

Smart Home: AN IOT BASED HOME AUTOMATION SYSTEM USING NODE MCU

BY

NITTANANDO SARKAR

ID: 162-15-7729

MD FARHADUZZAMAN

ID: 162-15-8241

MAHMUDUL HASAN

ID: 162-15-8257

This Report Presented in Partial Fulfillment of the Requirements for the
Degree of Bachelor of Science in Computer Science and Engineering

Supervised By

MR. ANIRUDDHA RAKSHIT

Senior Lecturer

Department of CSE

Daffodil International University

Co-Supervised By

RUBAIYA HAFIZ

Senior Lecturer

Department of CSE

Daffodil International University



DAFFODIL INTERNATIONAL UNIVERSITY

DHAKA, BANGLADESH

OCTOBER 2020

APPROVAL

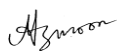
This Project titled “**Smart Home: AN IOT BASED HOME AUTOMATION SYSTEM USING NODE MCU**”, submitted by Nittanando Sarkar, ID: 162-15-7729, Md. Farhaduzzaman, ID: 162-15-8241 and Mahmudul Hasan, ID: 162-15-8257 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 8th October, 2020.

BOARD OF EXAMINERS



Dr. Syed Akhter Hossain
Professor and Head

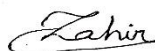
Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University



Chairman

Nazmun Nessa Moon
Assistant Professor

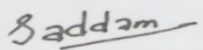
Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University



Internal Examiner

Gazi Zahirul Islam
Assistant Professor

Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University



Internal Examiner

Dr. Md. Saddam Hossain
Assistant Professor

Department of Computer Science and Engineering
United International University

External Examiner

DECLARATION

We hereby declare that this project has been done by us under the supervision of **Mr. Aniruddha Rakshit, Lecturer (Senior Scale)**, Department of Computer Science and Engineering, Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

Supervised by:

Aniruddha Rakshit

Mr. Aniruddha Rakshit
Lecturer (Senior Scale)

Department of Computer Science and Engineering
Daffodil International University

Co-Supervised by:

Rubaiya

Rubaiya Hafiz

Lecturer
Department of CSE
Daffodil International University

Submitted by:

Nittanando Sarkar

Nittanando Sarkar

ID: 162-15-7729
Department of CSE
Daffodil International University

Md. Farhaduzzaman

Md. Farhaduzzaman

ID: 162-15-8241
Department of CSE
Daffodil International University

MAHMUDUL HASAN

Mahmudul Hasan

ID: 162-15-8257
Department of CSE
Daffodil International University

©Daffodil International University

ACKNOWLEDGEMENT

First, we express our heartiest thanks and gratefulness to the almighty God for His divine blessing for making it possible to complete our final year project.

We really grateful and wish our profound our indebtedness to **Mr. Aniruddha Rakshit Senior Lecturer**, Department of CSE Daffodil International University, Dhaka. Deep Knowledge & keen interest of our supervisor in the field of” Internet of Things (IoT)” to carry out this project. His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior drafts and correcting them at all stage have made it possible to complete this project.

We would like to express our heartiest gratitude to **Prof. Dr. Syed Akhter Hossain;** Head, Department of Computer Science and Engineering, for being kind and friendly with us throughout these years and also to other faculty members and the staff of CSE department of Daffodil International University.

We would like to thank our entire course mate in Daffodil International University, who took part in this discuss while completing the course work.

Finally, we must acknowledge with due respect the constant support and patients of our parents.

ABSTRACT

This paper presents a flexible home control and environment monitoring system .We came with a proposal with low cost and simple methodology of home automation .Technological advancements in the field of automation is getting simpler and doing more progress .Also the user of internet is increasing .Nowadays humans have made the internet such an integral part of their life that without it life is really helpless .People are using several technologies at home and outdoor like smart TV, Smart card and they are really appreciating it day by day .So that is why, here we are with this smart home technology using Internet of Things (IoT) .This paper is going to explain our idea, which we implemented using node Mcu, Firebase and the Internet of Things along with an android based mobile application which will be used for the operation of our system.

TABLE OF CONTENTS

CONTENTS	PAGE
Board of examiners	ii
Declaration	iii
Acknowledgements	iv
Abstract	v
CHAPTER	
CHAPTER 1: INTRODUCTION	1-4
1.1 Introduction	1
1.2 Motivation	1
1.3 Objectives	2
1.5 Expected Outcomes	2
1.6 Report Layout	3
CHAPTER 2: BACKGROUND	5-8
2.1 Terminologies	5
2.1.1 Node Mcu	5
2.1.2 Relay board	5
2.1.3 Sensors	5

2.1.4 Firebase	5
2.1.5 Android Application	5
2.2 Related Work	6
2.3 Comparative Analysis	6
2.4 Challenges	7
CHAPTER 3: REQUIREMENT SPECIFICATIONS	9-14
3.1 Business Process Modeling	9
3.2 Requirement Collection and Analysis	9
3.3 Use Case Modeling and Description	11
3.4. Design Requirement	12
CHAPTER 4: DESIGN SPECIFICATION	15-17
4.1 Front End Design	15
4.2 Back End Design	16
4.3 Interaction Design and User Experience	17
CHAPTER 5: IMPLEMENTATION AND TESTING	18-20
5.1 Implementation of Database	18
5.2 Implementation of Front-End Design	18
5.3 Test Results	19
CHAPTER 6: IMPACT ON SOCIETY, ENVIRONMENT AND SUSTAINABILITY	21-22
6.1 Impact on society and Environment	21

6.2 Ethical Aspects	21
6.3 Sustainability Plan	22
CHAPTER 7: DISCUSSION AND CONCLUSION	23
7.1 Discussion and conclusion	23
REFERENCES	24-25
PLAGIARISM REPORT	26

LIST OF FIGURES

FIGURES	PAGE
Figure 1.1: Proposed System	1
Figure 3.1: UML Diagram of The System	9
Figure 3.2: Physical Component	11
Figure 3.3: Flow chart of The System	12
Figure 3.4: Required Hardware for Design	13
Figure 3.4.1: Physical Components Setup	13
Figure 3.4.2: Circuit Diagram	14
Figure 4.1: Interface Design of The Application	15
Figure 4.1.1: XML Code For UI	16
Figure 4.2: Real Time Database	17
Figure 5.2: Application UI	19

CHAPTER 1

INTRODUCTION

1.1 Introduction

Smart phone, smart TV, smart card these are the terms we all are familiar with. This 'smart' term before phone or TV means, a mobile phone that will include advanced functionality beyond making only phone calls and sending messages .For TV it will be a traditional TV with internet and web facilities which will allow the user to stream music, videos, browsing the internet etc .Now we are here with a concept of SMART HOME where we used Internet Of Things (IOT) for home automation .This system, showed in figure 1.1 will allow us to control our electrical home appliances by a smart phone or computer .Lights ,fans ,AC , TV ,security camera even the smoke detector of our home can be controlled by our phone from anywhere in the earth using the internet.

