SMART HOME - SPEECH RECOGNITION BASED HOME AUTOMATION AND SECURITY USING IOT

A PROJECT REPORT

Submitted By

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of

Master of Computer Applications

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DECLARATION

I undersigned hereby declare that the project report (Smart Home - Speech Recognition Based Home Automation and Security Using IOT), submitted for partial fulfillment of the requirements for the award of degree of Master of Computer Applications of the APJ Abdul Kalam Technological University, Kerala is a bonafide work done by me under supervision of Assistant Prof. Vinitha V. This submission represents my ideas in my own words and where ideas or words of others have been included, I have adequately and accurately cited and referenced the original sources. I also declare that I have adhered to ethics of academic honesty and integrity as directed in the guidelines of the Institutional Ethics Committee of the college and have not misrepresented or fabricated any data or idea or fact or source in my submission. I understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title.

Place : Trivandrum

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DEPARTMENT OF COMPUTER APPLICATIONS

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CERTIFICATE

This is to certify that the report entitled **Smart Home - Speech Recognition Based Home Automation and Security Using IOT** submitted by **Shijo Shaji** to the APJ Abdul Kalam Technological University in partial fulfillment of the requirements for the award of the Degree of Master of Computer Applications is a bonafide record of the project work carried out by him under my guidance and supervision. This report in any form has not been submitted to any University or Institute for any purpose.

Internal Supervisor   External Supervisor

Head of the Dept

ACKNOWLEDGEMENT

ABSTRACT

The project aims in designing a system which makes operating of electrical appliances in home through Android mobile phone possible. The controlling of electrical appliances is done wirelessly through speech recognition application in android phone and by using the Wi-Fi feature present in it. Here in this project, the Android smartphone is used as a speech-based remote control for operating the electrical appliances. The project also aims to deal with home security like gas leakage and door tampering using sensors. It also helps to minimize the electric usage and notify the user about security aspects through alert notifications. The project uses the Arduino microprocessor and sensors to control and monitor usage. The project also uses android IDE platform to give a voice command and to monitor the usage and to display alert messages.

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Chapter 1

Introduction

The Wireless Home Automation System is an integrated system to facilitate elderly and disabled people with an easy-to-use home automation system that can be fully operated based on speech commands. The system is portable and constructed in a way that is easy to install, configure, run, and maintain. Combining voice recognition technology to home automation systems make the system more user friendly and easy to operate. Normal people require home automation to satisfy their needs and comfort while for physically challenged people it is a social challenge. It can provide great assistance. Home automation systems can be labeled to two medium in which how it is connected and they are either wired or wirelessly connected. The main difference between these two kinds is that home appliances are linked wirelessly to a central controller if it a wireless home automation system. On the other hand, the appliances are connected to a central controller if the medium use wired communication method. Wireless system had been introduced in order to dispose of wired communication among home appliances. The microcontroller control the appliance based on the information given to it. The proposed solution will need to be easy to use, simple, secure, and robust and be useful on most of the smartphones.

Study's shows that seventy-five percent of the market share is Android and a total of one hundred and nine million android smartphone were shipped in the second half of 2018. Android smartphone became the top operating system in the market in the present time worldwide and it became the most popular operating system known to man.

Chapter 2

Requirement Analysis

2.1 Purpose

The main objective of this project is to build a smart home device which can be used to control the home appliances via the internet using speech. The home automation device that the project tries to build can be integrated with almost all the home appliances and can be used to control them remotely from any part of the world. Automation plays an increasingly important role in the global economy and in day by day encounter. Engineers work to associate automated devices with mathematical and organizational tools to create complex systems for rapidly expanding parameters of applications and human activities. For the development of smart cities, there is a need to automate everything, so the concept of the smart home automation system is an idea which is used to make the city smart.

A Smart Home is one that provides comfort, security and gives the feeling of home to house members. Smart homes also provide Energy efficiency (low operating cost) and convenience at all times, for every individual at home. Home automation means monitoring and control of household objects intelligently for effective usage. The device can also be connected to an Android App which you can develop on your own using some applications like MIT App inventor etc. By using this app, you will be able to monitor and control the home appliances from any part of the world with ease. To facilitate the wireless connectivity with the system, the Arduino-NodeMCU with inbuilt WiFi module is used. This establishes the internet connection to the system and all the home appliances can, in turn, be connected and controlled by the internet.

2.2 Overall Description

The proposed system create a home automation system at low cost and easy to use for users and it will also benefit the clients by making it cost effective and the most important advantage is that it will make the house a much more convenient

place for the users especially for the elders and the handicapped. The voice command function will be given to control any appliances or devices at home. This will provide better communication in an automated home as compared to normal homes.

2.2.1 Product Functions

- Establishing a wireless network communication between the Android and the home automation system, using a microcontroller.

- Create a simple yet reliable home automation system using Arduino-NodeMCU as a microcontroller that will be the medium between the android and the home appliances.

- To create a suitable android app that will work efficiently with the Arduino-NodeMCU board in order to control the home appliances.

- Program the Arduino-NodeMCU board in a way that will let it interact with the android app.

- Integrate sensors with Arduino board to provide security and to minimise the electricity usage.

- Program the android app which helps to control the home appliances using speech and also notify the user about the security aspects of the home.

