DECLARATION

We HAKUZUMUREMYI Emmanuel and TUYISHIME Solonge hereby declare that this Project "IoT SMART HOME CONTROL SYSTEM" submitted in partial fulfillment of the requirement for the Advanced Diploma in ELECTRONICS AND TELECOMMUNICATION TECHNOLY, at KIGALI INDEPENDENT UNIVERSITY, is our original work and has not previously been submitted elsewhere. Also, we declare that a complete list of references is provided indicating all the sources of information quoted or cited.

HAKUZUMUREMYI Emmanuel

Signature…….

Date……. /……./…….

TUYISHIME Solonge

Signature…….

Date……. /……./……..

CERTIFICATION

This is to certify that the Project work entitled “IoT Smart home automation “is submitted by HAKUZUMUREMYI Emmanuel and TUYISHIME Solonge in partial fulfillment of the requirement for the award of the degree Electrical and Electronic engineering department in Electronics and telecommunication technology is a record of work carried out by him under my guidance.

Supervisor: Eng.GASIRABO Eugene

Signature ……...

Date: ….. /….. / 2021

Head of department of Electrical and Electronics Engineering

MUSABYIMANA Jean Pierre

Signature ……...

Date: ….. /….. / 2021

DEDICATION

We dedicate this work to our beloved parents, brothers and sisters who may see this work as a fruitful result of their support, encouragement and love. Who have always been by our side in time of need, since we started our academic study till today. Finally, we dedicate it to all our classmates for the part they played in our studies during those long and exciting years.

ACKNOWLEDGEMENTS

Our first gratitude, appreciation and thanks goes to the Almighty God, who guided us through this journey that was not easy.

We express our deepest thanks to Electrical and Electronics Engineering department for taking part in useful decision and giving necessary advices and guidance and arrange all facilities to make life easier. I choose this moment to acknowledge their contribution gratefully.

It is our radiant sentimental to place on record our best regards, deepest sense of gratitude to our supervisor Eng.GASIRABO Eugene for his careful and precious guidance which were extremely valuable for our study both theoretically and practically, for his technical, wise advice, inspiration, motivation and guidance support during the elaboration of this project.

We highly express our thanks and gratitude for ULK administration and others staffs for their great help. Moreover, we express and appreciate our school practice supervisor for his help, advice throughout our teaching practice.

We wish to express our sincere thanks to ULK for giving us the opportunity of making practice exercises to the department of Electrical and Electronics Technology especially option of Electronics and Telecommunication.

ABSTRACT

In these days, there is a problem to control our home remotely in case of outside such as turn on or off lights, electrical devices as TV, air condition, open or close the doors, etc., the study offers a solution to develop Smart Home Automation System using Internet of Things (IoT). The proposed model of Smart Home Automation control elements of your home environment such as lighting, heating and air conditioning, using any smart phone or computer through particular web application. The main objective of the study is to improve safety, security, expand usability and make life easier for people of all abilities. Smart home automation provides high degree of security and safety and energy saving. With smart home automation your home is in the palm of your hands where ever you are at any time.

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LIST OF ABBREVIATIONS

AC: Alternating current

API: application programming interface

ASCII: American Standard Code for Information Interchange

AVR: Automatic Voltage Regulation

CRT: Cathode Ray Tube

CSS: Cascading style sheet

dB: decibel

DC: Direct current

HTML: Hypertext markup language

IC: integrated circuit

ICSP: in circuit serial programming

ICT: Information Communication and Technology

IDE: Integrated Development Environment

IoT: Internet of things

LCD: Liquid Crystal Display

LPG: liquefied petroleum gas

MHz: Megahertz

MS: Microsoft

PC: Personal Computer

PCB: Printed Circuit Board

PWM: Pulse Width Modulation

RAM: Random access memory

RDMS: Relational Database Management Systems

ROM: Read Only Memory

SDA: Serial data

SIM: subscriber identity module

SQL: Structured Query Language

TTL: transistor transistor logic

UART: Universal asynchronous receiver transmitter

USA: United States of America

USB: Universal Serial Bus

VCC: Voltage common collector

VDC: Direct Current voltage

XAMPP: Cross-platform, Apache server, MariaDB, PHP and Perl

CHAPTER ONE: INTRODUCTION

1.1 General background

In 1752, Benjamin Franklin ran his famous kite experiment that sparked the discovery of electricity. As a prominent American scientist and one of America's founding fathers, Franklin tied a key to a kite string during a thunderstorm and proved that static electricity and lightning were one and the same thing. Following this historic result, people were eager to try to harness the power of electricity for the primary goal of lighting their homes in a cheap and safe way instead of oil and gas lamps which were flammable and dangerous. This revolutionized the world in a lot of different ways since then people have improved the technology leading to industrial revolutions and many more, as technology develops people always try to find a way of making life more efficient and simple using technology (Isaacson, 2008).

Due to people working for many hours and having a busy schedule, smart devices started to be invented in order to improve people's standards of living and also providing and efficient, easy and time saving ways of doing things, this is where this project comes in hand in providing an easy, secure and effective way of controlling your loads using Internet of things (IoT) where ever you are in the world.

1.2 Problem statement

As people tend to spend more time on works and other things they tend to forget to turn ON or OFF their load and usually remember when they are far from where they can be operated, and also some loads need to be controlled at specific times when the owner is also far for example at works, all there resulted to wastage of electric power and poor production efficiency, there was also another problem mostly faced by the old and disabled people moving around to control their loads.

1.3 Objectives

1.3.1 Main objective

The main objectives of this project is to Design and IoT SMART HOME CONTROL SYSTEM.

1.3.2 Specific objectives

The specific objectives of this project are:

1) To build a circuit that controls the home loads (lights, socket outlets, and many more) by communicating with our web application.
2) To build web application where users will be able to control their loads using a smart phone, computer wherever they are as long as they have access to the internet.
3) To build a web application where the administrator adds new users in the system and assign loads to users.

1.4 Scope of project

This project is limited to users whose homes can have access to internet since the project uses a Wi-Fi shield, and also accessing the web application requires internet, this project is also designed for controlling a maximum of eight loads, but this can be eliminated by using a microcontroller with increased out puts.

1.5 Project organization

This report discusses the design and implementation of Smart home control system. It is subdivided into five chapters the first chapter is the Introduction, the second chapter is the literature review, the third chapter is Methodology, the fourth chapter is presentation and result analysis and the fifth chapter is Conclusion, summary and recommendations.

1.6 Research question

What impact can the use of IoT smart home contribute in simplifying people's lives in controlling home loads online, and what impact can it contribute to power saving in terms or remotely switching off the lights as needed?

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter consists of the discussion about the basics of electronic elements and electrical devices that are joined together in order to achieve the desired result during the design and implementation of our project. Although there are several electronic and electrical elements and devices, this chapter will focus on those which are included with smart home as the purpose of our project (American 's new future, 2001).

2.2 ELECTRONIC AND ELECTRICAL ELEMENTS INCLUDED IN OUR CIRCUIT

An electronic component is any basic used to affect electrons or their associated fields. Whereas electrical element is conceptual abstraction representing, idealized electrical component. Such as, WIFI Arduino ESP8266, 8 channels relay module, wireless router, circuit breaker, incandescent lamps, and computer (Nelkin, 2001).

2.2.1 Nodemcu (ESP8266)

The esp8266 is the name of microcontroller designed by espressif system , Espressif system is a Chinese company based out of Shanghai . (Kolban, 2016).