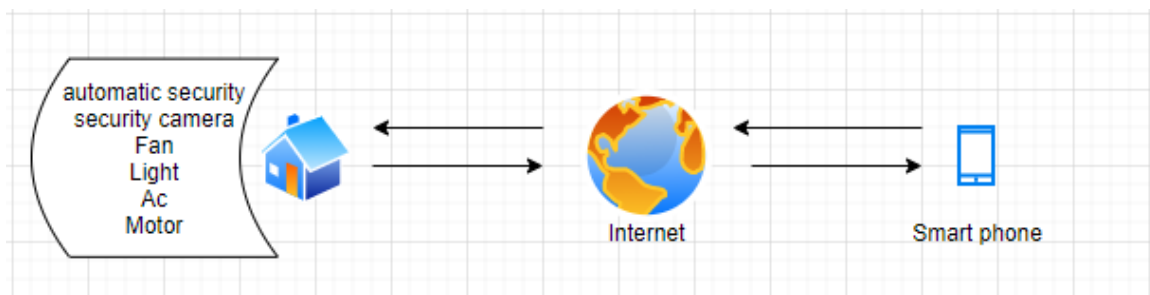


Figure 1.1: Proposed system

1.2 Motivation

Day by day every kind of devices are getting updated where smart devices are getting more smarter and people are very fond of these automatic devices or smart devices .Now

let's think of a situation where a guy is using his smart phone laying on his bed ,light and AC is ON .Now he wants to sleep but for that he have to go to the switch board and turn off the light .Now in this digital era ,where he has a smart phone with internet on his hand and we have IOT why we have to do this thing manually .It will also be very much helpful for the older and physically disabled people .

1.3 Objectives

- Compatibility: we want to make the life of people more enjoyable and interesting through our project .so we make sure that all the appliances of a home will perform perfectly together and the system will be compatible with any situation.
- Improvability: we will upgrade the system with respect to the time .we will upgrade the software mainly so we will look on the part where it will upgrade the system easily by not changing any hardware for the user.
- Remotely operable: Our system allow the user to control all the features remotely .Like before reaching at home anybody can turn on AC to make the room cooler or turn off lights, or any other electrical appliances of other rooms from his/her room .Monitoring the security camera or other is also possible by the system remotely.
- Energy management: There is some energy saving features in the system .Like it will turn off the system automatically when not in use.
- Security: If there is any problem related with circuit, user can shut down the system from his phone .It also has the backup system in the firebase it will keep the data for later use.

1.4. Expected Outcome

People will have many benefits and features like if there is automated windows in the house, they can set a particular time when it will automatically open and close .same

thing can be done with the other appliances so people will be more interested in automated system than the old manual one .sometimes we forget to turn off the oven or induction after leaving the house and it is such a dangerous situation that often people has to come back leaving important things .our system will give the people relief from this situations .It will make them tension free on this .people of old ages and also who are disabled will find it easier to operate the appliances .It may notify the user when to turn on things and make them off .so people will forget less about their home things .we are highly expecting that people will love our system when they will find that from their smart phone they can operate every appliances of their house which is also very secured.

1.5 Report Layout

Chapter 1: Introduction

In this chapter we have discussed about our motivation for this project, then the objectives and the expected outcome of the system followed by the report layout.

Chapter 2: Background

We discussed the background circumstances of our proposed system here .we talked about the related work where we mentioned some similar project that are done by others .the terminology that we used in the paper is also mentioned and then the challenges we faced during the implementation.

Chapter 3: Requirement Specification

All the requirements throughout the project is discussed in this section .Like Business process modelling, requirement collection and analysis, use case modelling and description and the design requirement.

Chapter 4: Design Specification

This chapter contains the front end design, back end design, Interaction design and user experience followed by implementation requirement.

Chapter 5: Implementation and Technique

Here we discussed all about implementation and testing of our project .how the database is implemented, implementation of the front end design, testing implementation, test results and the report are included in this chapter.

Chapter 6: Impact on Society, Environment and Sustainability

This chapter contains the impact of our project on our society, environment, ethical aspects of our proposed project and our sustainability plan for the future.

Chapter 7: Conclusion

This is the chapter where we concluded our project report with some short of discussion on the whole project.

CHAPTER 2

BACKGROUND

2.1 Terminologies

2.1.1 Node Mcu

Node Microcontroller unit[8] is an open source software and hardware development environment that is built around a very low cost system in a chip called the ESP8266 .this is the wi-fi module we used in our system .

2.1.2 Relay board

Relay boards[9] are computer boards with a lineup of relays and switches .these things have input and output terminals and are mapped to control the voltage supply.

2.1.3 Sensors

A sensor is a device that estimates physical input from its environment and converts it into some data that can be interpreted by either a human or a machine .we used several sensors which are discussed in the requirement section.

2.1.4 Firebase

Google firebase is a development platform that helps us to build, grow and improve our apps .we used in our project the real time database of firebase which is a cloud hosted database.

2.1.5 Android application

We used an android based application for the input command .we made it using the android studio and the language used in it was XML.

2.2 Related Works

Home automation is such a popular topic that all over the world many other people has worked on it and many other are still working using many other techniques . Since technology has developed a lot in last few years ,IOT[10] based home automation is also upgraded .One of the earliest system was developed using DTMF receiver [1] where ringing line was used for the communication interface and the authentication of user .There are some systems developed using GSM with micro controllers like Arduino or PIC microcontrollers[2] [3] .these systems can be operated without internet .only a SIM card and text messages can be used to operate these kind of systems .Raspberry pi is also very popular for developing this type of project and many people used it[4] [5] as microcontroller and E-mail is used to carry the messages rather than text messages of GSM .but in this case for every command user has to write a mail which is quite annoying and the cost of raspberry pi is also high if compared to Arduino or PIC microcontroller . There has been some research on smart home using Bluetooth technology[6] .which is also a wireless system like Wi-fi but it has the disadvantages of operable range .Operable range is very less in this system .It has been observed that this type of systems which are based on Wi-fi [7] has the best possible advancement in this sector.