2.2.2 Hardware Requirements

- Intel Core i7 7th gen

- 16 GB RAM

- 100 mbps Network Interface Card

- Arduino NodeMCU Microcontroller

- Monochrome 0.96" 128x64 OLED Graphic Display

- Reed Switch

- MQ-6 Gas Sensor

- Single Channel Relay

- LDR Light Sensor

- Servo Motor

- Breadboard and Jumper Wires

2.2.3 Software Requirements

- Linux

- Arduino IDE

- Kodular App Developer

- Firebase Database

2.3 Functional Requirements

Functional requirements represent the intended behaviour of the system. This behaviour may be expressed as services, tasks or functions that the specified system is required to perform. The system should be designed such a way that most of the customers consider the basic system should contain some important functions such as turn on or turn off the lamp, locking or opening the door, and controlling the cooling system in their home, and they prefer all these functions can be control by voice. This requirement is the basic request of most customers and considering the voice control application are widely used in the cellphone market. Cellphone application is also a basic and essential requirement for the customers, considering more and more people prefer using the cellphone in their daily life, the home automation should also be applied in this field, which is the most convenient and comfortable method to control the home devices. ISO and Android are two types of application platforms, considering the market information and development cost, the proposed system use Android application platform to develop a voice based home automation system. Some customers also need to satisfy the security need which is also added in the proposed system. Besides this parts, using this application in a remote place is also an important point for the customers, they wish to use this system without the limitation of the distance, therefore, applying the WIFI and Bluetooth and another high-speed type of communication is necessary. These parts are the main points in the customer's requirements. There might be some other points which the customers mentioned, considering some people prefer using button rather than voice or they may be inconvenient to use voice control in some places, button control is also needed in the proposed system design.

2.4 Non Functional Requirements

A non-functional requirement is a requirement that specifies criteria that can be used to judge the operation of a system, rather than specific behaviours. This

should be contrasted with functional requirements that define specific behaviours or functions . According to the FURPS definition of non-functional requirements, it divide the non-functional requirements into 5 parts: Accessibility, Usability,Reliability, Performance and supportability.

- **Accessibility**

  Accessibility is the degree to which a product, device, service, or environment is available to as many people as possible. Accessibility can be viewed as the ability to access and benefit from some system or entity. In this case, the system should be accessible to different kind of people and different kind of devices. People can use the control system in different kind of devices based on Android Platform .

- **Usability**

  Usability is the ease of use and learnability of a human-made object. Though the system based on voice control there are still some concerns about usability. The voice recognition systems usually have troubles with some voice with an accent, however, a user requires should be accepted and executed. If the system cannot recognize or fully recognize the user's command, it should give the user some related options based on the command. Also a system based on voice control doesn't mean the system can only be controlled by voice commands. Users should be able to control the system by press the buttons. The people can also control the system by some touch-based control method.

- **Reliability**

  Reliability emphasizes dependability in the life cycle management of a product. Dependability, or reliability, describes the ability of a system or component to function under stated conditions for a specified period of time. People usually live in a house for 5 years or longer, so both the software and the hardware should be able to work a long time without maintenance. The hardware in the system should be safe enough to control the switch of some electronic equipment. If the user wants to cut off the power, the user should be able to turn on and turn off the smart element by hand. Also, a user should be able to track all the command has been made and the system should keep tracking users commands.

- **Performance**

  Performance is characterized by the amount of useful work accomplished by a system compared to the time and resources used. A user should get feedback in a very short time after he gives the commands, just like talking to real people.

The processing time here should be short enough and the system should rely on the server to do the recognition job and complex calculation works.

- **Supportability**

  Supportability refers to the ability of technical support personnel to install, configure, and monitor computer products, identify exceptions or faults, debug or isolate faults to root cause analysis, and provide hardware or software maintenance in pursuit of solving a problem and restoring the product into service. Incorporating serviceability facilitating features typically results in more efficient product maintenance and reduces operational costs and maintains business continuity. suggests that there should be a set of documentation of the system so that the system can be maintained with some documentation. Also suggests that there should be a software update to keep the software working in the best condition.

Chapter 3

Design And Implementation

3.1 Overall Design

Home automation is computerization of the home, housework or household action. Home automation may incorporate a control unit for controlling of lighting, machines, and different frameworks, to give enhanced accommodation, solace, better energy saving, productivity and security. The idea of home automation has been around for quite a while and items have been available for a considerable number of years, however, no such arrangement has gone through to the standard yet. Home computerization for the elderly and debilitated can give expanded personal satisfaction to persons who may generally need parental figures or institutional consideration. It can likewise give a remote interface to home apparatuses or the automation system itself, through phone line, remote transmission or the web, to give control and observe and monitor by means of an smartphone.

3.2 Hardware Interfaces

Hardware and controllers are an essential part of the projects that are expected to bring about some electrical or mechanical changes in their environment. To bring about any change in the physical world, the computer that runs a program can only send out signals in the form of electrical pulses. These pulses are of no use unless they are properly coupled to a well-developed hardware system that can perform the physical changes to realize what the software intended to do. This part describes the implementation of the whole system, from Arduino-NodeMCU board to the appliances. This system is integrated using Arduino-NodeMCU board integrated with WiFi module, relay modules, sensors, an android device, an Android app to control the Arduino board, and other electronic components.

3.2.1 LDR (Light Dependent Resistance)

This device is used as a sensor. The special feature of this sensor is that the resistance of this sensor is inversely proportional to the light falling on it. The usability of this device is to get real-time feedback of the luminance of the light or

to determine if the light is on/off. If the light is ON, the LDR will offer minimum resistance and the voltage drop across the pin of the microcontroller would be maximum. In the case when the light is OFF, the voltage drop across the pin of the micro controller would be minimum, this way the microcontroller can sense if the light is ON/Off. This not only gives the user a real-time status of the element (light) but also informs the user in case the light fails to respond in the desired manner. It realizes the following system requirements.

