

Final Year Project Report

Internet of Things based Home Automation



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A report submitted in the partial fulfillment of degree of BS(CS)

DECLARATION

Certified that this project report of “**Internet of Things based Home Automation**” is the bonafide work of “**Abuzar Riaz and Mohiz Wali**” who carried out the project work under my supervision.

(Signature of Supervisor)

Dr. Waqas Aman

Acknowledgment

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Abstract

The “Internet of things”(IoT) is becoming an increasingly growing topic of conversation both in the workplace and outside of it. IoT aims to provide interconnection among a variety of objects (things) including cell phones, coffee makers, washing machines, headphones, lamps, wearable devices and almost anything else you can think of. Loss of vision, hearing and ability to move freely can affect daily lives functioning of anybody. It is difficult for such handicapped and elderly people to manage and control some home appliances. No one wants to rely on constant help of other to meet their day to day needs and perform household chores. In Home automation system, people are inclined to a lifestyle where they can manage and control appliances - things - from anywhere. It provides comfort to users by sitting in his home and still being able to monitor and control the home appliances in any part of house.

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Chapter 1

Introduction

This chapter contains core information about “Internet of things”(IoT) and home automation concept. Main problem is highlighted in project description section. Motivation behind choosing this project and project constraints are also addressed. Also, we have discussed the approach of how the design will meet the criteria given in the project proposal.

1.1 Background

The “Internet of things”(IoT) is becoming an increasingly growing topic of conversation both in the workplace and outside of it. IoT aims to provide interconnection among a variety of objects (things) including cell phones, coffee makers, washing machines, headphones, lamps, wearable devices and almost anything else you can think of [1].

IoT is more than smart homes and connected appliances, however. It scales up to include smart cities think of connected traffic signals that monitor utility use, or smart bins that signal when they need to be emptied and industry, with connected sensors for everything from tracking parts to monitoring crops [2].

A number of companies and research organizations have offered a wide range of projections about the potential impact of IoT on the Internet and the economy during the next five to ten years. Cisco, for example, projects more than 24 billion Internetconnected objects by 2019; 2 Morgan Stanley, however, projects 75 billion networked devices by 2020.3 Looking out further and raising the stakes higher, Huawei forecasts 100 billion IoT connections by 2025.4 McKinsey Global Institute suggests that the financial impact of IoT on the global economy may be as much as \$3.9 to \$11.1 trillion by 2025 [3].

Smart homes or Home Automation Systems (HAS) is one particular instance in the IoT concept. The Home Automation concept has existed for many years. The terms Smart Home, Intelligent Home has been used to introduce the concept of networking appliances and devices in the house. Home automation Systems (HASs) represents a great research opportunity and has a significant business

value. The objective of HAS is to manage and control home appliances to provide improved comfort, energy efficiency and security system [4].

In HAS, people are inclined to a lifestyle where they can manage and control appliances - things - from anywhere. It provides comfort to users by sitting in his home and still being able to monitor and control the home appliances in any part of house.

1.2 Problem Description

Loss of vision, hearing and ability to move freely can affect daily lives functioning of anybody. It is difficult for such handicapped and elderly people to manage and control some home appliances. No one wants to rely on constant help of other to meet their day to day needs and perform household chores. Smart homes, using assistive technologies, allows the handicapped and elderly to keep up control over their daily activities and offer a more positive personal satisfaction by enabling them to keep up their self-esteem.

In such cases, it is necessary to automate the mentioned operations for such people to offer them a more independent life. Moreover, it will help them to utilize the saved time and energy.

Now a days people often stay away from their houses for days and weeks, there are certain things which need to be done on specific time and on regular basis like watering garden, fridge, freezer and switching off unnecessarily lights etc. By using our application people can manage and perform such tasks using their cell phones.

1.3 Motivation

Motivation behind this project is to assist and facilitate the elderly and handicapped persons who are more likely to be exposed to daily life problem than normal people, in a way to automate their homes to provide ubiquitous access and provides healthier standard of livings.

The excellence of a home automation system is that it is very versatile, adaptable and its abilities are restricted just by our creative energy. With the rapid development in the field of home automation, it's about time that we move towards across the board reception of such a framework.

1.4 Project Objectives

1.4.1 Academic objectives

Academic objectives are to implement the theoretical knowledge we have studied during our undergrad studies into practical field. And to explore how to research and learn new techniques, tools and technologies that can be handy for a fresh graduate.

1.4.2 Product Objectives

The objectives of proposed project are as follows:

- To help handicapped and elderly people to control appliances remotely.
- To improve standard of living by eliminating the risk of physical interaction with electric switches.
- Time saving as appliances can be controlled by device without manual interaction with electric switches.
- Cost reduction by efficient consumption of electricity.
- Any device capable of WIFI connectivity can control appliances thus making it flexible in control.

1.5 Project Scope

Primarily, a web app will be developed for HAS interaction. We may develop a smart phone app if time permits. For web app development we will use languages like, PHP, HTML, JavaScript as there is well established developer community that will provide helpful guidelines.

We will not automate any real home appliance because of the financial cost they incur and because of the risk that they may be damaged during implementation. Instead, will assume that Light Emitting Diodes (LEDs) and processor fan are the targeted home appliances to reflect on how home appliance can be connected and controlled.

1.6 Methodology

We will use a Raspberry Pi module as the home appliances controller to which one or more appliance can be connected to be controlled. It offer features of a mini computer, component and appliances are connected to inputs/outputs ports of Raspberry Pi. Because of the vast development in remote technology, several different connections are available such as WIFI, GSM and Bluetooth. Each of them has their own specifications and applications. We have chosen to implement WIFI technology in our project because of its suitable capabilities and moreover almost every current smart phone/laptop has built-in WIFI adapter.

Additionally, a web-based application will be developed to provide an interface for the user to send control commands to the controller. It will also display the current status of particular appliances. The web app and the control unit will communicate via a relay placed at the home site.

We will use SDLC (System Development Life Cycle) methodology for the development of this project. Phases of SDLC are as follow:

1.6.1 Requirement Gathering

All the tools, devices and software used during our project will be taken into consideration in this phase. We had studied similar project and are gathering functional and non functional requirements of our project.