2.3 Comparative Analysis

So many people out there has researched and developed home automation system technology using different methods .We have mentioned some of the work with references in Related Work section .If we analyze them and compare with our system it will help to understand, which system working better or if any improvement is needed in our system .Considering the system that used bluetooth is one of the good one but operation range is limited in bluetooth .

The system that used GSM, requires no internet for operation as it use SIM card and to send input command, user has to send messages every time .We found it quite annoying and it requires also a minimum cost to send messages every time from a SIM.

Rasberry pi is a mini computer that is used in another home automation system where Email is used to send the command to the system .First of all this system will be costly and secondly composing Email every day for official work is normal but to turn on the light or fan of our room if we has to send Email we think the manual system is better.

There are many other works using several technologies all have many advantages and disadvantages as we have also but if we have a look on our project, The entire system is developed with low cost .The android application we used to operate our home is very user friendly and the best thing is, the main thing the user need to operate the system is a Smart phone with internet, which is one of the most available thing nowadays.

2.4 Challenges

If we go for the overall challenges there are many issues that stand against our way .At first we can consider the availability of the internet .our project is internet based .without the internet connection any user will not be able to use the system and the appliances.

Then we could look after the price .price of the components used in our system and the full cost of our IOT [10] enabled system is quite high .This problem could be solved once the concept of home automation become more popular.

Another thing is that the Global market[11] players are commonly under the impression that our market is not ready or educated enough for advanced devices or products .This impression led to a low level of awareness of IOT systems or smart home appliances among the consumers of our community.

Where we are thinking about smart home, it will be less useful without the improvement of infrastructural systems .like smart power grid, smart drainage system, smart water supply and similar smart building management system will have to be introduced to get the real feedback of IOT based smart home.

During implementation of our project we found it quite interesting .during the database implementation we were in a little problem as not every database can deal with the real time data, then we found the Google firebase .anyway after that we couldn't find the library for Arduino IDE to link up with the firebase .somehow we managed to do it by a developers pre created library in his personal project.

CHAPTER 3

Requirement Specification

3.1 Business Process Modeling

Business process modeling is the graphical representation of any company's business process. In this case it will be the activity of representing the process of our proposed system so that our current method may be analyzed and improved. It is usually done through different graphing methods such as flow chart, unified modeling language etc. We have represented our process by a UML diagram in the figure 3.1.

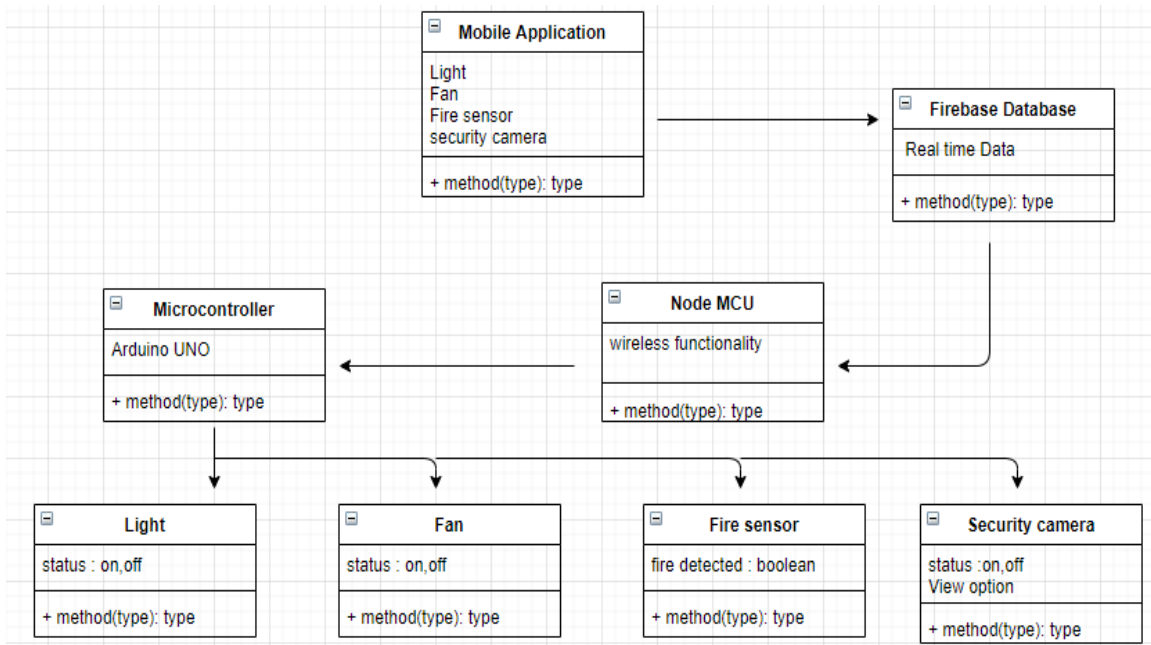


Figure 3.1: UML diagram of the system

3.2 Requirement Collection and Analysis

There are some basic requirements collected during implementation of the system.

First of all we will be using NodeMCU ,which is an open source development board and firmware based in the widely used ESP8266-12E Wifi module [8] .From the mobile application users command will be received by it .It will act as the central controller

An android application will be needed for input command, which we have developed in android studio using java .By using the application user will be able to control all the appliances of his/her home and will enjoy all the features of the system.

Google firebase is one of the major required stuff in our project .It is a Google-backed application used for creating ,managing and modifying data from any android, IOS or web applications .It is also a cloud hosted real time database .It shares a real time database instance for every connected user in the system.

Then we will be in need of several sensors like temperature sensor, PIR, air quality sensor, voice or sound sensors, video cameras, pressure sensor, humidity sensor, water level sensor, accelerometer etc .In the figure 3.2 some physical components are shown with activation.