The esp8266 advertises itself as it is a self-contained Wi-Fi networking solution. It is self as a bridge from existing to Wi-Fi and it is also capable of running self-contained application. The volume of esp8266 didn't start until 2014 which means in the scheme of things this is a new bland entry in the line-up processors. A couple of years after Ic production, 3rd party OEMs are taking these Ic chips and building "breakout boards" for them. They are very tiny and virtually impossible for hobbyists to attach wires to allow them to be plugged into breadboards Thankfully, these OEMs bulk purchase the ICs, design Basic circuits, design printed circuit boards and construct pre-made boards with the ICs reattached Immediately ready for our use (Kolban, 2016).

There are a variety of board styles available. The two that we focused on have been given the names ESP-1 and ESP-12. It is important to note that there is only one ESP8266 processor and it is this processor that is found on ALL breakout boards. What distinguishes one board from another is the number of GPIO pins exposed, the amount of flash memory provided, the style of connector pins and various other considerations related to construction. From a programming perspective, they are all the same.

Figure 1: nodemcu (ESP8266)

2.2.1.1 The specification of nodemcu (ESP8266)

When we approach a new electronics device, we like to know about its specification. Here bellow are table show us some details points:

Voltage	3.3v
Current consumption	10uA – 170Ma
Flash memory attachable	16MB max (512K normal)
Processor	Ten silica L106 32 bit
Processor speed	80-160MHz
RAM	32K + 80K
GPIOs	17 (multiplexed with other functions)
Analog to Digital	1 input with 1024 step resolution
802.11 support	b/g/n/d/e/i/k/r
Maximum concurrent TCP connections	5

Table 1:esp8266 specification of nodemcu

The question of determining how long an ESP8266 can run on batteries is an interesting one. The current consumption is far from constant. When transmitting at full power, it can consume 170mA but when in a deep sleep, it only needs 10uA. That is quite a difference. This means that the run

time of an ESP8266 on a fixed current reservoir is not just a function of time but also of what it is doing during that time and that is a function of the program deployed upon it (Kolban, 2016)

The ESP8266 is designed to be used with a partner memory module and this is most commonly flash memory. Most of the modules come with some flash associated with them. Realize that flash has a finite number of erases per page before something fails. They are rated at about 10,000 erases. This is not normally an issue for configuration change writes or daily log writes but if your application is continually writing new data extremely fast, then this may be an issue and your flash memory will fail (Kolban, 2016).

This module comes with a built in USB connector and a rich assortment of pin-outs. It is also immediately breadboard friendly (Kolban, 2016).

2.2.1.2 Applications of Nodemcu (ESP8266)

Major Fields of ESP8266 applications to Internet-of-Things include:

- Home Appliances
- Home Automation
- Smart Plug and lights
- Mesh Network
- Industrial Wireless Control
- Baby Monitors
- IP Cameras
- Sensor Networks
- Wearable Electronics

2.2.1 Relay module

This is a LOW Level 5V 8-channel relay interface board, and each channel needs a 15-20mA driver current. It can be used to control various appliances and equipment with large current. It is equipped with high-current relays that work under AC250V 10A or DC30V 10A. It has a standard interface that can be controlled directly by microcontroller. This module is optically isolated from high voltage side for safety requirement and also prevent ground loop when interface to microcontroller (Handson, 2016).

Figure 2: Relay board 8 channels *(Handson, 2016)*

2.2.2.1 Specifications of relay board

- Relay Maximum output: DC 30V/10A, AC 250V/10A.
- 8 Channel Relay Module with Opto-coupler. LOW Level Trigger expansion board, which is compatible with Arduino control board.
- Standard interface that can be controlled directly by microcontroller (8051, AVR, *PIC, DSP, ARM, ARM, MSP430, TTL logic).
- Relay of high quality low noise relays SPDT. A common terminal, a normally open, one normally closed terminal.
- Opto-Coupler isolation, for high voltage safety and prevent ground loop with microcontroller ; Module Board: 138 x 56 mm. (Handson, 2016).

2.2.2.2 Eight Channel relay module inputs

VCC: Connected to positive supply voltage (supply power according to relay voltage)
GND: Connected to supply ground, IN1: Signal triggering terminal 1 of relay module, IN2: Signal triggering terminal 2 of relay module , IN3: Signal triggering terminal 3 of relay module, IN4: Signal triggering terminal 4 of relay module , IN5: Signal triggering terminal 5 of relay module , IN6: Signal triggering terminal 6 of relay module ,
IN7: Signal triggering terminal 7 of relay module and IN8: Signal triggering terminal 8 of relay module (Handson, 2016).

2.2.2.3 Eight Channel relay module outputs

Each module of the relay has one NC (normally close), one NO (normally open) and one COM (Common) terminal. So there are 8 NC, 8 NO and 8 COM of the channel relay in total. NC stands for the normal close port contact and the state without power. NO stands for the normal open port contact and the state with power. COM means the common port. You can choose NC port or NO port according to whether power or not. (Handson, 2016).

2.2.2.4 Eight Channel relay module testing set up

When a low level is supplied to signal terminal of the 8-channel relay, the LED at the output terminal will light up. Otherwise, it will turn off. If a periodic high and low level is supplied to the signal terminal, you can see the LED will cycle between on and off. (Handson, 2016).

2.2.2.5 Applications of 8 channel relay module

- It can be applied to Arduino and raspberry pi
- Relays are suitable for driving high power electronics devices such as lights, electric fans and air condition.
- A relay can be used to control high voltages with a low voltage by connecting it to an MCU.
- They are also designed to control high voltage AC loads from lower voltage DC control circuitry and they accomplish this by using infrared lights as the “contact” (Handson, 2016)

2.2.2.6 Advantages of 8 channel relay modules

One such advantage of using 8 channel relay module is that they can be switched by a much lower voltage and at a much lower current than most mechanical relays. Also because there are no moving contacts. Solid state relays can be switched much faster and for much longer periods without wearing out (Handson, 2016).

2.2.3 Incandescent lamp

An incandescent light bulb, incandescent lamp or incandescent light globe is an electric light which produces light with a wire filament heated to a high temperature by an electric current passing through it, until it glows .The hot filament is protected from oxidation with a glass or quartz bulb that is filled with inert gas or evacuated. In a halogen lamp, filament evaporation is prevented by chemical processes that redeposit metal vapour onto the filament, extending its life. The light bulb is supplied with electric current by feed-through terminals or wires embedded in the glass. Most bulbs are used in a socket which provides mechanical support and electrical connections (Karlicek, 2016).

Figure 3: Incandescent lamp *(Karlicek, 2016)*

2.2.4 Circuit breaker

A circuit breaker is a type of switch that automatically breaks the circuit and cut off the current when a certain current value is excluded. Unlike a wire fuse that has to be replaced, a circuit breaker can reset and switched on again (Prévé, 2013).

Figure 4: Circuit breaker *(Prévé, 2013)*

2.2.4.1 Function of circuit breaker

It detects fault condition by interrupting the continuity and is used to determine if there is the fault. It is used to protect the circuit against the damaged caused by over load and short circuit for electrical circuit (Prévé, 2013).