3.2.2   NodeMCU

NodeMCU is an open source LUA based firmware developed for ESP8266 WiFi chip. By exploring functionality with ESP8266 chip, NodeMCU firmware comes with ESP8266 Development board/kit i.e. NodeMCU Development board. NodeMCU Dev Kit/board consist of ESP8266 WiFi enabled chip. The ESP8266 is a low-cost Wi-Fi chip developed by Espressif Systems with TCP/IP protocol. NodeMCU Dev Kit has Arduino like Analog (i.e. A0) and Digital (D0-D8) pins on its board. It supports serial communication protocols i.e. UART, SPI, I2C etc. Using such serial protocols NodeMCU can connect it with serial devices like I2C enabled LCD display, Magnetometer HMC5883, MPU-6050 Gyro meter Accelerometer, RTC chips, GPS modules, touch screen displays, SD cards etc.
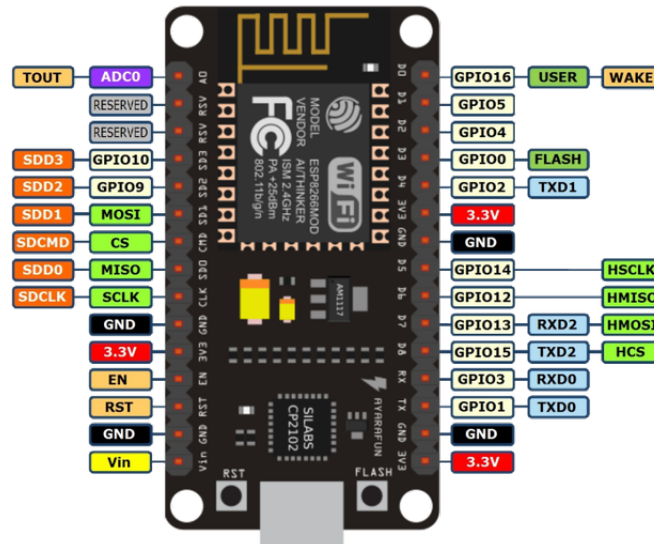

Figure 3.1: The pinout of NodeMCU

3.2.3   Single channel Relay

A Relay is a digital switch to control much higher voltages and currents than your normal Arduino boards does. When inputs a logic voltage, the relay will switch to allow current to flow or cutoff, depending on your wiring. A Relay usually

consists of a coil, 1 common terminal, 1 normally closed terminal and one normally open terminal. When the coil is energized, the common terminal and the normally open terminal will have continuity.

3.2.4   Servo motor

A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate an object at some specific angles or distance, then you use servo motor. It is just made up of a simple motor which runs through servo mechanism. If the motor is used is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called an AC servo motor. It help to get a very high torque servo motor in a small and lightweight package. Due to these features they are being used in many applications like a toy car, RC helicopters and planes, Robotics, Machine etc.

3.2.5   MQ-6

The MQ6 Gas Sensor module is useful for gas leakage detection. They are used in gas leakage detecting types of equipment in home and industry, are suitable for detecting of LPG, iso-butane, propane, LNG, avoid the noise of alcohol, cooking fumes and cigarette smoke. Due to its high sensitivity and response time, measurements can be taken as soon as possible. The sensitivity of the sensor can be adjusted by using the potentiometer.

3.2.6   Door tampering sensor

A reed switch is an electromagnetic switch used to control the flow of electricity in a circuit. They are made from two or more ferrous reeds encased within a small glass tube-like envelope, which become magnetised and move together or separate when a magnetic field is moved towards the switch. The switch effectively works like a gate, or a bridge, in an electric circuit so when the two reeds are in contact, electricity can flow around the circuit operating a device. Unlike mechanical switches they do not require something or someone to physically flick them on or off, they are controlled completely by invisible magnetic fields.

3.2.7   OLED Display

This display is made of 128x64 individual white OLED pixels, each one is turned on or off by the controller chip. Because the display makes its own light, no back-light is required. This reduces the power required to run the OLED and is why the display has such high contrast. Due to its crispness the proposed system

use this display. The design is completely 5V-ready, with an onboard regulator and built-in boost converter. It's easier than ever to connect directly to your 3V or 5V microcontroller without needing any kind of level shifter.

3.3   Software Interfaces

Software interfaces (programming interfaces) are the languages, codes and messages that programs use to communicate with each other and to the hardware. This interaction involves the how the user can interact with the application through involving both the hardware and the software itself.

3.3.1   Arduino IDE

The Arduino integrated development environment (IDE) is a cross-platform application that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards. The source code for the IDE is released under the General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring.The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that is compiled and linked with a program stub main() into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in the hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

3.3.2   Firebase

Firebase is a mobile and web application development platform developed by Firebase, Inc. in 2011, then acquired by Google in 2014. As of October 2018, the Firebase platform has 18 products, which are used by 1.5 million apps. Firebase Auth is a service that can authenticate users using only client-side code. It supports social login providers Facebook, GitHub, Twitter and Google. Additionally, it includes a user management system whereby developers can enable user authentication with email and password login stored with Firebase. Firebase provides a real-time database and backend as a service. The service provides application developers with an API that allows application data to be synchronized across clients and stored on Firebase's cloud. The company provides client libraries that enable integration with

Android, iOS, JavaScript, Java, Objective C, Swift and Node.js applications. The database is also accessible through a REST API and bindings for several JavaScript frameworks such as AngularJS, React, Ember.js and Backbone.js. The REST API uses the Server-Sent Events protocol, which is an API for creating HTTP connections for receiving push notifications from a server. Developers using the real-time database can secure their data by using the company's server-side-enforced security rules.