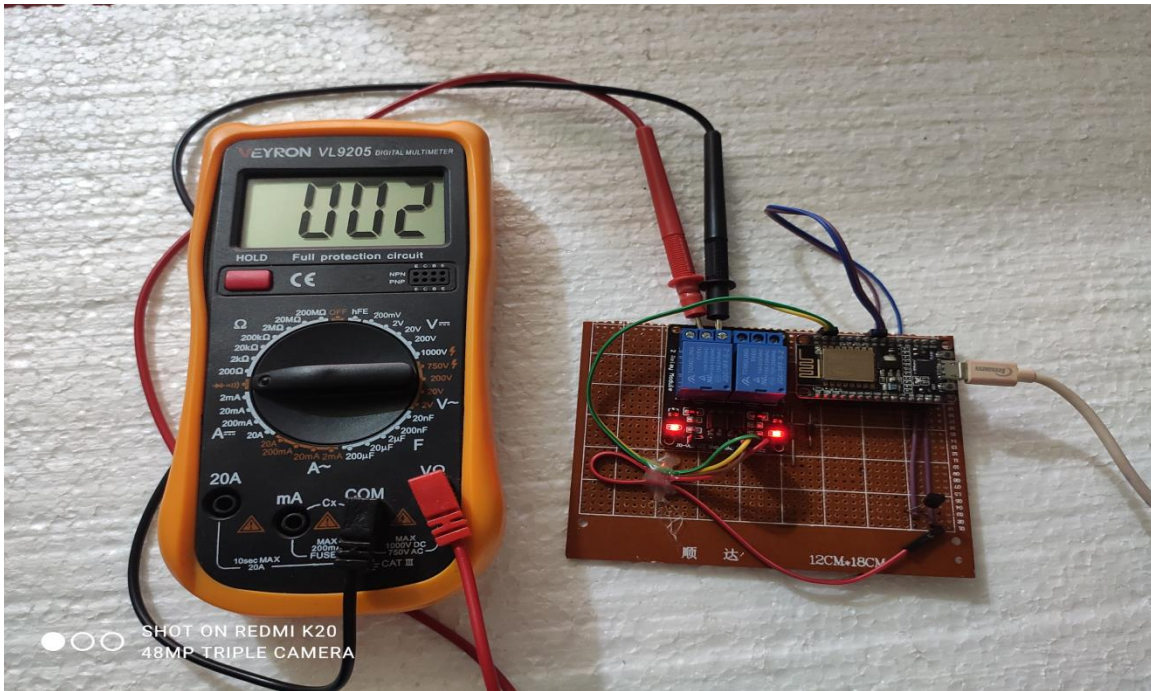


Figure 3.2: Physical Component

3.3 Use Case Modeling and Description

We have introduced a flow chart of our system in this section on figure 3.3 .To start our system a mobile application need to be launched which require internet connection .If the device is not connected to the internet it will not proceed to the user interface and will send notification to connect to the internet .After the connection is established, the system will check for any update from the IOT devices in the back end .then it will refresh the application and the user interface will appear .whole system can be operated from that UI .If any input command is not given it will stay as it is and if any command is given, data will be stored in the firebase from that node MCU will face the data and will process it through microcontroller and then the user will get the output.

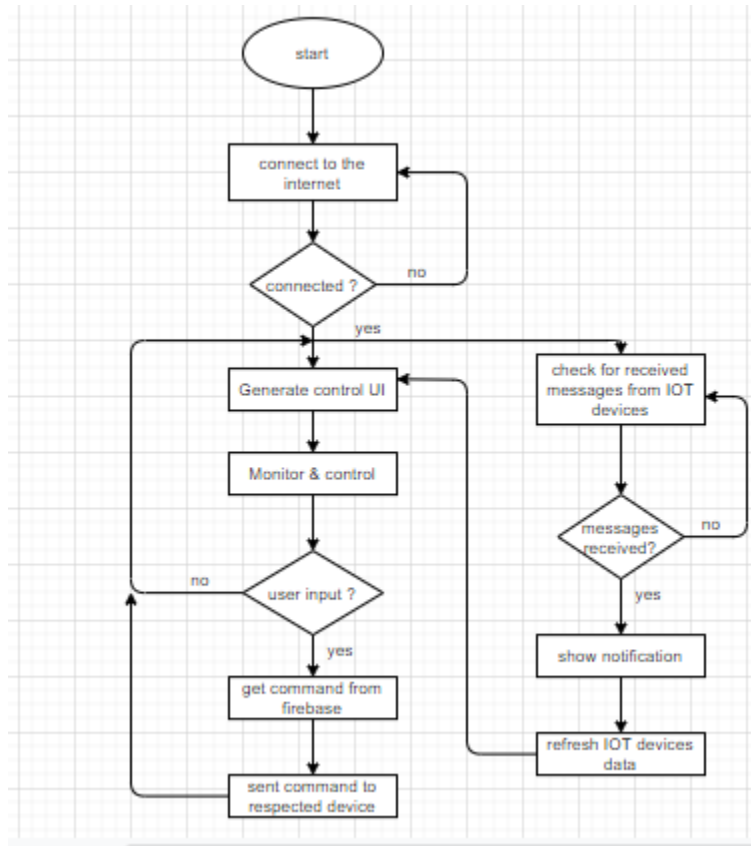


Figure 3.3: Flow chart of the system

3.4 Design Requirement

In our project, design means the design of the user interface of the mobile application and then the hardware design .we designed the application on android studio in java .so the required item was a computer which can run android studio, as android studio is a heavy IDE and has some requirements on computers .Another IDE for arduino is used to program the hardware elements .We used Google firebase as the database in our project .The next thing we need is the knowledge on java .And for the hardware design it requires a Wifi module, which is the Node Mcu, several sensors , relay boards, LEDs, etc. .This is all that requires for the design of the system and shown in the figure 3.4 .In the figure 3.4.1 the setup of the hardware and in figure 3.4.2 a circuit design is shown.