1.6.2 Design

In this phase, overall layout of web application and hardware programming is designed. Necessary features that needs to be added in our application was taken into consideration and configuration of raspberry pi with appliances is studied.

1.6.3 Implementation

The actual coding of web application is written, and the configuration and fine-tuning for the hardware to meet the functional and non functional requirement is also performed.

1.6.4 Testing

Developed application will be tested in this phase; any bugs will be identified and removed. We may consult any hardware expert to evaluate our hardware design.

Chapter 2

Literature Review

In this section, we will discuss features and benefits of our home automation system and will also compare our system with the other systems that are already developed.

We will discuss our proposed system that how it is useful and better than the other systems and how it is going to control the home appliances.

2.1 Existing System

In this section, we will discuss other systems that can also manage and control the home appliances via cell phones, Bluetooth or via web. Every system has its own functionalities, But there are certain limitations too.

Some well known systems that are already presented are as follows:

- Heating, Ventilation and air conditioning (HVAC): this system is used for controlling all home energy monitors via a user friendly interface.
- Smart home systems (SHS): this system is also used for controlling and managing the home appliances but this system only works with INSTEON products.
- Real-time operating system based home automation system: this system is also able to control home appliances but it uses Bluetooth technology only.
- Another home automation system(home automation through GSM modem was also developed before but that system was only serving for the security reasons and that was also controlled through a message and a GSM modem was used.

2.2 IoT Based Other Smart Homes

Initially smart homes were ideas only but not reality. Smart homes gain popularity and fame in 21st century, when different other technologies were in the development stages. Smart home is an affordable option and feasible technology for its users. Internet of Things (IoT) conceptualizes idea of monitoring and controlling objects (things) through internet.

A lot of People have been trying to implement the concept of smart homes and their researches are directed in the following directions.

Internet of Things refers to a concept of intelligently connected devices which deliver intelligent solutions regarding security, energy efficiency, health, education and many aspects of life [5].

A solution was implemented which was based on wireless communication where all home devices are connected to a configured slave node. Slave node communication is handled through master node through RF and serial RS232 [6].

Another system was developed where the home devices were connected via bluetooth to internet and the protocol that provided the data link between internet and mobile phone was wireless application protocol (WAP) [7].

An internet-based fuzzy controlled inverter was also developed which implemented monitoring and control for an air conditioning system. The system involved the use of PLCs (programmable logic controllers), client/server, induction motors and temperature sensing modules. The database, created in the server, could be accessed by the user. This reference command was also recorded in the database along with the temperature sensed and the speed of inverter-controlled motor devices [8].

2.3 Home Automation

In IoT based home automation system (HAS), people will be able to manage and control all home appliances “things” from anywhere through a cell phone which will be connected to the Internet. It provides comfort to user by sitting in their home and still being able to monitor and control the home appliances.

It will be easy and comfortable way to control the home appliances. The customers will be able to control the home appliances from anywhere and at anytime without any kind of restriction. And our system is not going to be in a limited range but we will be able to control the appliances “things” from anywhere.

We can also schedule our system by giving it related commands of on/off state at a specific time of the day.

2.4 Advantages of IoT Based Smart Home

Idea of smart and intelligent home has gained attention because of its many advantages. Some of the advantages of smart home are as under'

2.4.1 Automation- Home Security

The main advantage of home automation system (HAS) is that we can access and monitor our home appliances. It is truly possible to connect to our home network while we are miles away from home. We can have a look at its security while we are still away we can check the security system by switching on the lights and can have a look at the current status of the home.

We can also make our home security system better than before in case our alarm system is triggered then we will be able to on/off all our electrical appliances.

We can also make our doors programmable so we will also be able to control the locking of our doors or we can also make them programmable by giving them a specific timing of opening and closing.

In simple words we can schedule them according to our needs and this is a safe, easy and convenient way.

2.4.2 Remote Management of Home Appliances

IoT based home automation system (HAS) will give us an easy access to control the home appliances things remotely from a mobile device from anywhere in the world. We can connect to our home network at anytime from anywhere just with an Internet connected device or from a mobile phone.

In home automation we can automate a lot of things that includes lights, fans, and other electrical appliances. Web App will also provide information and a detailed history about our home as we are going to maintain a database from our system. Anyone can start interacting with home automation system by just signing in the web App and then he will be able control the home by only performing a click.

2.4.3 Saves Time

Humans have to move from one place to another while carrying out their daily routine stuff. Now one doesnt have to worry about their home because of the grand-tech feature of a smart home. One can control his/her home from anywhere at any time. In short, it will save time and will practice more productivity.

Chapter 3

Requirement Specification

In this chapter, we are going to discuss the detailed description of the requirement specification phase of our project. In requirement specification phase functional and non-functional requirements are included and may also include use cases that describe user interaction with the system. Requirement specification enlists basic requirements for the development of the project.

Requirement gathering phase of our project is very detailed. IoT is the technology that is now coming into our homes now. Application is going to be developed a basic home automation which is going to be used for our ease and comfort.

3.1 Application System Requirement

Figure 3.1 shows the basic working of our system. System is required to be operated in two ways one if time permits is while using a smart phone and the other is we can also control it through web application . The working through web server is detailed below.