3.3.3 Android IDE

Kodular is an online app building platform to build beautiful apps. Kodular is a website/tool that allows users without too much technical knowledge to start developing applications for smartphones and tablets. In that sense, we know about WordPress, a website that allowed, in a very simple way and without requiring programming knowledge, create web pages. Something similar but with applications for the Android operating system looks for Kodular, whose creators already have experience because it is an evolution of Makeroid, a platform based on App Inventor of MIT that has recently changed its name. Its operation is very simple and is that creating applications only requires dragging components (the basic visual elements of an application, the interface) to a smartphone that has a blank screen. These components can be text boxes, or side or floating menu buttons. To understand all this, it is ideal to go through its related videos on YouTube. The applications born from Kodular, in addition, have a nice appearance, because the components have the style of the material design guides. Some of these components are visible and allow interaction, while others are in visible responsible for obtaining data from the devices, to notify changes, etc.

3.4 System Design

The System Design is the combination of security alarming framework and home automation. In this system, the light is controlled using a single relay which is connected to pin D5. The door is controlled by a servo motor which is connected to Arduino using pin D2. LDR sensor senses the result and uploads it to cloud firebase using Arduino pin A0. Gas sensor upload sensed result using pin D1and door Sensor using pin D0. The working of Air Controller(AC) is simulated using a display and is connected to pin D3 and D4. The buzzer will alarm when the Gas leakage occurred or when the door has tampered. The speech module in Android is used to give a voice command and is updated to the cloud, it can also be control manually. When the security of the proposed system is compromised, an alert message with an alarm notification is given to the user using the notification module.
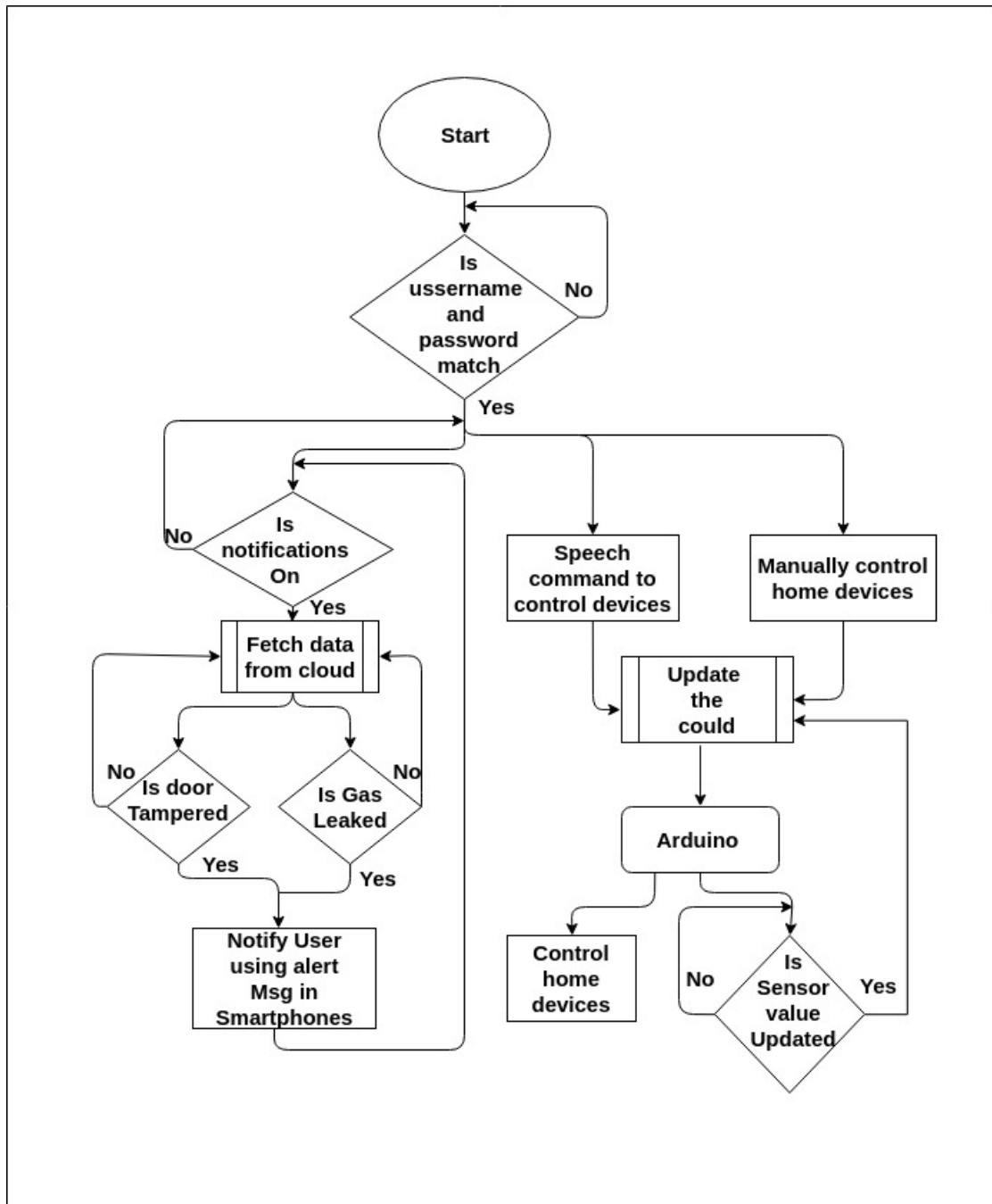
Figure 3.2: Flowchart of Proposed System