2.2.4.2 Characteristics of circuit breaker

- Voltage classes
- Current rating
- Type of circuit breaker

2.2.4.3 Types of circuit breaker

- Low voltage circuit breaker
- Magnetic circuit breaker
- Thermal magnetic circuit breaker Medium voltage circuit breaker

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter demonstrates different methods and strategies that were used to conduct this project, we highlighted the methods which are interview, observation method and documentation methods. Furthermore, we reviewed different softwares and programming languages that were also used while designing and implementing this project.

3.2 Methodology

3.2.1 Observation

Observation, as the name implies, is a way of collecting data through observing. Observation data collection method is classified as a participatory study, because the researcher has to immerse him/herself in the setting where her respondents are, while taking notes and/or recording. The advantages of observation data collection method include direct access to research phenomena, high levels of flexibility in terms of application and generating a permanent record of phenomena to be referred to later. At the same time, observation method is disadvantaged with longer time requirements, high levels of observer bias, and impact of observer on primary data, in a way that presence of observer may influence the behavior of sample group elements.

While collecting the data, it was hard to visit many homes since most of them they like privacy. But we managed to observe starting from our homes and some institutions, we also observed how the business is done on the side of vendors in the business of gas refilling and gas ordering.

3.2.2 Documentation

This technique is also necessary for getting information and help the researcher also to increase their knowledge so that he can easily solve the problem practically, it permits the researcher to consult books, other previous researchers, class notes, and the internet to find a different definition of words and codes for solving it.

Here we have read many class notes; consult different books from the school even outside the school so that we can easily solve the problems as stated before.

3.3 Softwares used

Application software (app for short) is a program or group of programs designed for end-users to perform specific tasks. While designing and implementing this project we used different kind of softwares like Arduino IDE, Sublime text editor, Xampp and browsers [Chaudhuri.A.(2018].

3.3.1 Arduino IDE

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, mac OS, Linux) that is written in functions from C and C++.It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards. In this project Arduino IDE was used in writing and upload program to esp8266 [John ,M.(2019)].

3.3.2 Sublime text editor

Sublime Text is a sophisticated cross-platform source code editor with a Python application programming interface (API). It natively supports many programming languages and markup languages, and functions can be added by users with plugins, typically community-built and maintained under free-software licenses. This software was used in writing PHP, JavaScript, HTML and CSS codes [Mark,J.(2013)].

3.3.3 XAMPP

The full form of XAMPP is X stands for Cross-platform, (A) Apache server, (M) MariaDB, (P) PHP and (P) Perl. The Cross-platform usually means that it can run on any computer with any operating system. XAMPP is an open-source software developed by Apache Friends. XAMPP software package contains Apache distributions for Apache server, MariaDB, PHP, and Perl. And it is basically localhost or a local server. This local server works on your own desktop or laptop computer. XAMPP was used test the website before uploading it to the remote web server. XAMPP server software gave us a suitable environment for testing MYSQL, PHP, Apache, and Perl projects on the local computer [SAMUEL,P.(2013)].

3.3.4 Browsers

A web browser, or simply "browser," is an application used to access and view websites. Common web browsers include Microsoft Internet Explorer, Google Chrome, Mozilla Firefox, and Apple Safari. The primary function of a web browser is to render HTML, the code used to design or "

markup " webpages. Each time a browser loads a web page, it processes the HTML, which may include text, links, and references to images and other items, such as cascading style sheets and JavaScript functions. The browser processes these items, then renders them in the browser window. While designing the web application we used many popular web browsers in order ensure browser compatibility [Board.E.(2018)].

Figure 5: popular web browsers

[Luimes.A.(2018)]

3.4 Programming languages

A programming language is a set of commands, instructions, and other syntax use to create a software program. Languages that programmers use to write code are called "high-level languages." This code can be compiled into a "low-level language," which is recognized directly by the computer hardware [Edward, D(2014)].

High-level languages are designed to be easy to read and understand. This allows programmers to write source code in a natural fashion, using logical words and symbols. In the design of this project different programming languages were which are Arduino C language, HTML, CSS, PHP, Java script [Dean. (2019)].

3.4.1 Hypertext Markup Language (HTML)

Stands for "Hypertext Markup Language." HTML is the language used to create webpages. HTML was invented by Tim Berners-Lee, a physicist at the CERN research institute in Switzerland. He came up with the idea of an Internet-based hypertext system.

Hypertext means a text that contains references (links) to other texts that viewers can access immediately. He published the first version of HTML in 1991, consisting of 18 HTML tags. Since then, each new version of the HTML language came with new tags and attributes (tag modifiers) to the markup [Dean.(2019)].

3.4.2 Cascading Style Sheet (CSS)

Cascading Style Sheets, fondly referred to as CSS, is a simple design language intended to simplify the process of making web pages presentable.

CSS handles the look and feel part of a web page. Using CSS, you can control the color of the text, the style of fonts, the spacing between paragraphs, how columns are sized and laid out, what background images or colors are used, layout designs, variations in display for different devices and screen sizes as well as a variety of other effects.

CSS is easy to learn and understand but it provides powerful control over the presentation of an HTML document. Most commonly, CSS is combined with the markup languages HTML. CSS has several advantages among them include CSS saves time, Pages load faster, Easy maintenance, Superior styles to HTML, Multiple Device Compatibility, Global web standards [Dean.(2019)].

3.4.3 Java script

JavaScript is a dynamic computer programming language. It is lightweight and most commonly used as a part of web pages, whose implementations allow client-side script to interact with the user and make dynamic pages. It is an interpreted programming language with object-oriented capabilities.

Java script was used to create and control dynamic website content, i.e. anything that moves, refreshes, or otherwise changes on your screen without requiring you to manually reload a web page. Features like: animated graphics, photo slide shows, autocomplete text suggestions, interactive forms [Dean.(2019)].

3.4.4 Hypertext Pre-processor (PHP)

PHP is a server side scripting language. that is used to develop Static websites or Dynamic websites or Web applications. PHP stands for Hypertext Pre-processor, that earlier stood for Personal Home

Pages. PHP scripts can only be interpreted on a server that has PHP installed. PHP is integrated with a number of popular databases, including MySQL, PostgreSQL, Oracle, Sybase, Informix, and Microsoft SQL Server, PHP was used in making logical decisions and connecting the interface with the database through SQL [Williams, E.(2002)].

3.4.5 Structured Query Language (SQL)

SQL is Structured Query Language, which is a computer language for storing, manipulating and retrieving data stored in a relational database.

SQL is the standard language for Relational Database System. All the Relational Database Management Systems (RDMS) like MySQL, MS Access, Oracle, Sybase, Informix, Postgres and SQL Server use SQL as their standard database language. SQL was used to access data in the relational database management systems, define the data in a database and manipulate that data, create and drop databases and tables, create view, stored procedure, functions in a database [Williams, E .(2002)].