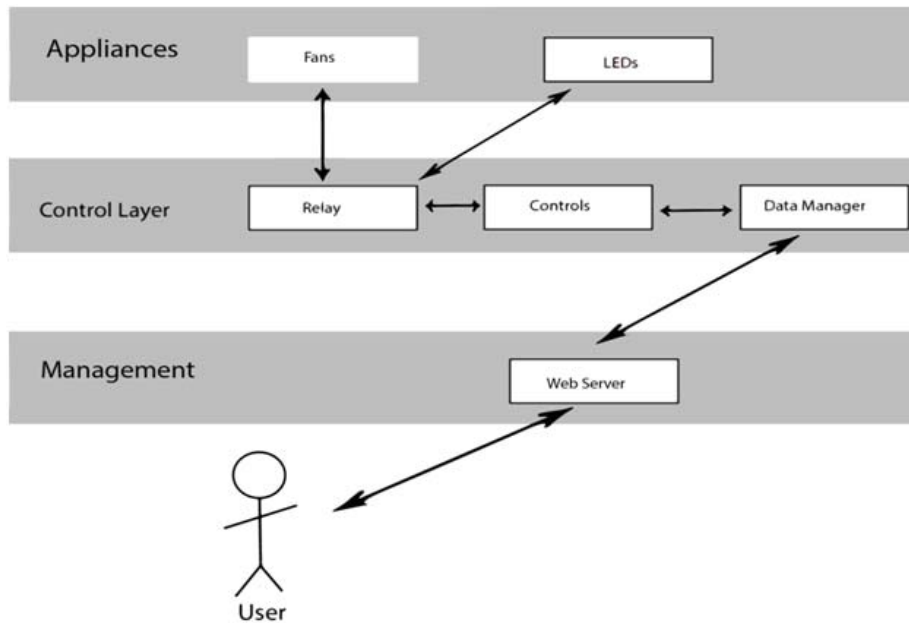


Figure 3.1: Application System Requirement

3.1.1 Web Application

User should be able to control the system through web application, user will send input through web application to Raspberry pi and Raspberry pi will read the data and will perform an action according to the instructions that are being given i-e switch ON/OFF. It will allow the user to change and update the status of the room from ON/OFF.

3.1.2 Android Application

A mobile application is designed for the android operating system. User will install that application system in their respective android device then it will ask for an authentication. User can view the status of the devices and can control it from there very easily.

3.1.3 Raspberry Pi

A single raspberry pi will be used. This raspberry pi will be the main component of the system as it is going to control all the system. This is going to be the central mainframe of the system that is going to communicate with the rest of the system. It will receive inputs from the mobile application and the web application and then going to act according to the given inputs.

3.2 Functional Requirements

Functional requirements defines the basic working and functions of a software system that how system is going to work.

Following are the functional requirements of our project.

3.2.1 Login/Logout

User have to login into the system to use the application. The login procedure should be simple, user have to enter his user name and password.

3.2.2 Change status

User must be able to view and update the status of the devices i.e ON/OFF.

3.2.3 View status

When the user will open the application he will be able to view the status of the rooms and all the other devices that are connected.

3.2.4 Storage

Our system will also manage a database for Storing the record of the status of the devices in the home. System should be able to record the historic data of all the appliances.

3.2.5 Password Change

The password would be default for the first time but user would be able to change the password after the user has logged in into the system.

3.2.6 Recover Password

The password recovery option will be provided in case the previous password has been lost from the user.

3.3 Non-Functional Requirements

The non-functional requirements of the application are as follows.

3.3.1 Reliability

System must be reliable low cost, easy to use and should work according to the instructions that are being given by the user.

3.3.2 Portability

System must be portable, user can use the application from anywhere at any time with the availability of internet connection.

3.3.3 Response time

Systems response time describes that system will be quick enough to respond within seconds, system will quickly respond to the changes and will update the changes in the database.

3.3.4 Simplicity

Application would be simple and easy for the user of the application. The coding is also done using simplicity approach.

3.3.5 Security

System will be secure in a way that only the authorized person will be able to access the system after giving his credentials which will gets match from the database. New user has to sign up and will be given access given access after successful sign up.

3.4 Use Cases

These are the main use cases of our project which are detailed below.

