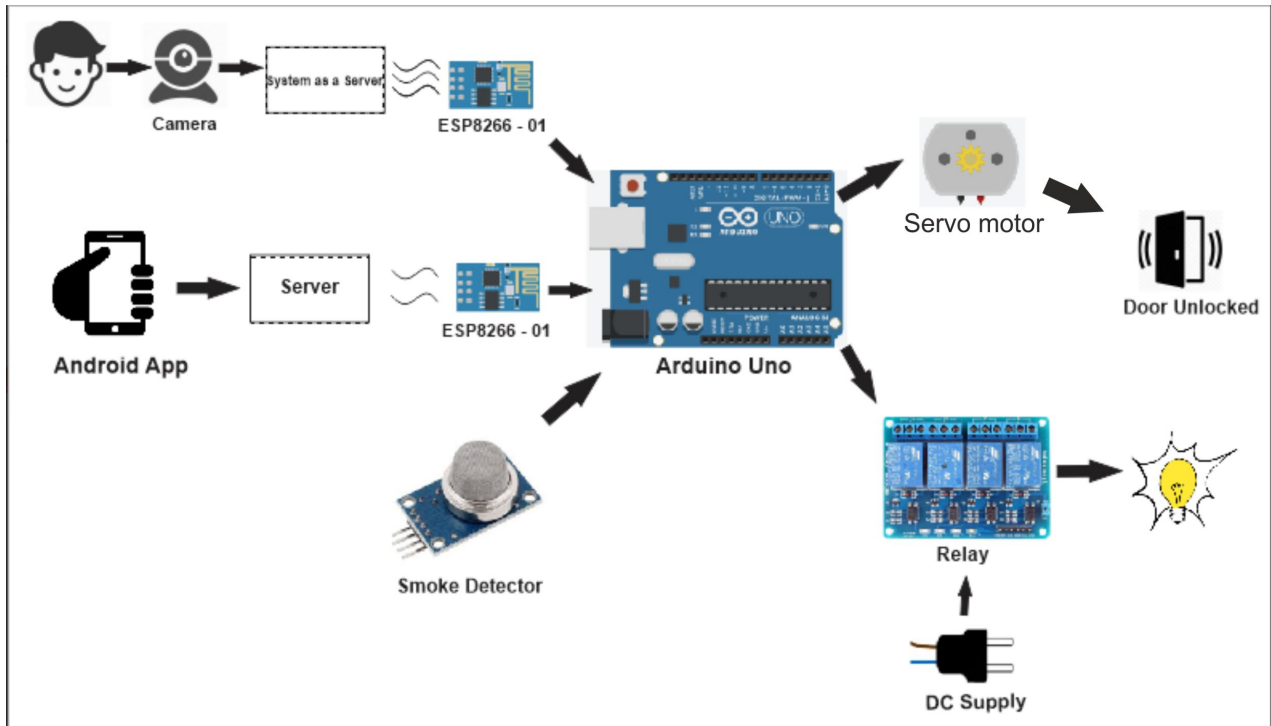
Problem Definition

Specially abled people face many challenges like not able to see walk or hear. To ease their lifestyles a system is needed to be developed that helps them to easily control the home appliances using just a mobile application. Replacing the manual work of controlling the appliances using switches, to controlling them using smartphone devices is required especially for the specially abled people.

Security being one of the serious issues faced by people over the last years, any system developed must be secured. For a mass of people who face challenges for just day to day normal activities security becomes one of the major concern for them. A face recognition system that makes their house secure is required.

Automating and Securing homes using cost efficient equipments and technologies is very complicated. With so many Minds developing systems to cover all these constraints very few are affordable to mass of specially abled.

Proposed System Architecture/Working



[Fig.1.1]Hardware Architecture

Fig.1.1 shows the hardware architecture of the proposed system consisting of various smart IoT components that are used to automate and secure the house. The application that is provided to the user is secured with one step authentication (User ID and Password). Its user interface consists of various interactive buttons and other elements that help user to navigate and provide the control over the electrical appliances of the home. Each action on the button sends values 1(ON) or 0(OFF) to the Thingspeak server on its respective field. The application gives HTTP POST requests to the server and the server records all the values received from the applications HTTP POST request in the form of JSON i.e; key-value pairs.

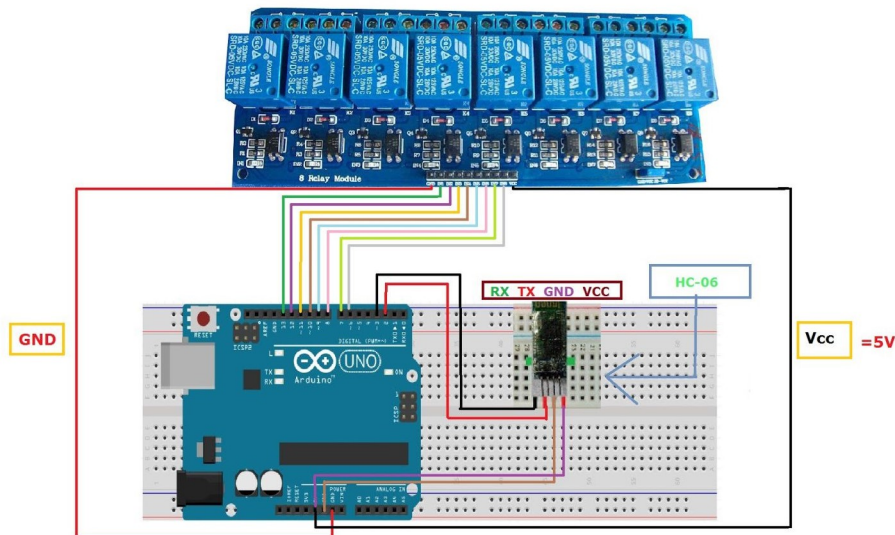
The Thingspeak server consists of fields that are assigned to particular appliances of the home. Each field has Each appliance has its own field that is connected to both the application and the Arduino board via ESP8266 module. The server records all the activities and stores the data in key-value format received from the application requests. This data is read by the Arduino board to further control the appliances via internet.