3.5 Flow chart

A flowchart is a type of diagram that represents a workflow or process. A flowchart can also be defined as a diagrammatic representation of an algorithm, a step-by-step approach to solving a task. The flowchart shows the steps as boxes of various kinds, and their order by connecting the boxes with arrows

3.5.1 Admin side flow chart

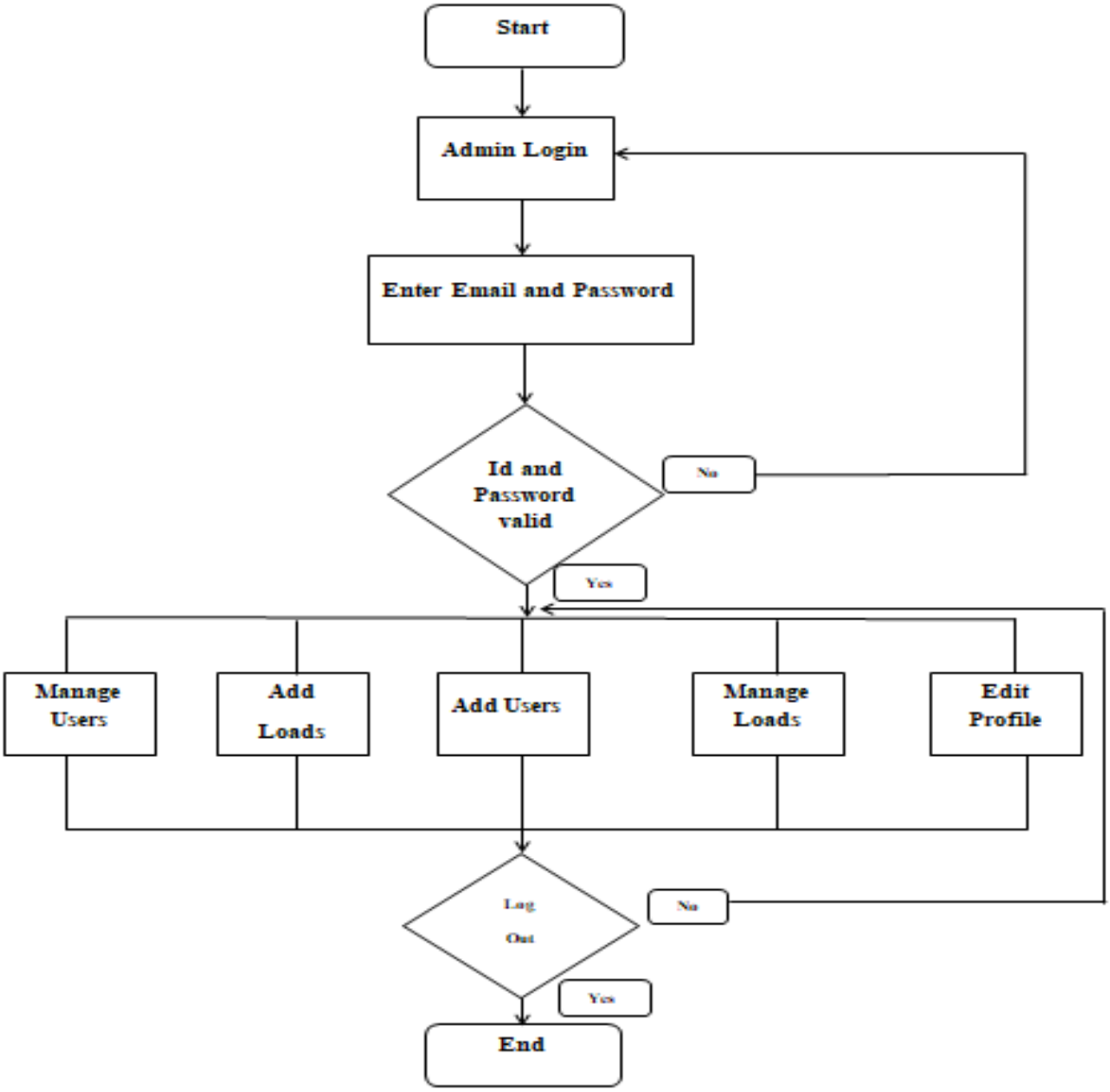

Figure 6: Flow chart of admin

3.5.1.1 Admin side flow chart description

Initially the system starts with a page pertaining admin log in ,if admin enters both collect email id and password then he /she is allowed into the system, when admin could not either enter collect email id or password ,the system will bring him/her back to the log in page.so when he/she enters in the system ,he/she will be allowed to manage both users, add new loads, add users, manages

loads and edit his/her profile as well. And when he/she needs to log out in the system admin flow chart will be end simply the admin will require the collect credentials to be able to do those tasks in the system.

3.5.2 User side flow chart

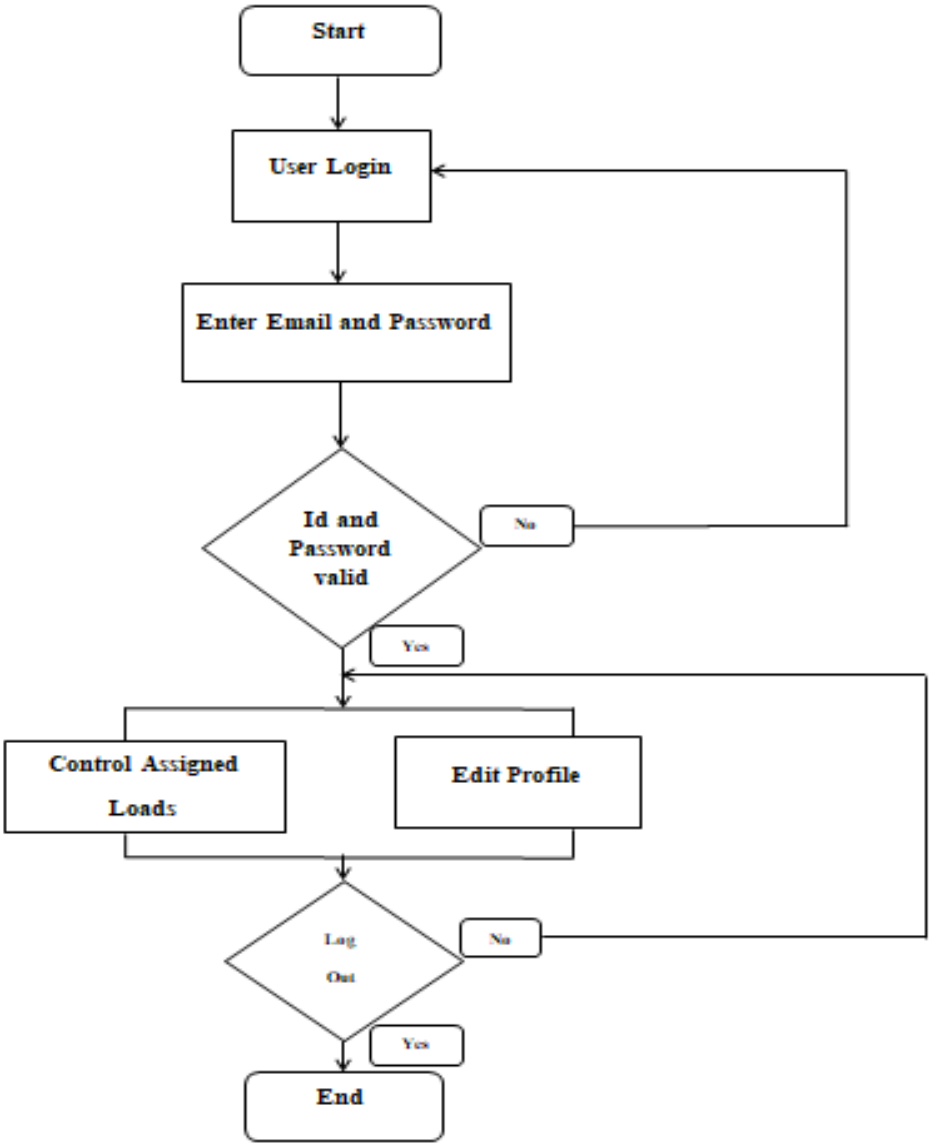

Figure 7: flow chart of admin

3.5.2.1 User side flow chart description

Initially the system starts with a page pertaining user log in, if a user enters both collect email id and password then he /she is allowed into the system, when a user could not either enter collect email id or password, the system will bring him/her back to the log in page.so when he/she enters in the system, he/she will be allowed to control assigned loads and edit his/her profile as well. And when he/she needs to log out in the system user flow chart will be end simply the user will require the collect credentials to be able to do those tasks in the system.