3.4.1 Main Use Case

Use case diagram figure 3.2 explains how one can use the system

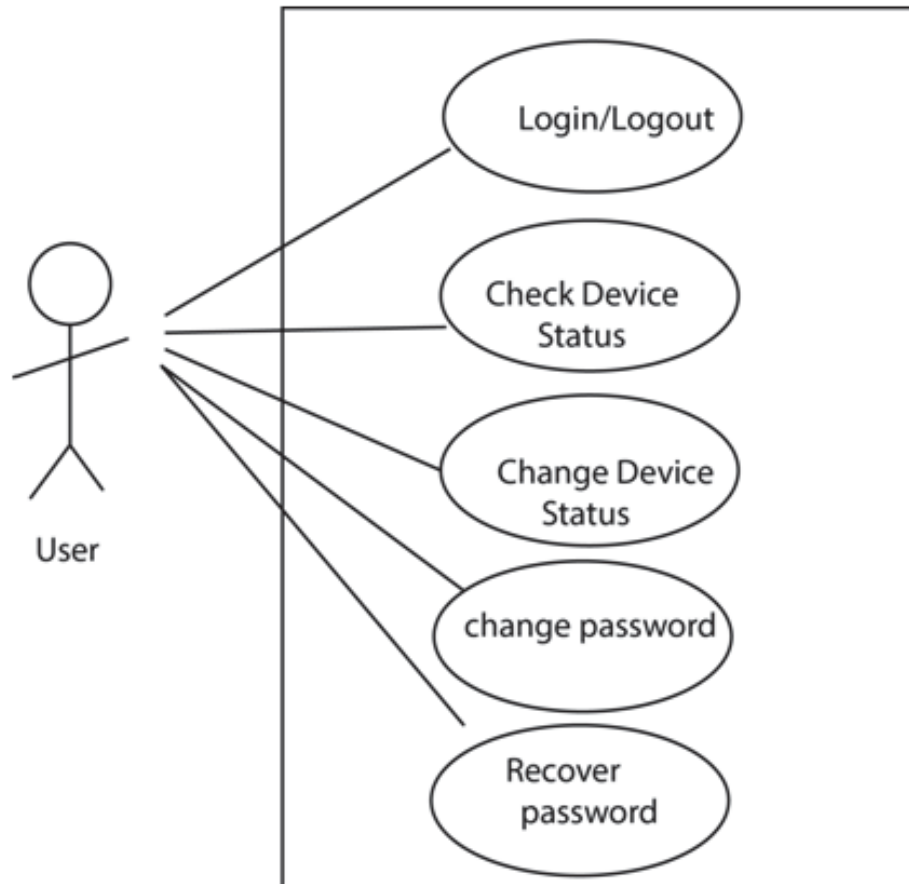


Figure 3.2: Use Case Diagram

3.4.2 Use Case 1

4. Use Case 4:

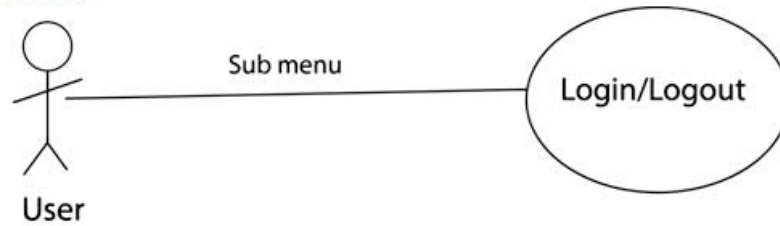


Figure 3.3: Login/Logout

Title	Login/Logout
Description	User can login/logout from the device
Primary Actor	User
Pre Condition	Application must be opened
Post Condition	User will be able to use the system
Basic Flow	System requests user to enter a valid Username and Password. User enters Username and Password and clicks the Login/Sign-in button. The system validates the Id and Password. The system verifies the Id and Password. The System displays the User Profile.
Alternate Flow	User enters an invalid Username and Password
Associated Use Case	None

Table 3.1: Login/Logout

3.4.3 Use Case 2

2. Use Case 2:

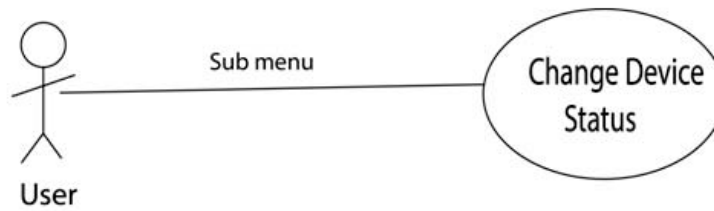


Figure 3.4: Change Device Status

Title	Change Status
Description	Change device status
Primary Actor	User
Pre Condition	Application must be opened
Post Condition	Device Status will change
Basic Flow	Status of device will be changed
Alternate Flow	Status of device will not change due to some error
Associated Use Case	None

Table 3.2: Change Device Status

3.4.4 Use Case 3

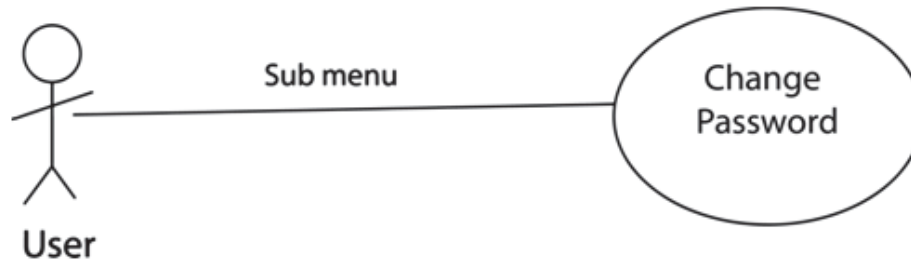


Figure 3.5: Change Password

Title	Change password and set a new one
Description	Log into system
Primary Actor	User
Pre Condition	Application must be opened
Post Condition	Device password will be changed
Basic Flow	System requests that actor enters his/her Username and request a new Password
Alternate Flow	User enters invalid Username or password
Associated Use Case	None

Table 3.3: Change Password

3.4.5 Use Case 4

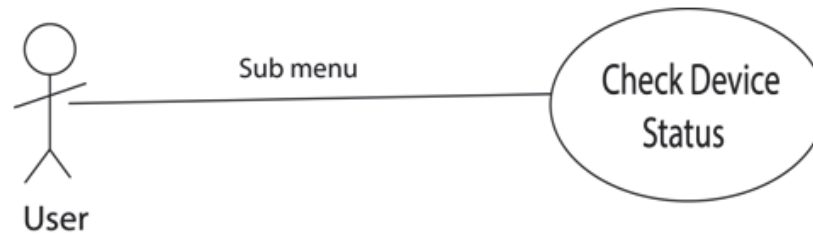


Figure 3.6: Check Status

Title	Room Status
Description	Check device status
Primary Actor	User
Pre Condition	Application must be opened
Post Condition	Show Device Status
Basic Flow	Status of the device can be checked
Alternate Flow	Device status is unable to check
Associated Use Case	None

Table 3.4: Check Status

3.4.6 Use Case 5

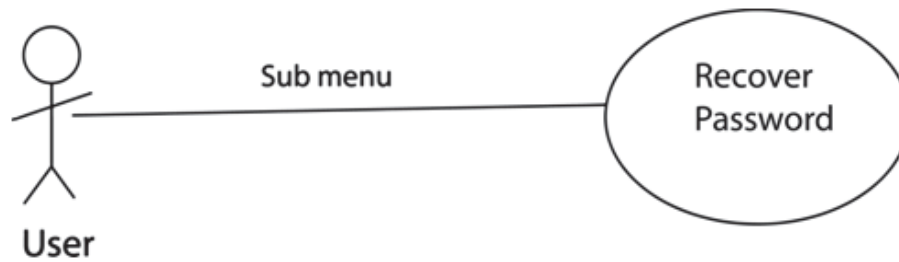


Figure 3.7: Recover password

Title	Recover Password
Description	In Case someone forget his/her password,he/she will be given option of recover password
Primary Actor	User
Pre Condition	Application must be opened
Post Condition	Password will be sent to user Emails address
Basic Flow	User must enter his/her email for a password
Alternate Flow	User enter an invalid email address for password recovery
Associated Use Case	None

Table 3.5: Recover password

Chapter 4

Design

In this chapter we will discuss different component that will be used in our project along with their interactions with each other. System architecture, design and structure are explained diagrammatically.

4.1 System Architecture

Our entire system consists of server and client part. The server is the web interface consisting of buttons and UI (User Interface) consists of PHP files and HTML files that will allow you to turn ON/OFF a device.

The client side consists of a Raspberry Pi with a relay circuit connected to its GPIO pin. The pi runs a python program which configures GPIO pins of raspberry pi with the circuit containing leds and fan. The python program also checks if the string obtained is ON / OFF based on which it switches ON/OFF the relay respectively via its GPIO pin.