The Proposed framework aims to give the most straightforward and effective approach to connect home appliances by giving voice commands in human (common) language. It also taking out the tedious procedure of navigating different application screens with only one voice direction. Basically, the client is authenticated by entering the predetermined username and password in the mobile. The customer sends voice directions to the mobile, which deciphers the message and updates the cloud and the Arduino sends the correct request to the specific apparatus.

The smartphone act as a central console, it figures out what action to be done by which machine to fulfil the customer solicitation.

The machines are controlled with the smartphone through an Arduino NodeMcu Board that sets up the possibility of the Internet of Things. The Arduino Boards are customized so that interfaced apparatuses respond to mobile inputs. Our task automates the activity of each and every machine in the house like light, AC, door, which greatly reduces the power consumption because of abundance use/wastage of the apparatus administrations. To meet the security, two sensors are mainly used, one to detect the door tampering, which when an intruder tries to open the locked door; an alert message notification will send to the owner. The second sensor is used to detect the gas leakage at the kitchen. Then also an alert message notification will send to the owner and the electricity supply to the kitchen will be cut. It can be restored by the owner using smartphone itself. The module will kill the caution after a fixed time delay. The warning will be activated again when the module identifies any compromise to security and the owner will get the notification again and the procedure proceeds so on.

3.5   DataFlow Diagram

A data flow diagram (DFD) is a graphical representation of the "flow" of data through an information system, modelling its process aspects. A DFD is often used as a preliminary step to create an overview of the system without going into great detail, which can later be elaborated. DFDs can also be used for the visualization of data processing (structured design).

A DFD shows what kind of information will be input to an output from the system, how the data will advance through the system, and where the data will be stored. It does not show information about process timing or whether processes will operate in sequence or in parallel, unlike a traditionally structured flowchart which focuses on control flow, or a UML activity workflow diagram, which presents both control and data flows as a unified model.
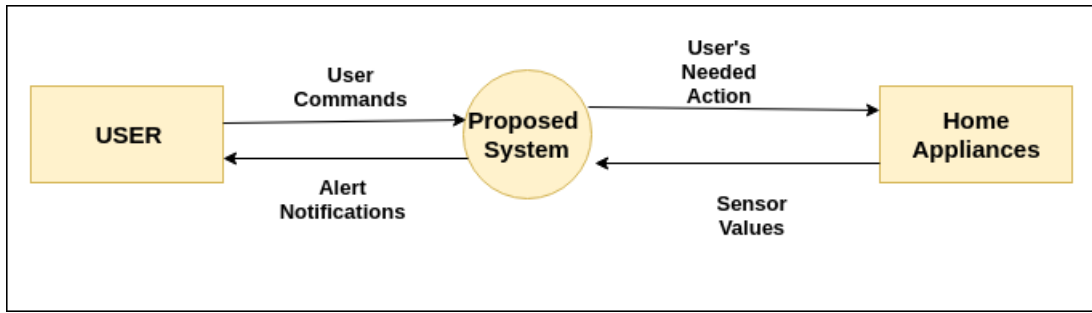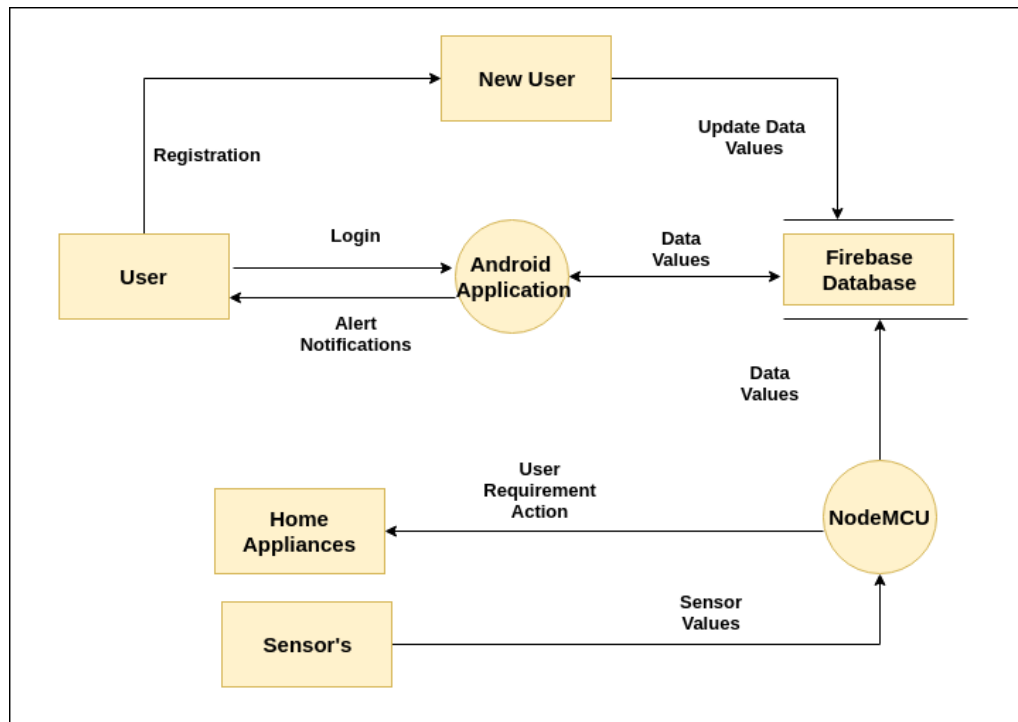
Figure 3.3: Level 0 Data Flow