CHAPTER FOUR: PRESENTATION AND RESULT ANALYSIS

4.1 Design of smart home

The following figure below shows the block diagram of SMART HOME. It is composed by 5 main parts: webserver, esp8266, switching circuit, external circuit and power supply. With this block diagram of the circuit, we are going to show the designing process that lead to a complete analysis of the global circuit diagram of automatic smart home system

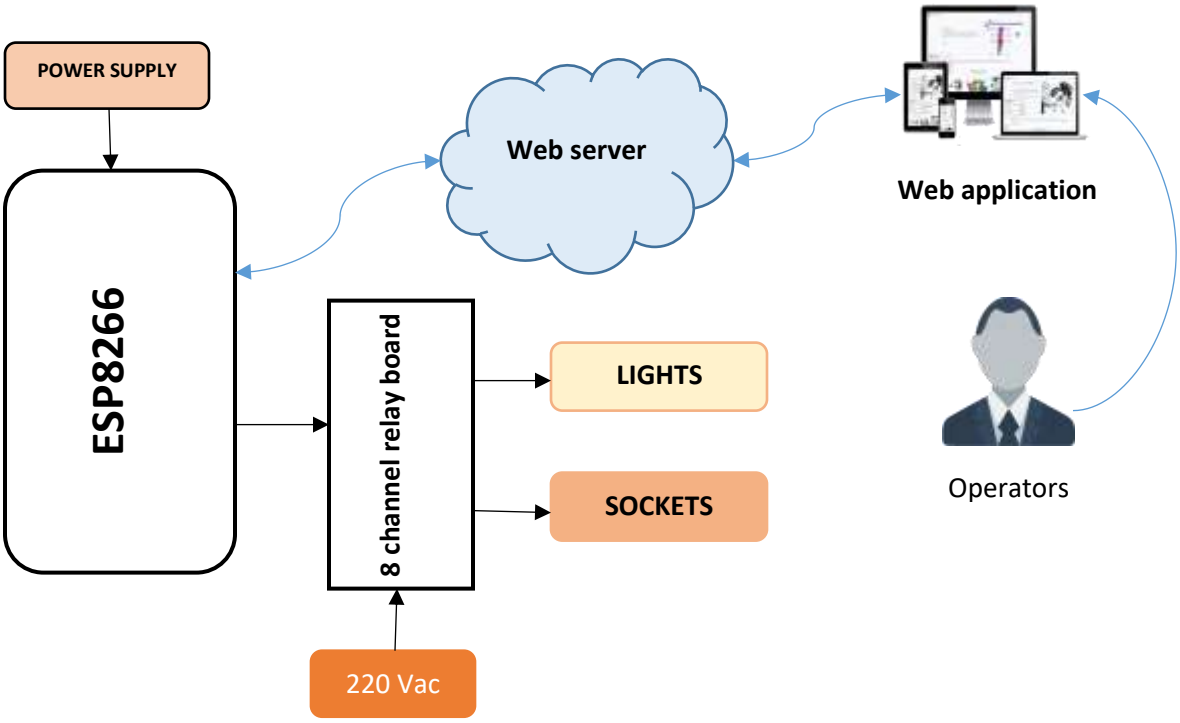

Figure 8: Block diagram of the system

4.2 Block diagram description

The basic block diagram of smart home is shown in the figure above. Mainly the block diagram consists of the following main blocks:

4.2.1 Operators

The operators will be either an admin or users who will be able to access website in order to control and monitor all loads of designed smart home.

4.2.2 Web server

This is the part where the database website is located, and an operator will access the website through this web server in order to control and monitor all loads of smart home. And this is the main part of the project because all information and data are stored in it.

It is also a master computer that stores the web pages and serves to the clients upon requested, in our project it is where our system hosted.

4.2.3 Nodemcu (ESP8266)

ESP8266 its low cost and high performance 32bit application processor along with a integrated TCP/IP stack based Wi-Fi. It has Capabilities such as Wi-Fi hotspot, Peer to Peer Communication and combined mode as a STA and AP. ESP8266 is a complete Wi-Fi system on chip that incorporates a 32-bit processor, some RAM and depending on the vendor between 512KB and 4MB of flash memory. This allows the chip to either function as a wireless adapter that can extend other systems with Wi-Fi functionality, or as a standalone unit that can by itself execute simple application. In this system it is used to collect data programmed from the website and executes them.so it works as an interface between the webserver and switching part of the system and controls the whole operations of the circuit according to the program inside

4.2.4 Switching circuit

This part is designed for switching the smart home loads and it is made by a relay board (8 channel relay module) which is a LOW Level 5V 8-channel relay interface board, and each channel needs a 15-20mA driver current. It can be used to control various appliances and equipment with large current. It is equipped with high-current relays that work under AC250V 10A or DC30V 10A. It has a standard interface that can be controlled directly by microcontroller. This module is optically isolated from high voltage side for safety requirement and also prevent ground loop when interface to microcontroller. In our project will be used to switch the loads according to the pulse given by an ESP8266.

4.2.5 External circuit

External circuit is the circuit composed by electric components. In this project these electrical components will be switched by an operator though the switching circuit and will be home loads like lamps, fridge, Ac, television and each loads operator wants to control.

4.2.6 Power supply

This is electrical device which supply electric power to an electrical loads or electronic loads.in this project we will use 2 types power supplies which are dc power supply and AC power supply, DC power supply will be used for supplying relay board and ESP8266 by 5 Vdc and AC power supply will be used to supply the external circuit which is electrical by using 220 Vac