4.1.1 Simulated Environment

As we have only developed a prototype for our project. Series of sensors are deployed on a board. These sensors will convey the status of appliances i.e. (on off state) and will act in the system as input. Appliances will be controlled by raspberry pi. It will also read sensors data which it will send periodically to raspberry pi upon request.

4.1.2 Web Application

Web application will act as an interaction platform between user and system. User will be able to check the status of appliances and can control the appliances from the browser of any devices having access to internet.

Figure 4.1 shows the overall architecture of system.

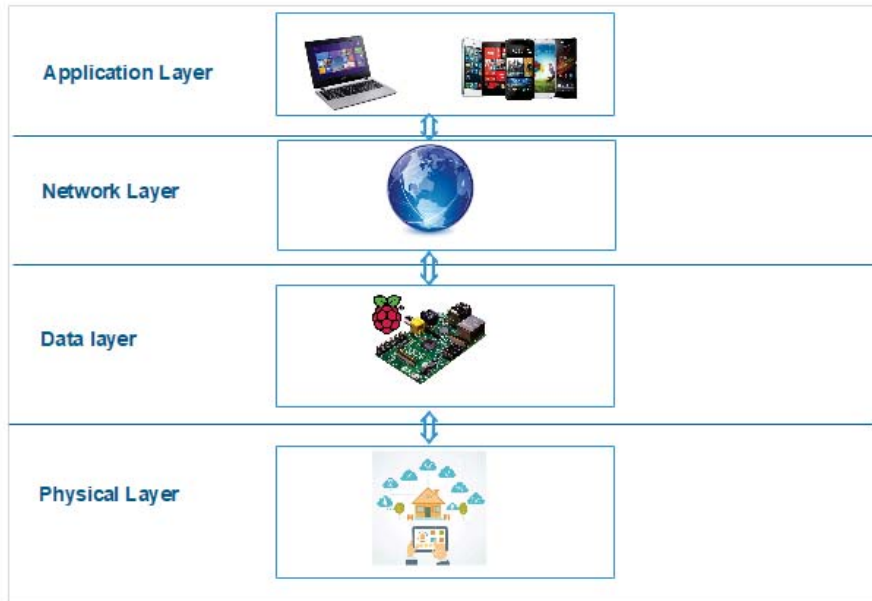


Figure 4.1: System Architecture

4.2 Hardware Selection

The hardware selection will be as follows:

4.2.1 Raspberry pi

Raspberry pi is a micro-processor that has almost the same functionality as a computer so it will be our central hub that will manage all the system.

4.2.2 Sensors

Sensors will be used i-e relays to convey the status of appliances i.e. (on off state) and will act in the system as input.

4.2.3 Transformers

We will also use a transformer, a transformer is a device which can control the voltage change. As raspberry pi can only take 5 volt so transformer is needed to decrease the alternating voltages and give the needed voltage to raspberry to operate.

4.3 Sequence Diagram

Sequence diagrams describe interactions among classes in terms of an exchange of messages over time. User opens the web application and he will be asked for his credentials. If his credentials are correct he will be given access to home page else he will be asked to try again. If user wants to check the status of all appliances his request will be forwarded to database where current status of all appliances will be returned to server and will be displayed on the screen. Figure 4.2 shows the ordering of process that can take place and interaction of process with each other. Description of process interaction is given below.

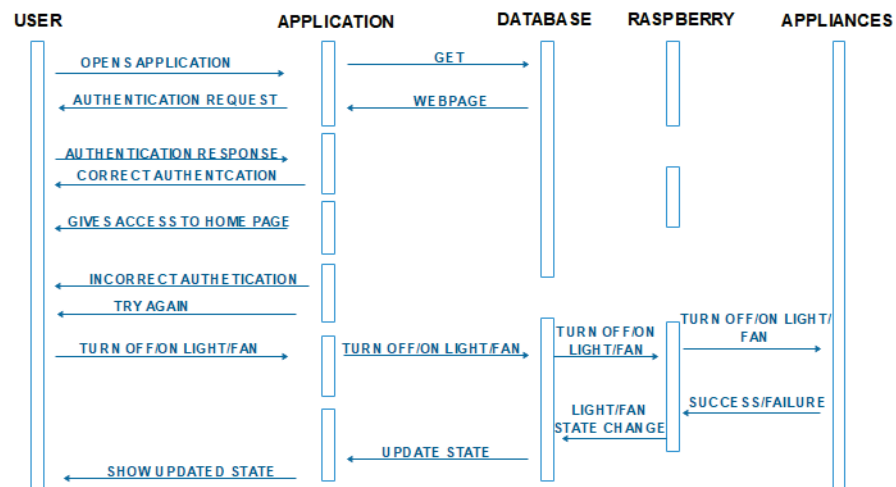


Figure 4.2: Sequence Diagram

4.4 Activity Diagram

It shows the work flows of stepwise activities and actions with support of choice.

4.4.1 Main Activity Diagram

figure 4.3 shows the activity diagram of the system.