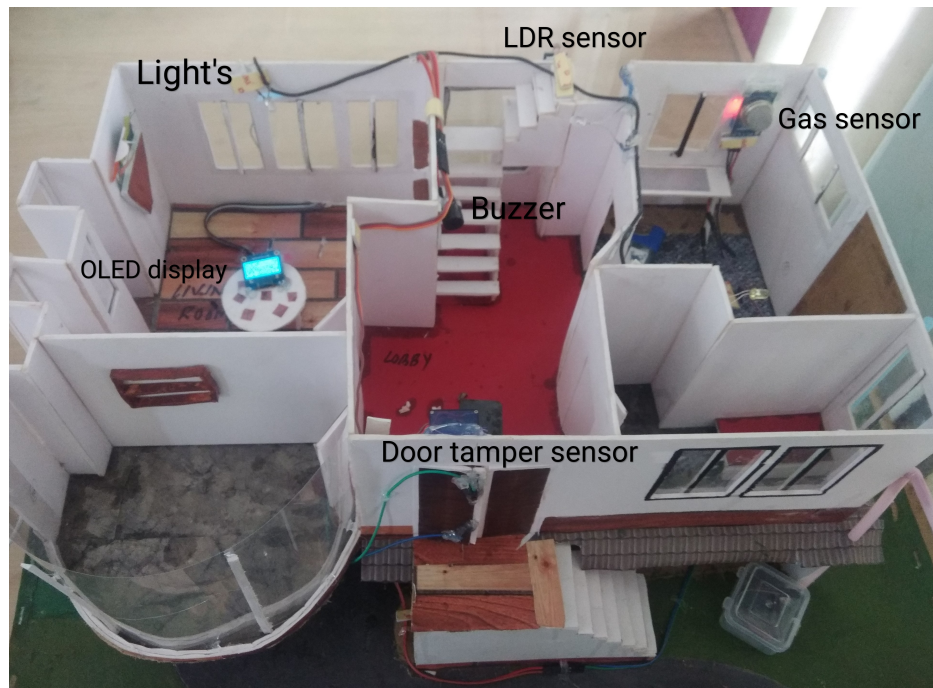Figure 3.4: Level 1 Data Flow

3.6 User Interface Design

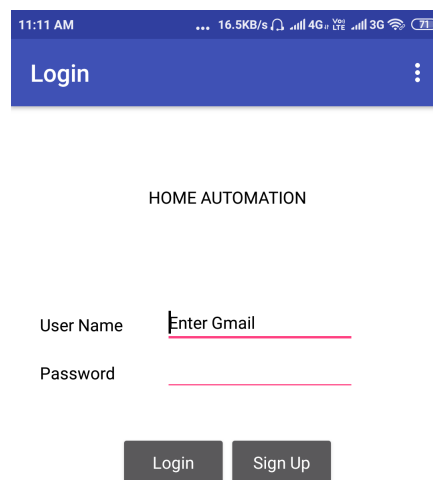Figure 3.5: Prototype of the Proposed System
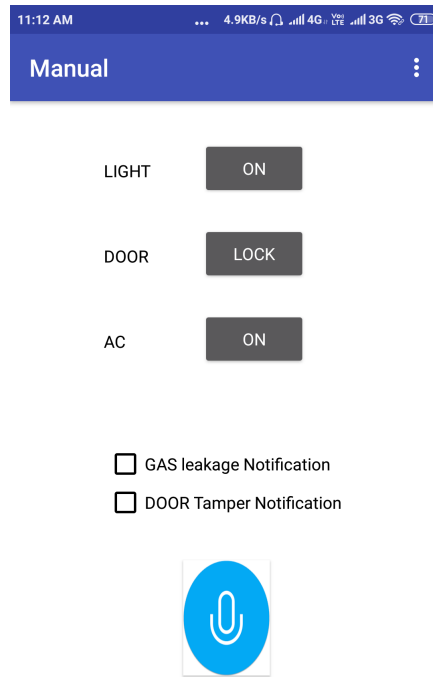

Figure 3.6: Login Page of Application

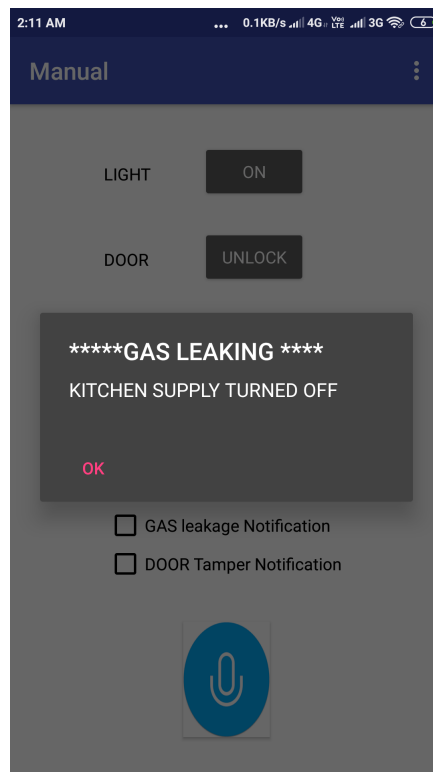Figure 3.7: Interface Page of Application