The ESP8266 module of the arduino setup is kept on polling mode so that it can read the data from the Thingspeak server constantly. The module constantly sends HTTP GET Request to the server to which the server provides values of the demanded field. As per the generated values the arduino board takes the decision whether to turn ON the appliance or turn it OFF using a relay module. Along with the control over electrical appliances of the house, the system makes use of various sensors like gas, water level and PIR (passive infrared

sensor) used to alert and assist the specially abled people. These sensors sense the change in environment and actuate with a particular action like sending notification to user and turning on emergency lights.

Security is provided to the house with the use of a smart face recognition system that makes use of Machine learning and image processing. The database of the system consists of known faces that should be allowed access to the house. The Main Door is equipped with a camera responsible to capture the image of the person at the door when the doorbell is hit. This image is then stored in the database. Once the image is captured it is compared with the images stored in the database. If the captured image matches with one in the database then the server value is updated with 1(TRUE) or 0(FALSE).

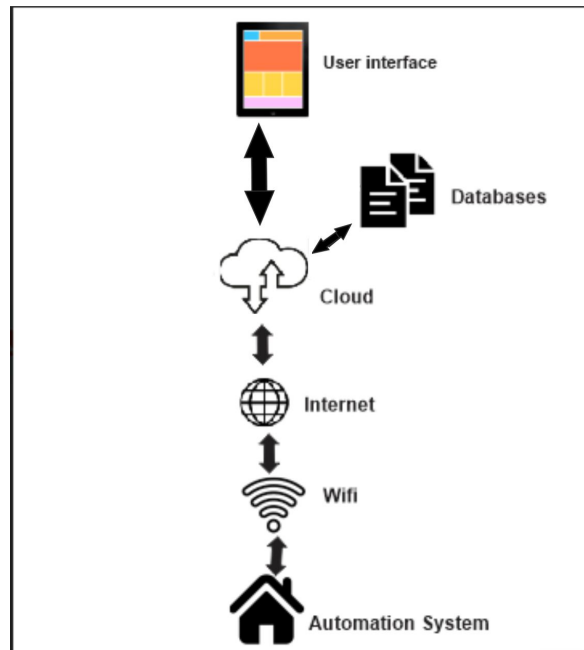
The ESP8266 which is kept on polling reads the value and if the server field value is true indicating that face is recognized, the servo motor connected to the arduino actuates by opening the latch of the main door and records the timestamp and logs of the entry also sending a notification to the mobile of the user. If the server field value is false indicating that the face is unrecognized it saves the image and records the timestamp and logs of the entry but does not actuates the servomotor.



[Fig.1.2] Circuit Diagram

Fig.1.2 Shows the circuit diagram of the proposed automation system with module ESP8266, Relay module and Arduino board.

This circuit diagram shows the connection of relay with arduino board and the relay is controlling appliances by the data received from the thingspeak server through wifi.



[Fig.1.3] Network architecture

Fig.1.3 Shows the Network Architecture and the request flow of the Proposed architecture. The Authentication details of the user are stored in a Local Databases connected to server. User is connected to the Internet via Wifi Routers which are also connected to the Automation System.

The request given by the user on the mobile application is forwarded to the server via internet which is then forwarded to the Proposed System connected through Wireless network.

Summary

The work presented in this report is related to an Intelligent Home Automation System for Specially Abled.

- Home Automation System.

In this, we have implemented an application which provides one step authentication to the user to help the user and to provide control over the electrical appliances of the home. Sensors like PIR and Ultrasonic sensors are used to alert and assist the specially abled people. The Thingspeak server records the data and stores it to a repository. The application requests are forwarded to the Arduino board through the server to control the appliances through the internet.

- Face Recognition Based Security System.

A system making use of smart face recognition system to secure the house with the use of various Image Processing and Machine Learning is to be implemented. Various face recognition algorithms like Eigen-Vector, PCA, Keras have been used to implement a face recognition system out of which one of the algorithm will be implemented.

The proposed system helps make the home of a specially abled person, smarter and secure by helping them control appliances remotely within the network. It will also make the home secure by implementing a security system using face detection techniques installed at the main-door of the home.

References

- [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”, Proceedings of the Third International Conference on Machine Learning and Cybernetics, Shanghai, 26-29 August 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.
- [6] Dwi Ana Ratna Wati, Dika Abadianto, “Design of Face Detection & Recognition System for Smart Home Security Application, International Conferences on Information Technology and Electrical Engineering, IEEE 2017.
- [7] Ayman Ben Thabet, Nidhal Ben Amor, “Advanced Smart Doorbell System Based on Face Recognition, 16th international conference on Sciences and Techniques of Automatic control computer engineering - STA’2015, Monastir, Tunisia, December 21-23, IEEE 2015.
- [8] T Archana, T. Venugopal, “Face Recognition:A Template Based Approach, International Conference on Green Computing and Internet of Things, IEEE 2015.
- [9] Mohammadjaved R. Mulla, Rohita P. Patil, Dr.S.K.Shah, “Facial Image Based Security System Using PCA, International Conference on Information Processing (ICIP) Vishwakarma Institute of Technology. Dec 16-19, IEEE 2015.
- [10] Yashwanth Sai, Vijai Chandra Prasad, Niveditha, Sasipraba, Vigneshwari & S.Gowri, “Low cost automated Facial Recognition system, IEEE 2017