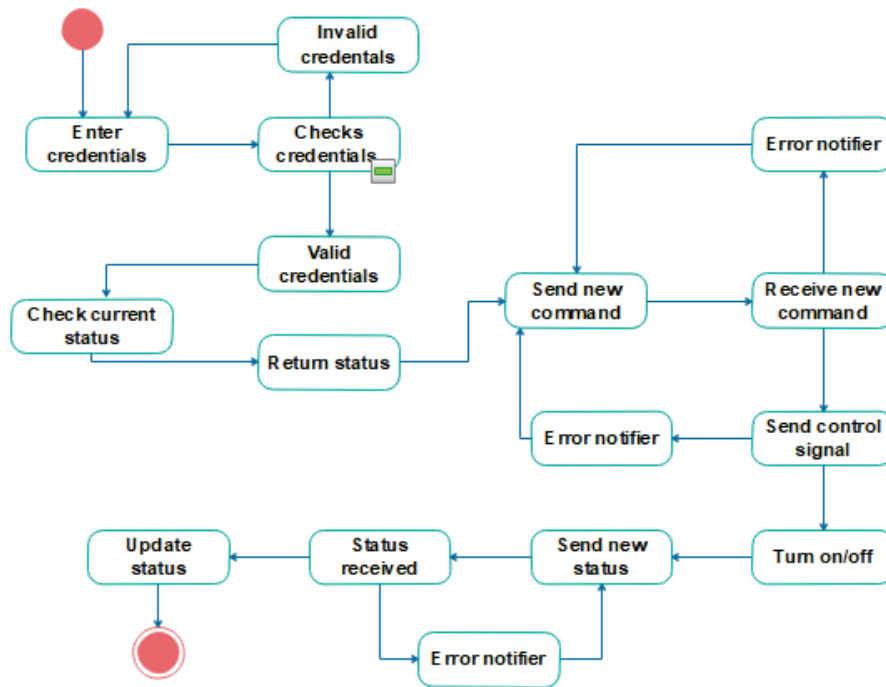


Figure 4.3: Activity Diagram

4.5 Entity Relationship Diagram

An entity relationship diagram (ERD) shows how entities such as people, concept or object relate to each other within a system. Defined set of symbols are used such as rectangle, oval, diamond and connecting lines depicts the interconnectedness of entities, their attributes and relationship.

Figure 4.4 shows ERD of our system.

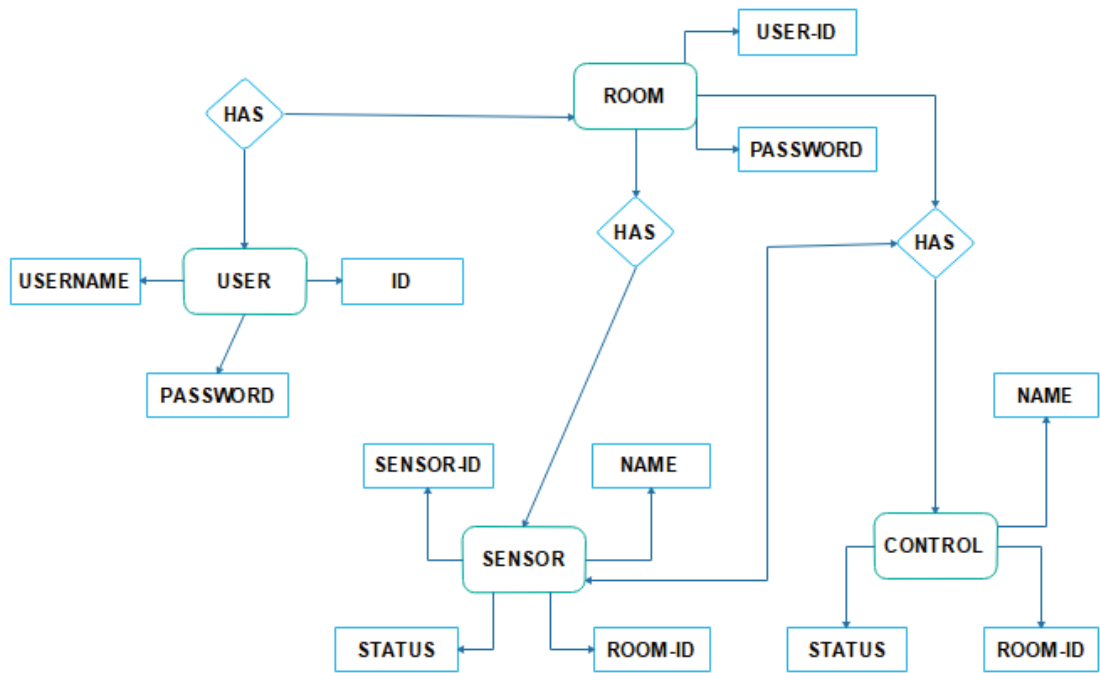


Figure 4.4: Entity Relationship Diagram

Chapter 5

System Implementation

In this chapter, we are going to discuss the detailed description of the System Implementation phase of our project. In System Implementation phase we will discuss the tools and techniques that we used for the development of our project. The main components of our project are as follows.

- Web application.
- Android application.
- Home Automation Components.

5.1 Tools And Technologies

The main technologies that we used for the development of the project are as under.

5.1.1 Raspberry pi

A raspberry pi will be used, this is going to be the central mainframe of the Home Automation system (HAS) that will give us an easy access to control the appliances things remotely from a web application from anywhere. Raspberry pi is a small microprocessor with powerful specifications. It is a device that is easy to use and implement. Because of its small size and efficient working it is preferable over other processors. In this project we will create such a system in which Home automation components will be connected to the raspberry pi and raspberry pi will control the devices using GPIO pins. Raspberry pi will receive all the commands and will act as a controller.

5.1.2 Visual Studio

Visual studio is a development tool that is used for the development of applications i-e ASP.NET web applications, XML web services, desktop applications

and other mobile applications all use the Integrated development environment.

5.1.3 Android Studio

Android studio is the integrated development tool that is used for the development of android applications. Android studio offer more choices to build better rich features productivity while developing android applications like:

- Better Compilation of code that gives more accurate results.
- Easy to build facility
- Good layout system with drag and drop
- Better built in support with integration with many platforms
- Best stable system with minimum crash chances

5.1.4 Languages

Language that we used for the development of our project is java. Java is widely used object oriented language. Java also supports wide range of libraries, it is also known as the mother language of the android operating system.

5.1.5 Methodology

As discussed above we have 3 main Modules in our system that are:

- Home Automation components
- Mobile application
- Web application

5.1.6 Home Automation Components

Home Automation components (HAC) comprises of following things listed below:

- Raspberry pi
- Sensors
- Relays

These components will be responsible for controlling the devices by using actuators (Relays) that will in turn connected to the raspberry pi and raspberry pi will receive the commands from the web/mobile application and then work accordingly.

5.1.7 Raspberry pi

A raspberry pi will be used, this is going to be the central mainframe of the Home Automation system (HAS) that will give us an easy access to control the appliances things remotely from a web application from anywhere. Raspberry pi is a small microprocessor with powerful specifications. It is a device that is easy to use and implement. Because of its small size and efficient working it is preferable over other processors. In this project we will create such a system in which Home automation components will be connected to the raspberry pi and raspberry pi will control the devices using GPIO pins. Raspberry pi will receive all the commands and will act as a controller.