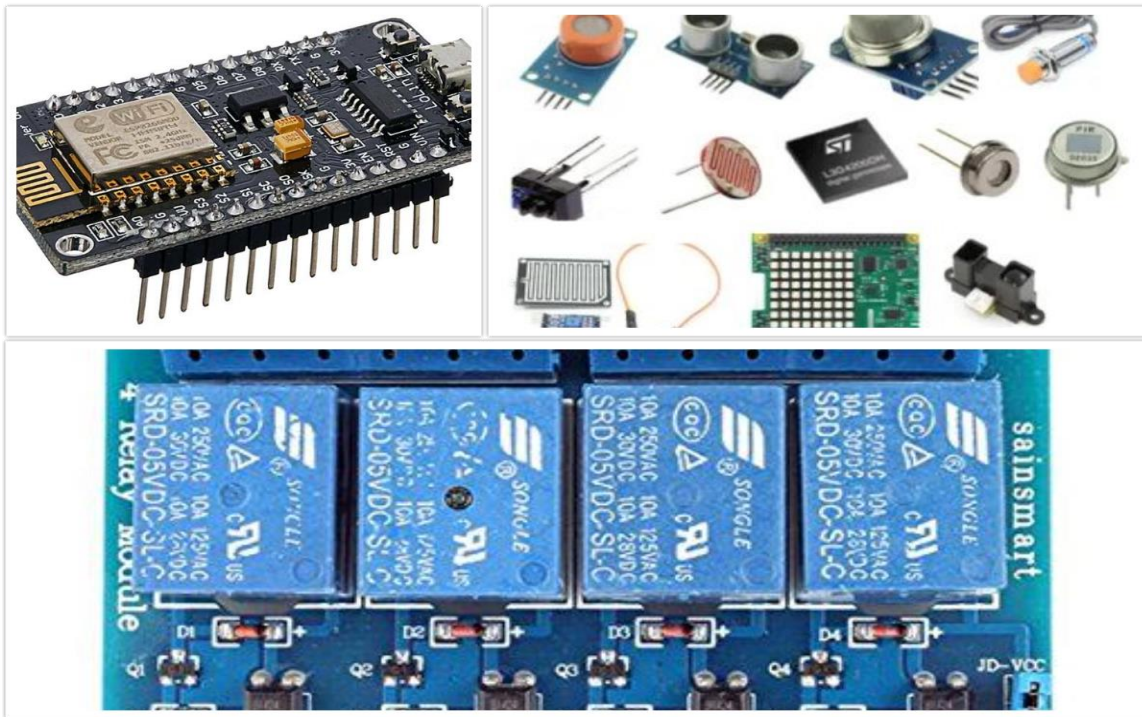


Figure 3.4: Required Hardware for Design

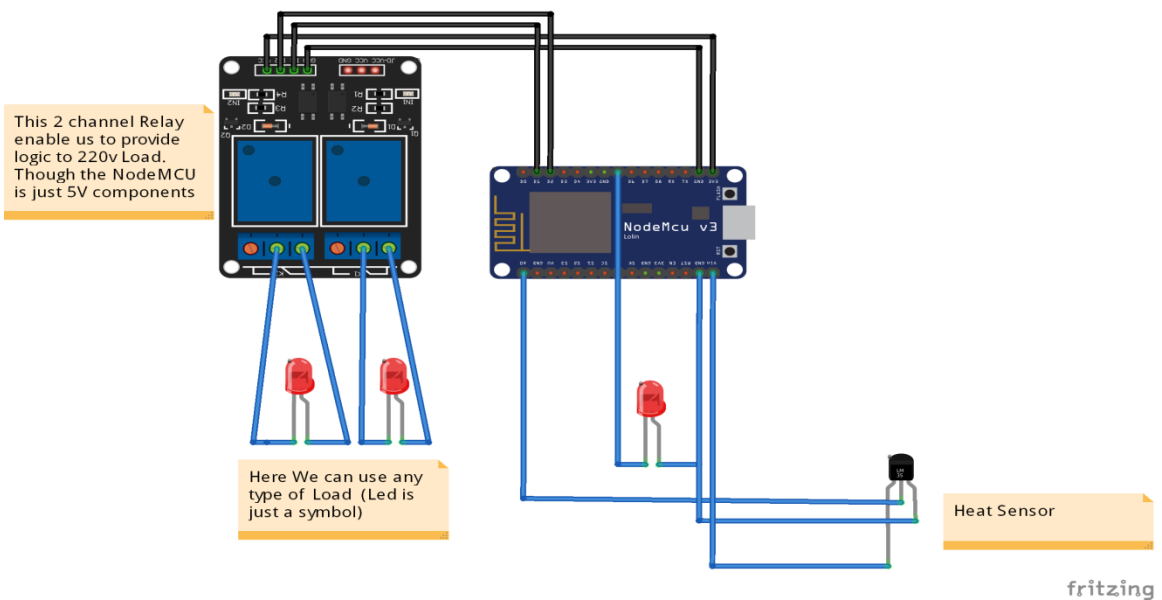


Figure 3.4.1: Physical Components setup

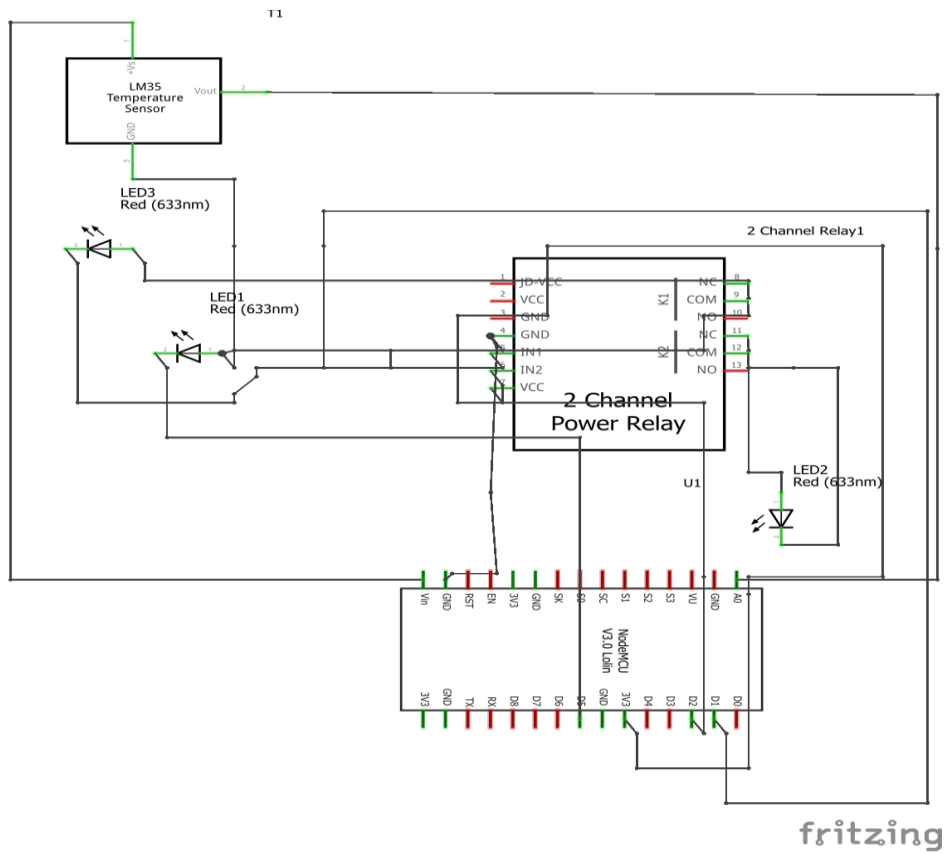


Figure 3.4.2: Circuit Design

CHAPTER 4

Design Specification

4.1 Front End Design

As we control our home automation system using the android app, first we design our app layout with adobe XD and then we convert it in xml that is very efficient to work with android platform. We created all the layout and the widgets with xml. On these widgets we add the functionality that will trigger the value of the database entity. And the following snap will tell about what we design as a Front-end.