Figure 3.8: Alert Notification in Application

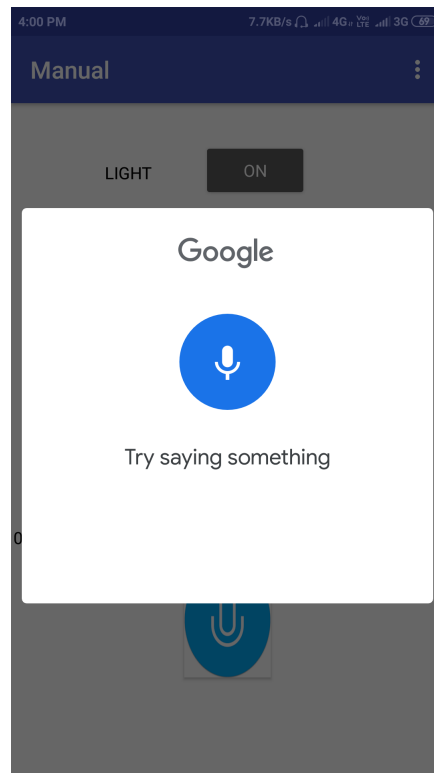Figure 3.9: Voice Control Module in Application

Chapter 4

Coding

Algorithm 1 Android Application

1: Register a new user using registration.
2: Login the user using the username and password.
3: If authenticated goes to main interface else display the message "Invalid username or password".
4: User can control the home appliances manually and using voice commands. It also display Alert notification and alarm.

Algorithm 2 Arduino NodeMCU

1: Initialize the system with the WiFi IP address.
2: Connect the Arduino board with Google cloud Firebase.
3: According to the updated value on cloud the Arduino control the connected home appliances.
4: It also updates the cloud value according to the value it senses using sensors.

Algorithm 3 Home Appliances Controlling

1: Authenticated user can control home appliances.
2: Can control light by turn on/off button or using the voice command "Turn on light" and "Turn off light" respectively.
3: Can also control door by using door lock/unlock button or using the voice command "door lock" and "door unlock" respectively.
4: Can also control the cooling system by using door Ac on/off button or using voice command "Turn on AC" and "Turn off AC" respectively.
5: It can also increase and decrease temperature using the respective button or using the voice command "Turn cooling up" and "Turn cooling down" respectively.

Algorithm 4 Home Security Controlling

1: Authenticated user get Alert notifications.
2: It will produce alert notification when some intruder tries to tamper closed door.
3: It will also produce alert notification when gas leakage in the kitchen. It also cut the electricity supply to the kitchen.
4: The buzzer at the home also rang when the alert situation occurs.

Chapter 5

Testing and Implementation

System testing is the stage of implementation which is aimed at ensuring that the system works accurately and efficiently before live operation commences. Testing is the process of executing the program with the intent of finding errors and missing operations and also complete verification to determine whether the objective are met and the user requirements are satisfied.

The ultimate aim is quality assurance. Tests are carried and the results are compared with the expected document. In that case of erroneous results, debugging is done. Using detailed testing strategies a test plan is carried out on each module. The test plan defines the unit, integration and system testing approach. The test scope includes the following: A primary objective of testing application systems is to assure that the system meets the full functional requirements, including quality requirements(Non functional requirements).

At the end of the project development cycle, the user should find that the project has met or exceeded all of their expectations as detailed in requirements. Any changes, additions or deletions to the requirements document, functional specification or design specification will be documented and tested at the highest level of quality allowed within the remaining time of the project and within the ability of the test team.

The secondary objective of testing application systems will be done, identify and expose all issues and associated risks, communicate all known issues are addressed in an appropriate matter before release. This test approach document describes the appropriate strategies, process, workflows and methodologies used to plan, organize, execute and the manage testing of software project "Smart Home - Speech Recognition Based Home Automation and Security Using IOT"

5.1 Unit Testing

Sl No	Procedures	Expected result	Actual result	Pass or Fail
1	Working of Log-in Page	Only Authenticated User Login	Same as expected	Pass
2	Controlling of Light	Light Control as Value changes	Same as expected	Pass
3	Controlling of Door	Door Open and close as Value changes	Same as expected	Pass
4	Controlling of Ac using OLED	AC Control as Value changes	Same as expected	Pass
5	Sensor values Reading	Sensor Read values as situation changes	Same as expected	Pass

Table 5.1: Unit Test Cases and Results

5.2 Integration Testing

Sl No	Procedures	Expected result	Actual result	Pass or Fail
1	Controlling light using application	Can turn on/off light using android application	Same as expected	Pass
2	Controlling door using application	can look/unlock door using application	Same as expected	Pass
3	Controlling cooling system using application	Can change and control temperature using application	Same as expected	Pass
4	Door tamper notification on application	Notify User using android application	Same as expected	Pass
5	kitchen Gas Leakage notification on application	Notify User using android application	Same as expected	Pass

Table 5.2: Integration Test Cases and Results

5.3 System Testing

Sl No	Procedures	Expected result	Actual result	Pass or Fail
1	Working of android	Can update values to database and notify user	Same as expected	Pass
2	Controlling of home appliances	can control as Value changes	Same as expected	Pass
3	Notify alert message	Notify user as sensor Value changes	Same as expected	Pass

Table 5.3: System Test Cases and Results

5.4 Advantages and Limitations

The proposed system consists of several advantages compared with previous systems.It overcomes the problem of range when it is structured by utilizing Bluetooth home automation framework. The proposed system also help to minimize the complexity that occurs when home automation is done by using GSM, then it either needs to make a call or send a message to control the device. The main the problem associated with it is the time delay and the complexity of the system.