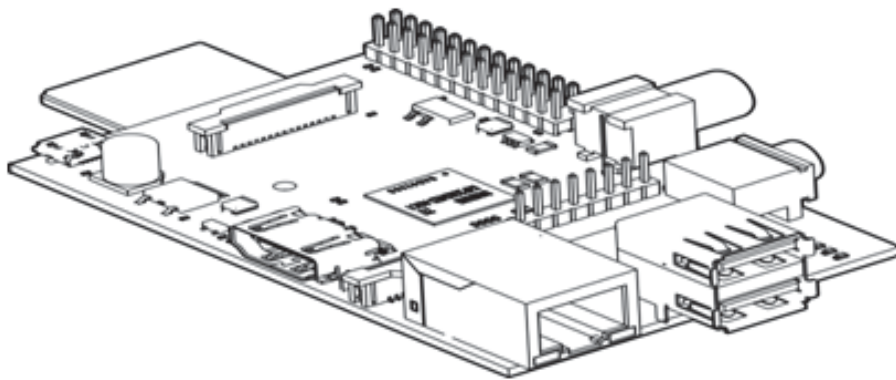


Figure 5.1: Raspberry pi

5.1.8 Sensors

In home automation system (HAs) the sensors will act as the main component and will be the reason for changing the status of the room from on to off. It will also gather the data of the room and will display it to the android application.



Figure 5.2: Sensors

5.1.9 Relay

Relay will be the reason for the output of the system and will on/off the devices, relay is a switch used for operating the circuit by opening and closing of the circuit. Relay use electromagnet to operate an apparatus.



Figure 5.3: Actuators

5.1.10 MVC framework

Model-View-Component (MVC) consists of three main components.

- The Model: Model objects are parts of application that is used for implementing the logic of the program, model objects store information in a database. Product object can gather data from database and can also update the information.
- The view: View displays the application user interface (UI). User interface is developed by using the data of the model. User interface is developed using the products data.
- Controller: In MVC the controllers are the responds to the inputs. Controllers are used to handle the user interaction that how user is going to interact with the product.

5.1.11 Mobile Application for Home Automation System

A mobile application is designed for the android operating system. User will install that application system in their respective android device then it will ask for an authentication. After authentication user will be able to view tabs of different rooms and their respective status. User can view the status of the devices and can control it from there very easily. HAs system will also maintain a database for the status of the devices and can also view the status from there.

5.2 System Implementation

Figure 5.4 shows the basic implementation of our system.

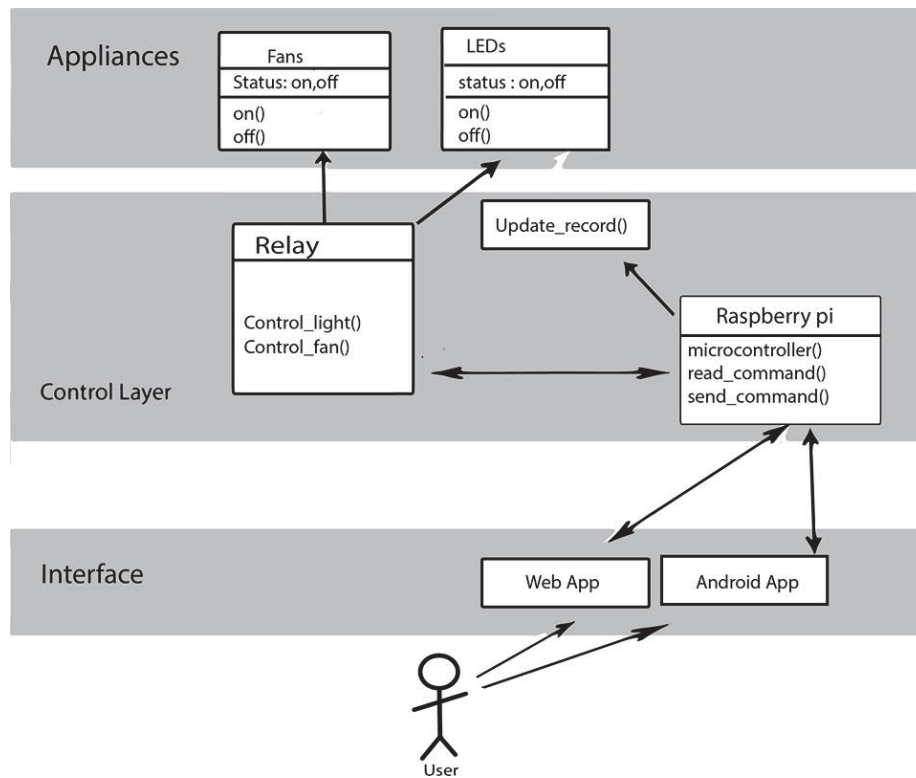


Figure 5.4: System Implementation

Chapter 6

System Testing and Evaluation

In this chapter, various software testing techniques have been applied in order to evaluate the application and detailed analysis of the result of each testing technique is described along with the conclusion about the final developed application.

6.1 Software Testing Techniques

Software testing is the process of evaluation a software item to detect differences between given input and expected output. Also to assess the feature of a software item. Testing assesses the quality of the product. Software testing is a process that should be done during and after the development process. In other words software testing is a verification and validation process [4] .

6.1.1 Verification

Verification is the process to make sure the product satisfies the conditions imposed at the start of the development phase. In other words, to make sure the product behaves the way we want it to.

6.1.2 Validation

Validation is the process to make sure the product satisfies the specified requirements at the end of the development phase. In other words, to make sure the product is built as per customer requirements.

6.2 Unit Testing

Component, programs and files are tested on individual basis to check if they are working properly. We have individually tested all the Component, resources and it is found that they are working properly as expected.

6.3 Integration testing

Component, programs and files are tested in order to verify their integration with each other. Integration testing of hardware component with themselves has been tested and they have configured well to produce expected output.

6.4 System Testing

The purpose of doing system testing is to see how well the system's compliance with specified requirements. Integration of hardware component and software application is test and Our system seems to fulfill all the required non-functional requirements.