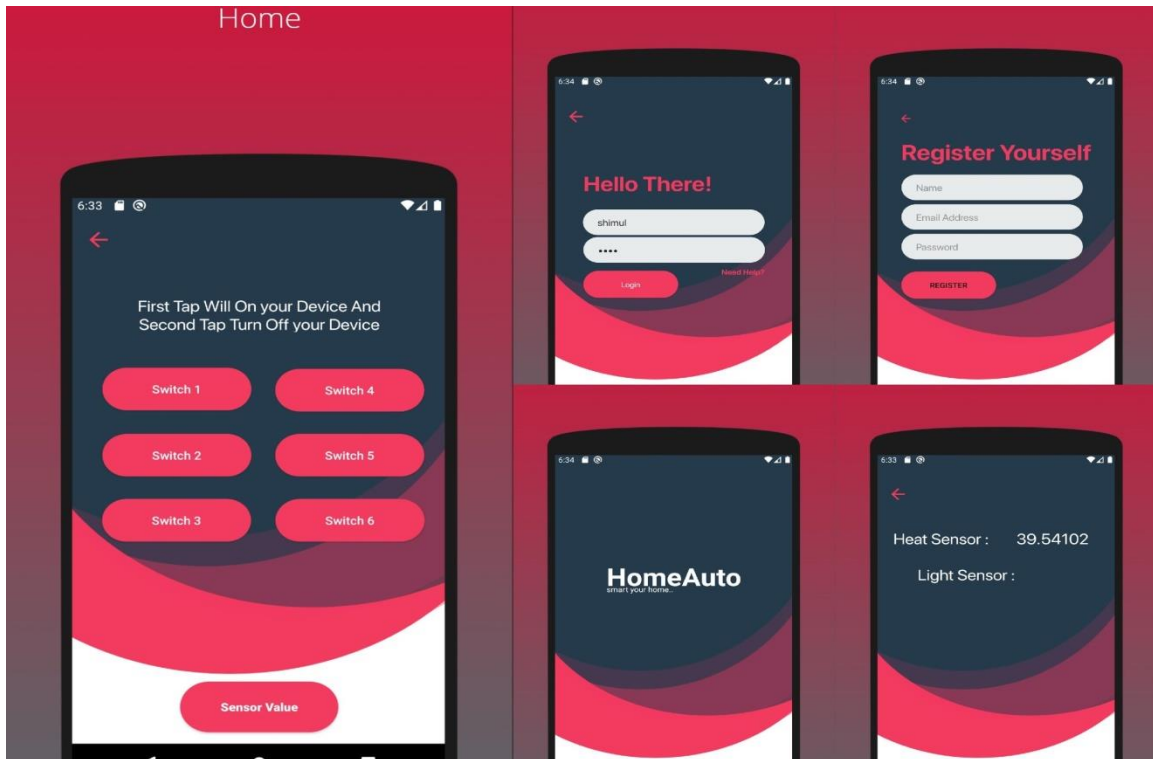


Figure 4.1: Interface design of the Android Application

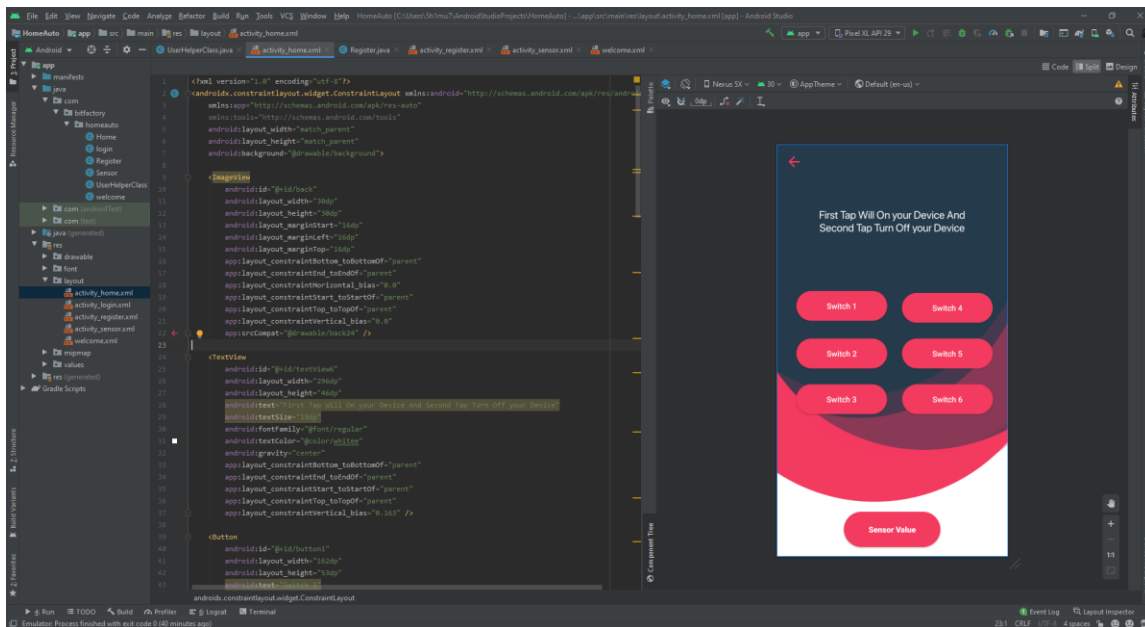


Figure 4.1.1: XML code for the UI

In figure 4.1 the UI design of the mobile application is shown .after launching the application with connection of internet, it will show the sign in page .For new user there is registration option which will be approved by the admin .after signing in, several options for the operation of our system will be there .Here in figure 4.1.1 the java code behind developing the UI of the application is shown.