4.3 Complete circuit diagram

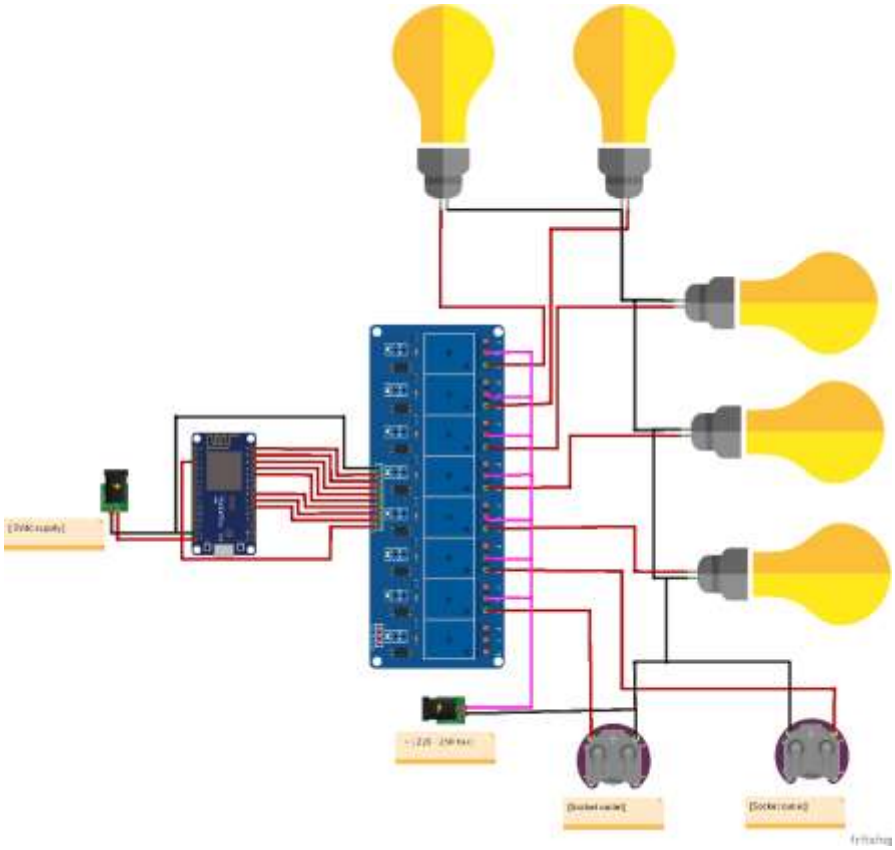

Figure 9: Full complete circuit

4.3.1 Working principal of the circuit

The circuit is build up with **3 main parts**, web application, electronic part and electrical part where in electronic part, there is ESP8266 and relay board of 8 channel designed for switching purpose and in electrical part, there are 8 loads to be controlled which lights and socket outlets. Once the system is powered on, the esp8266 attempts to connect to the wireless Router. Once the esp8266 is connected to the networks it starts to make http requests to the web server and retrieves back the status of the loads, having retrieved the status of the loads it then makes logical decision depending on the status and the program, to turn ON or OFF the loads accordingly, the loads are turned ON or OFF by providing low or high signal to the relay board respectively.

4.4 Implementation of smart home

The implemented system has three section, electronic section and data base section and electrical section.

4.4.1 Electronic section

The electronic section has 2 parts Relay board and Arduino ESP 8266
Connected together.

4.5 Data base section

The system data base contains 5 parts. Registration, add new loads, manage users, manage loads, editing profile, Control loads, below is a figure showing the index page of the web application

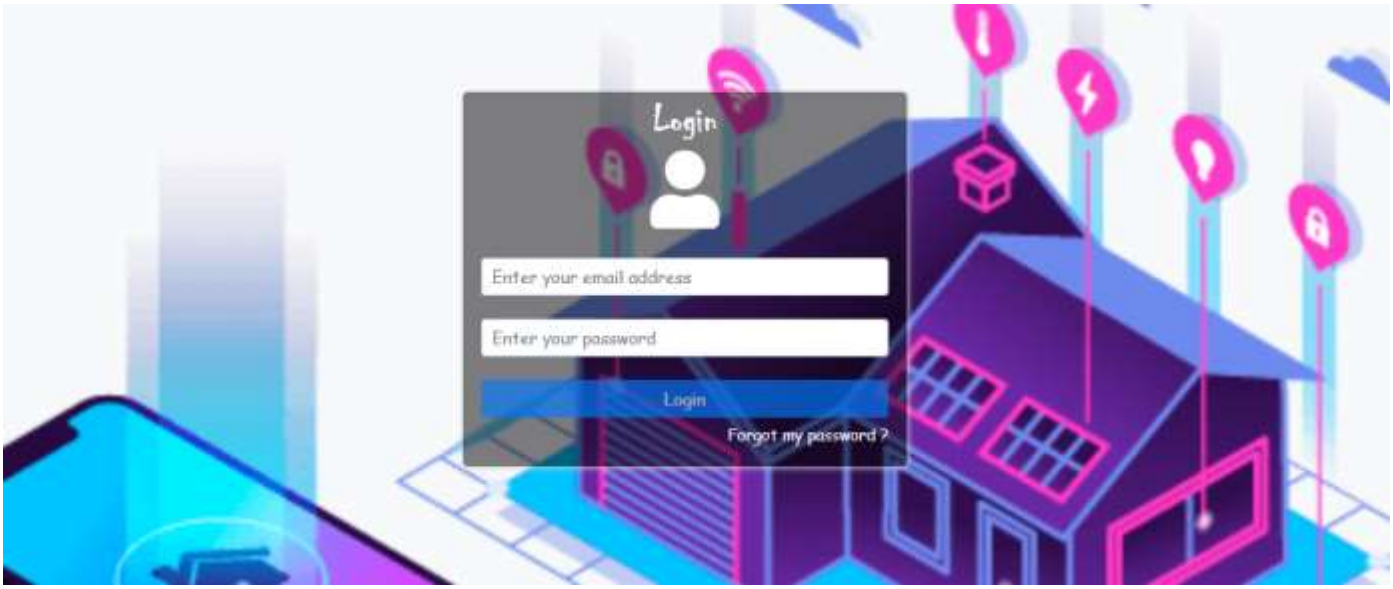

Figure 10 : Log in page

CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The project we have undertaken has helped us to gain a better perspective on various aspects related to our courses of study as well as practical knowledge of electronic equipment. We became familiar with software analysis, designing, implementation, testing and maintenance concerned with our project. The extensive capabilities of this system are what make it so interesting, from the convenience of IOT system that incorporating electronic circuit with ICT. A user is able to control only assigned loads from smart home and an admin can control all smart home loads and managing those loads so as to save energy used, saving time and saving money as well, this project is good because a user or an admin can control home loads even if he/she is not at home through online and the output wanted was achieved well.

5.2 Recommendation

This project is a small implication of our concept in automating, controlling internet of things system. The practical applications of this project are immense and can have vast level of implementation. This small concept can be used in fields such as home, Hotels, Restaurants industries, schools and other organizations having smart loads to be controlled online. So this is not the end of the project but rather is a step towards exploring other possibilities yielded by it. We feel very happy to have worked in such challenging project which has tremendous applications and possibilities. We recommend our brothers and sisters to work in such field, which actually gives a lot of satisfactions while working. The project works in the fact that it gives a lot of confidence to fight out through this challenging world. As one proceeds, one cannot believe how much knowledge he/she gains and the teamwork, which the project work teaches, really will have a new experience and we recommend all people to use this system because it is very interesting project in our daily life as technology is growth every second of the minute, they need to use this project so as to save time by controlling home loads online even they are not around.