6.5 Acceptance Testing

This is a type of testing that ensures if the system is ready to use and is often done of the user to see is the system meets its requirements. Acceptance testing reveals errors and omissions in the system.

6.6 Installation Testing

In installation testing, we check if the system can be installed with ease on user devices or not. During this testing our focus remains on the following things.

- To check if complete system is installed on the device and is functional.
- To validate the functional and non functional requirement of the system after its installation.

The application was tested on different versions of operating system like windows 8, windows 10. Satisfactory results were produced.

6.7 Test Cases

6.7.1 Test Case 1: Running The Application

TABLE 6.1 describes that when application is opened it must run properly on operating system.

Test case id	01
Description	Application should start properly.
Application	Web based app.
Author	Abuzar Riaz & Mohiz Wali.
Requirements	Application must launched when opened on device. Wifi connectivity must be available, Raspberry pi and circuitry must be powered on.
Steps to be taken	Open application by typing static ip address of raspberry pi.
Expected result	Application must launch without any error and with all functional operations.
Actual result	Application launched without any error.
Status	Success.

Table 6.1: Running The Application

6.7.2 Test Case 2: Login

TABLE 6.2 describes the connectivity of client with server.

Test case id	02
Description	To check if client is connected to server.
Application	Web based app.
Author	Abuzar Riaz & Mohiz Wali.
Requirements	Server must be started and Internet must be available.
Steps to be taken	Start client application and sever, enter user name and password, click login.
Expected result	User must login in case of correct authentication.
Actual result	User logs in.
Status	Success.

Table 6.2: Login

6.7.3 Test Case 3: Login

TABLE 6.3 describes the connectivity of client with server.

Test case id	03
Description	To check if client is connected to server or not.
Application	Web based app.
Author	Abuzar Riaz & Mohiz Wali.
Requirements	Server must be started and Internet must be available.
Steps to be taken	Start client application and sever, enter user name and password, click login.
Expected result	User must login in case of correct authentication.
Actual result	User is not able to login because of wrong authentication.
Status	fail.

Table 6.3: Login

6.7.4 Test Case 4: Application Connectivity With Server

TABLE 6.4 describes In order to get updates application must connects to server.

Test case id	04
Description	Application must be connected to server to get updates.
Application	Web based app.
Author	Abuzar Riaz & Mohiz Wali.
Requirements	Application must be connected to server to get hardware updates.
Steps to be taken	Applications gets connected with server to get the hardware instructions and change the status of the appliances.
Expected result	To access data from database.
Actual result	Successful Database connection and displays data.
Status	success.

Table 6.4: Application Connectivity With Server

6.7.5 Test Case 5: Raspberry Pi Connectivity With Server

TABLE 6.5 describes that raspberry must connects to server to send and receive data .

Test case id	05
Description	Data access is only possible if raspberry connects to server.
Application	Web based app.
Author	Abuzar Riaz & Mohiz Wali.
Requirements	Raspberry must connects to server to transport data.
Steps to be taken	Raspberry always connects with the server, it will get the data from the server and will save changes made in the server.
Expected result	Transportation of data from database.
Actual result	Connection with server and data display.
Status	Success.

Table 6.5: Raspberry Pi Connectivity With Server

6.7.6 Test Case 6: Raspberry Pi Connectivity With Server

TABLE 6.6 describes that raspberry must connects to server to send and receive data .

Test case id	06
Description	Data access is only possible if raspberry connects to server.
Application	Web based app.
Author	Abuzar Riaz & Mohiz Wali.
Requirements	Raspberry must connects to server to transport data.
Steps to be taken	Raspberry always connects with the server, it will get the data from the server and will save changes made in the server.
Expected result	Transportation of data from database.
Actual result	Connection with server failed due to wrong ip allocation.
Status	Success.

Table 6.6: Raspberry Pi Connectivity With Server

6.7.7 Test Case 7: Functional light/fan

TABLE 6.7 describes whether lights/fans are working properly.

Test case id	07
Description	To check if fans/lights are properly functional.
Application	Web based app.
Author	Abuzar Riaz & Mohiz Wali.
Requirements	User must be logged in, raspberry pi must be connected to server, lights/fan must be connected to raspberry pi in a proper circuitry. Device must be connected to same router as raspberry pi.
Steps to be taken	Start client application, successful login, click light/fan button on application to see the response.
Expected result	Fan/light should switch on.
Actual result	Fan/light switched on.
Status	Success.

Table 6.7: Functional light/fan

6.7.8 Test Case 8: Functional light/fan

TABLE 6.8 describes whether lights/fans are working properly.

Test case id	08
Description	To check if fans/lights are properly functional.
Application	Web based app.
Author	Abuzar Riaz & Mohiz Wali.
Requirements	User must be logged in, raspberry pi must be connected to server, lights/fan must be connected to raspberry pi in a proper circuitry.
Steps to be taken	Start client application, successful login, click light/fan button on application to see the response.
Expected result	Fan/light should switch on.
Actual result	Fan/light did not switched on because the setup of GPIO pins were not according to code written.
Status	Fail.

Table 6.8: Functional light/fan

Chapter 7

Conclusion & Future Works

Main aim behind this project is to assist and facilitate the elderly and handicapped persons who are more likely to be exposed to daily life problem than normal people, in a way to automate their homes to provide ubiquitous access and provides healthier standard of livings. HAs is both, a necessity and luxury. It is developed on a platform that is easy and widely used. Using internet make it convenient to be used from everywhere in the world.

We observed this project as a journey where we learned many lessons. Raspberry pi was a new tool for us, it was challenging for us to create whole outcome within given time frame. Another great challenge was to design a hardware that gets data from the sensors and send it to server. With the help of ALLAH we succeeded and the continuous hardship we came across while achieving the desired goals make us more dedicated and observe problem through different perspective. Moreover, we have also learned how to deal with problems like: time management, gathering information, interaction with different tools and implementation of different technologies.

Future Works

Future works may include some new features and functions that can be added in the system are as follows:

- Command through voice recognition.
- Face recognition user authentication.
- Improved hardware will increase systems performance.
- Platform compatibility.

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