4.2 Back End Design

Google Firebase is known as NoSQL[12] database programme, it also provides us Back-end service, easy to integrate with any web or mobile application and its pricing is free that's why we use this. It provides us the real time database, users send the real time interaction to Google Firebase and through Google Firebase the data is sent to NodeMCU which performs necessary steps to turning on/off the devices. Google Firebase provides

us everything as a package which we need to implement the Back-end, we don't use any Back-end language like php or Django because of Firebase .

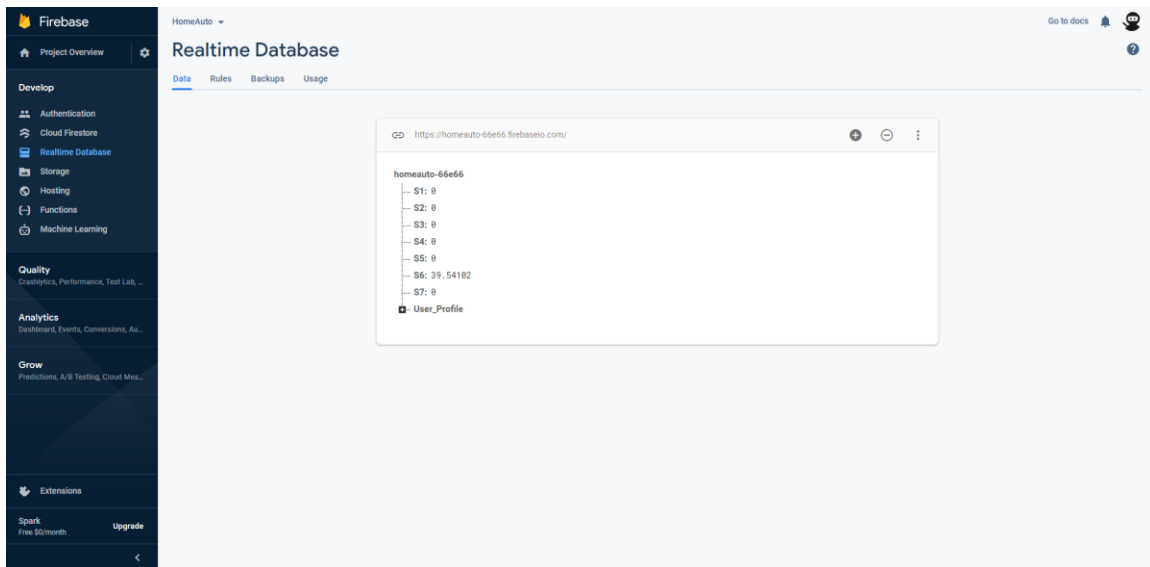


Figure 4.2: Real time Database

Here in this figure 4.2 the usage of the firebase is shown .we used Google firebase as it can deal with the real time data and that is the thing we need in our system.

4.3 Interaction Design and User Experience

Our system is very user friendly and easy to use .The interaction between the UI and the back end process is very frequent .when any button from the UI is pressed, for example, if any user press the light button to turn it on, the system process the request and execute it within a blink of eye .If the internet is fast the system will respond perfectly .we have tried it on our circuit a several times and in our experience it works better than many things.

CHAPTER 5

Implementation and Testing

5.1 Implementation of Database

We don't use any isolated database for storing data as Google Firebase offered us the server and also the database. There are few more steps to connect the database with NodeMCU, Firebase gives the authenticating key of the database which varies depending on the Firebase App and it gives access to use the database. We must provide the database URL and it must be the corresponding Firebase App. For the android App we add the json file which we get from the Firebase App. For fetching the lm35 (Heat Sensor) data we use `addValueEventListener()` cause we need to fetch the continuous value where we `addListenerForSingleValueEvent()` use for updating non-continuous value.

5.2 Implementation of Front End Design

We tried our best to make the Front-end minimalistic and also user friendly. First tap on the button will turn the device and second tap will turn off the device. We use the android app to interact with this system. So we designed the android app and which is our Front-end. It has several buttons for each of the appliances of a home .In figure 5.2 our application UI is provided.

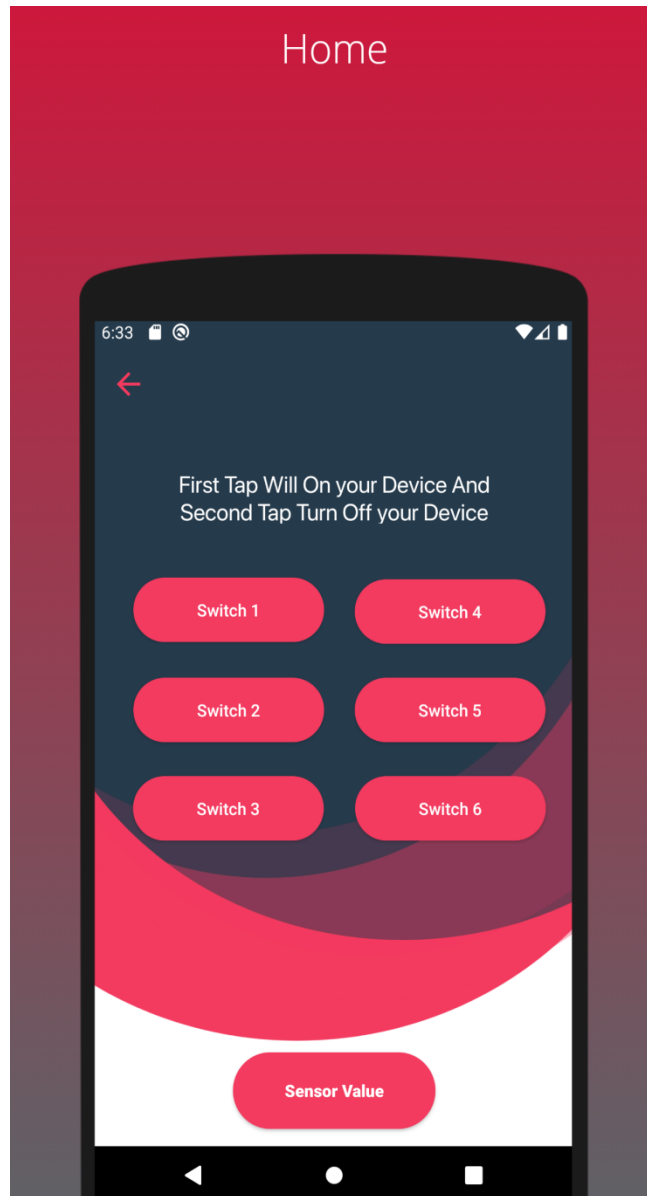


Figure 5.2: Application UI

5.3 Test Results

As a development project, it does not require much testing like research based projects .After implementing the hardware part and connecting it with the database and the mobile

application, we tested it to check whether all the appliances are responding or not in proper way, every sensors are sending data the to the database frequently or not. Anyway it was working fine.