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APPENDICES

Appendix one

Project codes

```
#include <ESP8266HTTPClient.h>
#include <ESP8266WiFi.h>
#include <ESP8266WebServer.h>
#include <ArduinoJson.h>
// WiFi parameters
const char* ssid = "e_connect";
const char* password = "1111111a";
HTTPClient http;
//host to send data
void setup() {
  Serial.begin(115200);
  Serial.print("Connecting to ");
  Serial.println(ssid);
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }
  delay(3000);
  Serial.println("WiFi connected");
  Serial.println("IP address: ");
  Serial.println(WiFi.localIP());
  pinMode(D0, OUTPUT);
  pinMode(D1, OUTPUT);
  pinMode(D2, OUTPUT);
```

```
  pinMode(D3, OUTPUT);
  pinMode(D4, OUTPUT);
  pinMode(D5, OUTPUT);
  pinMode(D6, OUTPUT);
  pinMode(D7, OUTPUT);
  digitalWrite(D0, HIGH);
  digitalWrite(D1, HIGH);
  digitalWrite(D2, HIGH);
  digitalWrite(D3, HIGH);
  digitalWrite(D4, HIGH);
  digitalWrite(D5, HIGH);
  digitalWrite(D6, HIGH);
  digitalWrite(D7, HIGH);
}
void loop() {
  String host = "http://smart-home.enlabs.rw/controler.php";
  const char* hosts;
  hosts = host.c_str();
  Serial.println(hosts);
  http.begin(hosts);
  http.addHeader("Content-Type", "application/x-www-form-urlencoded");
  int httpCode = http.GET();
  String payload = http.getString(); // get data from webhost continously
  String  input = payload;
  StaticJsonDocument<200> doc;
  DeserializationError err = deserializeJson(doc, input) ;
  if (err) {
    Serial.print("ERROR:");
    Serial.print(err.c_str());
```

```
  return;
 }
 Serial.println(payload);
 JsonArray status = doc["status"];
 int status_0 = status[0];
 int status_1 = status[1];
 int status_2 = status[2];
 int status_3 = status[3];
 int status_4 = status[4];
 int status_5 = status[5];
 int status_6 = status[6];
 int status_7 = status[7];
 if (status_0 == 0)
 {
  digitalWrite(D0, HIGH);
 }
 else
 {
  digitalWrite(D0, LOW);
 }
```

…….

Other contents of the code are hidden to prevent direct copy of our work

Appendix two

Web application pages and description

Registration: this where the admin will fill to register new user by filling his/her address, user name, telephone number, and email.

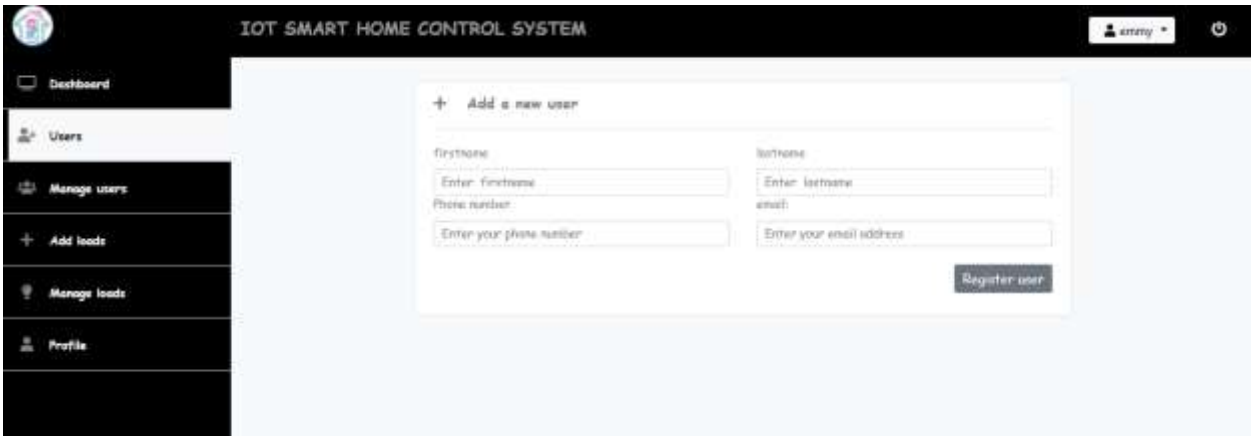

Figure 11: Registering new user

Manage users: This is where an admin manages users by assigning the loads that a user can control, remove user from controlling some smart home loads, deleting users and blocking users

Figure 12: Manage users

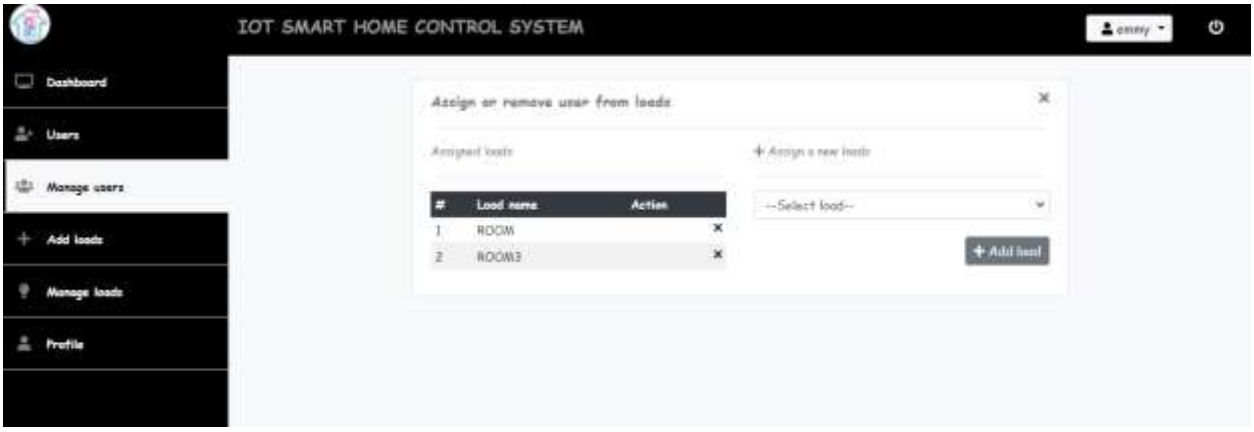

Figure 13: Assign or remove user from loads

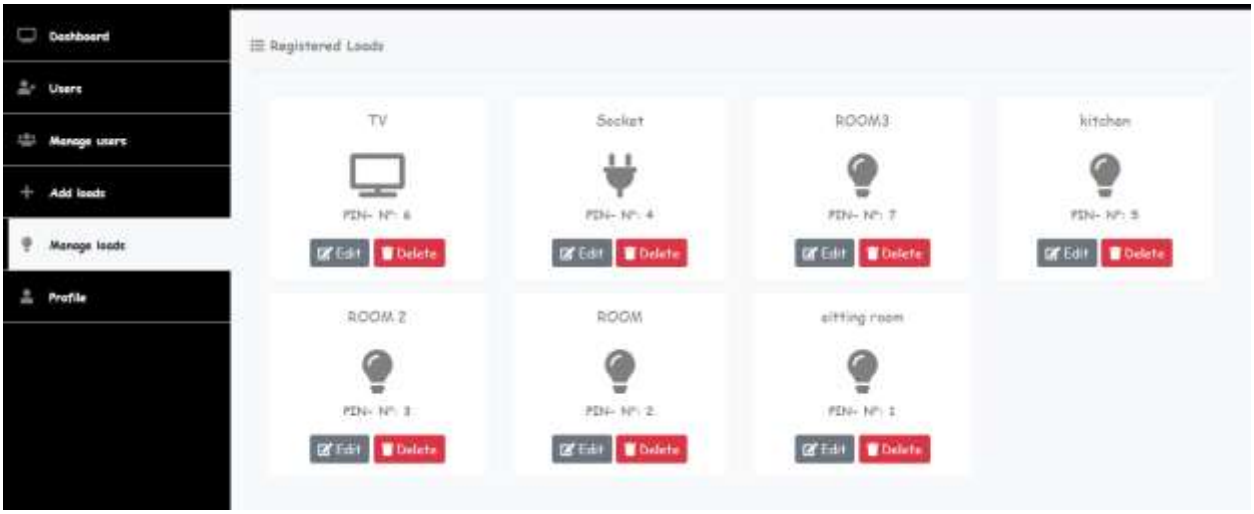

Figure 14: Admin edit and delete loads

Add loads: this is where an admin adds new loads. select the type of loads and the pin that those loads are connected to