5.4.1 Advantages

- Increase your independence and give you greater control of your home environment.

- Make it easier to communicate with your family.

- Save you time and effort.

- Improve your personal safety.

- Reduce your heating and cooling costs.

- Increase your homes energy efficiency.

- Alert you audibly and visually to emergency situations.

- Allow you to monitor your home while you are away.

5.4.2 Limitations

- Compatibility: Currently, there is no international standard of compatibility for the tagging and monitoring equipment. I believe this disadvantage is the most easy to overcome. The manufacturing companies of this equipment just need to agree to a standard.

- Complexity: The IoT is a diverse and complex network. Any failure or bugs in the software or hardware will have serious consequences. Even power failure can cause a lot of inconveniences.

- Technology Takes Control of Life: Our lives will be increasingly controlled by technology, and will be dependent on it. The younger generation is already addicted to technology for every little thing. We have to decide how much of our daily lives are we willing to mechanize and be controlled by technology.

5.5 Future Extensions

To ensure that the prototype created during this project can achieve its maximum potential, there are a number of improvements and changes that can be implemented. Also, the problems encountered throughout this project should be addressed.

Some of the proposed features of the software could not be implemented in time. One of these features was having guest accounts with limited time access to a lock and a user interface in the application to manage this. Another feature was logging of all user actions on the server side and a way to display it to the user either in the app or via a website. The application also needs to have a way to add a device to the user's list of devices and owners of locks need to be able to manage who else has access to their device.

Chapter 6

Results and Inferences

The Proposed system managed to successfully apply the Smart Home - Speech Recognition Based Home Automation and Security Using IOT and it was user-friendly and cost-effective. User-friendly, anyone can use just a click of a button on an android screen or using voice command and everything works. And it is cost effective as in it will cost exactly as the project requires (optimum price). The following section presents the acquired results from the project. It describes the final outcome of the prototype, the android application. Analysis of some of the hardware and android application is also stated.

6.1   Log In

When users enter our system, they are prompt with log in the interface, which can guarantee their security, authorization and privacy. What the users need to do is inputting their password through the number keyboard showing on the desk. When they fill in the right password, they will come to the main interface, otherwise, the interface will show users that the password is incorrect, thus they can try it again .

6.2   Main Interfaces

With the authorization, the user is presented with the main interface, it means the user can start control their house by voice now. On the screen, he or she can see the detailed status of information about his/her specific devices. Knowing the status of devices, users can make command better and more efficiently. For example, if the status of light is on, they do not need to turn on it again. In other words, when the light is on the light off button will only visible on the screen and vice-versa.

6.2.1   Cooling system

Since the working simulation of a cooling system is impractical,the system shows its working with the help of an OLED display, ie, when the cooling system is

off ,the display will show the message AC OFF and when the cooling system turned on it will display the message Ac On with default temperate 25 C and the interface also provide the provision to increases the temperature up to 30 C and to decrees the temperature to 20 C after that it will show message Max Cooling and Min cooling respectively in the mobile device.

6.2.2   Microphone

The microphone is the essential and indispensable part to a voice control device when users want to output command, they just need to click on this button, then a new dialogue box will appear in the phone and will start to record what they say, and then send it to Arduino over Wi-Fi. Users can be informed that their phones with that change are receiving their voice when they finish the command. Finally, it will receive the feedback and transfer it to users via voice system. The user can control the application that is available in the interface using this.

6.2.3   Light System

The users can know the status of their lights simply through the button of the screen. User can simply control the light through the button in the middle of the screen, users can also control their devices by voice all the time. As a result, our interface design can basically satisfy our requirement demand.

6.2.4   Automatic Door

By using the interface we can open and close the door. The status of the door can be identified using the button visible on the interface. We can also control the door by using voice also,for that, to open the door the command door unlock is used and the command door lock is used to close the door.

6.2.5   Security features

The designed system deals with two security feature one is the kitchen gas leakage and another is the door tampering. The door tampering notification will automatically activate when the door is locked and when some intruder tries to open the locked door will produce alert alarm and pop up notifications to users mobile. When gas leakage occurs the interface will automatically cut the electricity supply to the kitchen and the user will be notified with alert alarm and pop up notifications.

Chapter 7

Conclusion

It can be concluded that Smart Home - Speech Recognition Based Home Automation and Security Using IOT was a success. The system consists of an Arduino-NodeMCU board, a number of sensors, an Android phone, an OLED Display, home appliances and an Android Application with speech module. It is user-friendly and it is cost effective. The system also successfully met the objectives and they are, Constructed a wireless home automation system controlled by a smartphone specifically an android device with a speech module. The designed system also provides the security features and alert the user if anything goes wrong. Designed and implement cost-effective home automation system yet an efficient one. Designed a user-friendly and a safe system to control home appliances especially aimed to aid the elders and handicapped

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