CHAPTER 6

Impact on Society, Environment and Sustainability

6.1 Impact on Society and Environment

'Smart Home' doesn't it sound amazing? Our home automation project includes almost every appliances of our home that we use every day and a several times .In a developing country like Bangladesh, on first glance it may look or sound like bizarre as most of the people here are living under the poverty line .But if we take an action to use it in homes of different areas we highly expect that they will love it .In our country in almost every home someone is using smartphone and internet .when people will use it they will understand its advantages, security and also the enjoyment .people will appreciate it and will be one step more smarter .It may decrease the use of manual switchboards which may lead to lose jobs in some sectors .

In our country AC blast , gas leakage, theft , robbery ,short circuit these types of accidents occur almost every day .with our home automation project we can turn off the AC remotely if it remains on while nobody at home and we have also a sustainability plan for this .By air composition sensor we can prevent any accident that can be occurred by gas leakage .people will be able to monitor their home from anywhere by the security camera which can avert theft and robbery which are already in use and giving a good feedback .

This way it will help our society, community to prevent such unexpected accidents and can make our environment better and smarter.

6.2 Ethical Aspects

We proposed this project based on an ethics that whatever it is, or whatever our intention is to making this project, it will be useful for human life .It will be very helpful for the physically disabled and old aged people to operate the home appliances .This will reduce the risk of several accidents that are occurring around us very often as described in the previous topic .It will save human life and their assets from being destroyed.

6.3 Sustainability Plan

Now we are going to present our project just as proposed .But We have a bigger plan with it for future work .We will be adding more features .in our proposed system input commands are given through a mobile application where several buttons have to be pressed to operate the appliances .we will make it voice controlled subsequently .we are planning to add some artificial intelligence features also .Like the system will be keeping the data of the user that when the user is switching off the fan/AC in the morning .the system may calculate the estimated time when the user get up in the morning from that data and then can send him some notifications on that time for switching off the things or not .what temperature the user prefers it also can be estimated by their daily data and the system can turn the AC on that preferable temperature for the particular user .when multiple appliances are on the system will send notification, like when both the fan and AC is on, the system will notify the user that Fan can be turned off .there are many other features that can be added in it and we will be working on those in upcoming days.

CHAPTER 7

Discussion and Conclusion

So finally we are going to conclude our proposal with some short of discussion .Our proposal was about a home automation system where we represented a smart home in which every electrical appliances of a home that are used by human will be connected with a single system .The system will be operated by a mobile application .User will be able operate each of the appliances that are connected with the system through the application.

It has a lot of benefit like energy efficiency, enhanced security system, hands free convenience, easy customization and automated task saves our time also.

Despite all of this, it has some disadvantages also .The cost of the system is a little high, operation of the system requires at least a smart phone with internet connection, the protocols used in it is different than the old manual system .But if we consider all of its major benefits like security, energy efficiency these things can be overlooked.

We are expecting that people will appreciate are work and we are trying our best .This is all about for now but in our expansion plan there will be lot more.

REFERENCES

- [1] Baki Koyuncu, "PC remote control of appliances by using telephone lines," 1955, IEEE Transactions on Consumer Electronics, Vol 41(1), pp 201-209
- [2] Dhiraj Sunehra and Vemula Tejaswi, "Implementation of speech based home automation system using Bluetooth and GSM" International conference on Signal processing, Communication, Power and Embedded System (SCOPE)-2016
- [3] Shubham Magar, Varsha Saste , Ashwini Lahane, Sangram Konde and Supriya Madne, "Smart home automation by GSM using android application" International conference on information, communication and embedded systems (ICICES 2017).
- [4] Jain Sarthak, Vaibhav Anant and Goyal Lovely , "Raspberry Pi based Interactive Home Automation System through E-mail ", IEEE transaction, 2014 International Conference on Reliability, Optimization and Information Technology ICROIT 2014, India, Feb 68 2014.
- [5] Jan Gebhardt, Michael Massoth, Stefan Weber and Torsten Wiens , "Ubiquitous Smart Home Controlling Raspberry Embedded System", UBICOMM: The Eighth International Conference on Mobile Ubiquitous Computing, Systems, Services and Technologies, 2014
- [6] R Piyare and M Tazil "Bluetooth based Home Automation System using cell phone" 2011 IEEE 15th International Symposium on Consumer electronics
- [7] Vikram N, Harish K S, Nihaal M S, Raksha Umesh, Shetty Aashik and Ashok Kumar, "A Low Cost Home Automation System Using Wi-Fi Based Wireless Sensor Network Incorporating Internet of Things(IoT)" 2017 IEEE 7th International Advance Computing Conference.
- [8] NodeMcu : NodeMcu details and specifications, available at <https://www.make-it.ca/nodemcu-arduino/nodemcu-details-specifications/>, last accessed on 06-10-2020 at 02:00 pm.
- [9] Relay board: Relay board information, available at https://www.globalspec.com/learnmore/industrial_computers_embedded_computer_components/industrial_computing/relay_boards#:~:text=Relay%20boards%20are%20computer%20boards,of%20several%20onboard%20relay%20channels ,last accessed on 06-10-2020 at 02:05 pm.

[10] Internet of Things (IoT): The Internet of Things: An overview, available at https://www.internetsociety.org/resources/doc/2015/iot-overview?gclid=EAIaIQobChMIxObmqr_6wIVBK6WCh36ZgzvEAAYASAAEgII4fD_BwE ,last accessed on 06-10-2020 at 02:07 pm.

[11] Challenges of automation: Home automation and its challenges in emerging markets, available at <https://blog.se.com/building-management/2019/07/30/home-automation-and-its-challenges-in-emerging-markets/> ,last accessed on 06-10-2020 at 03:07 pm.

[12] NoSQL database: Firebase real time database, available at https://firebase.google.com/products/realtime-database?&gclid=EAIaIQobChMI1o6Rnfb_6wIVGLeWCh3uBAJIEAAYASAAEgJFR_D_BwE ,last accessed on 06-10-2020 at 03:10 pm.

PLAGIARISM REPORT

Home Automation

ORIGINALITY REPORT

14 %	%	%	14 %
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS