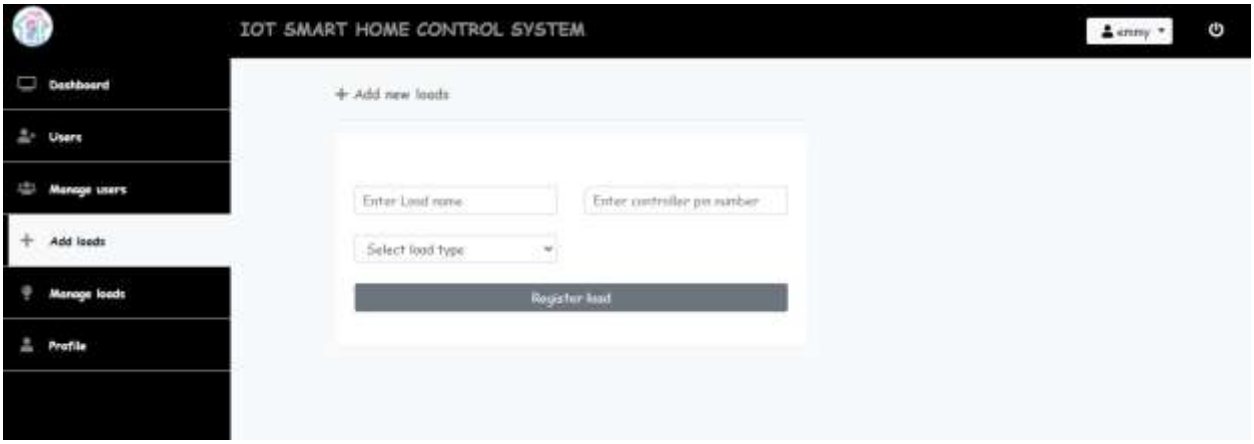

Figure 15 : Adding new loads

Control loads: this is where an admin and a user control the home loads where by an admin can control all smart home loads and a user can only control the assigned loads and here there is some indications showing that the loads are either ON or OFF.

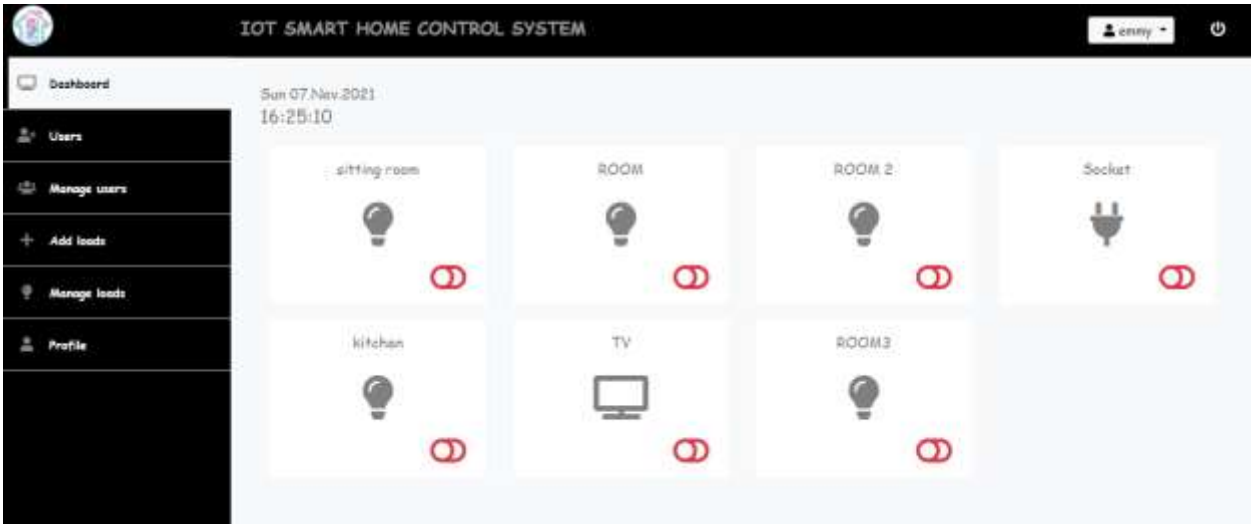

Figure 16: Admin controlling smart home loads

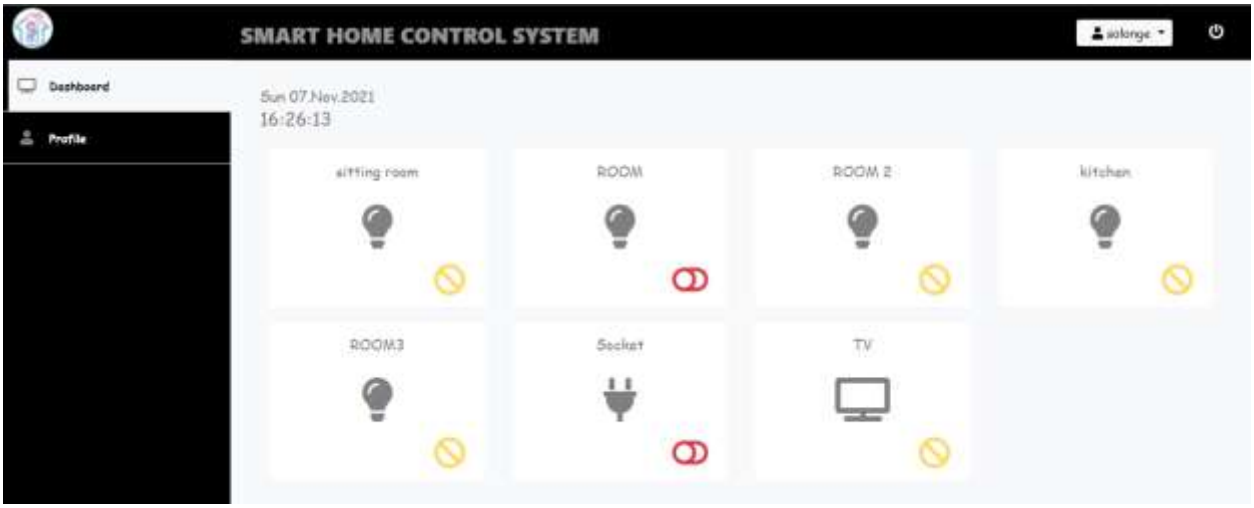

Figure 17: User controlling only the assigned smart home loads

Appendix three

Project budget

#	Item	Price /item in Rwf	Quantity	Total price in RWF
1	Esp8266	12,000	1	12,000
2	lamps	800	5	4,000
3	sockets	500	2	1,000
4	Circuit breaker	2,000	1	2,000
5	8 channel relay	12,000	1	12,000
6	Stepdown module	2,000	1	2,000
7	Lamp holder	500	5	2,500
8	wires	300	15 m	4,500
9	Soldering wire	200	1m	200
10	Wooden box	3,500	1	3,500
11	Cable ties	150	2	300
12	glue	1000	2	2,000
13	Cloud hosting	10,000	1	20,000
14	jumpers	20	50	1,000
15	Transport			20,000
16	Communication			15,000
17	Printing			10,000
			Total	107,000