**A HOME AUTOMATION SYSTEM**

O.Y.Navarathneraja           IT15050786

A.R.J. Akwaththa                       IT15093660

H.M.P.H. Halpe                    IT15052902

W.S.H. Boteju                   IT14034114

Final Report (Draft)

The dissertation was submitted in partial fulfilment of the requirements for the B.Sc. Special Honors degree in Information Technology

Bsc. Special Honors Degree- Information Technology

Department of Information Technology

Sri Lanka Institute of Information Technology

Sri Lanka

September 2018

**DECLARATION OF THE CANDIDATES AND SUPERVISOR**

We declare that this is our own work and this final draft does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

|  |  |  |
| --- | --- | --- |
| Name | Student ID | Signature |
| O.Y.Navarathneraja | IT15050786 |  |
| A.R.J. Akwaththa | IT15093660 |  |
| H.M.P.H. Halpe | IT15052902 |  |
| W.S.H. Boteju | IT14034114 |  |

**The above candidates are carrying out research for the undergraduate Dissertation under my supervision.**

Name of the Supervisor:                  **S**ignature of the supervisor:                                    Date:

Mr.Yashas Mallawarachchi

**ABSTRACT**

      This project revolves around creating a home automation system prototype with the main focus of having the ability to lock or unlock a door, centralized control of lighting, controlling high tech appliances through the internet to provide improved convenience, comfort, energy, efficiency and safety. The system consists of a central device, a server, sensors, and an application. The popularity of home automation has been increasing greatly in recent years due to considerable affordability and simplicity through smartphone and tablet connectivity. The techniques employed in home automation include those in building automation as well as the control of domestic activities, such as lighting control system, and the use of other electrical appliances. When Internet of Things also known as IOT, comes to our homes, it can be widely incorporated into making our castle smarter, safe and automated.

Once the System is implemented, Home automation system should be tested to find bugs and mismatches in the requirements. Prototype installation should be inspected and tested for bugs, functionality and ease of use. Fixing a bug or adding additional functionality to an automation system can have unforeseen consequences, which would lead to costly downfalls.

As home automation apps become more intelligent, their capabilities become almost endless, from controlling lights and locks to small appliances. Instead of having different apps for different functions, our app will be able to manage everything from one place.

And most importantly, due to the increase in energy consumption, increase population, and limited time frames, there is a grave need to conserve time, effort and energy in any way possible. Henceforth, this proposed system will be cost effective, flexible, and have the capability to control and monitor the home environment, at your fingertips.

**ACKNOWLEDGEMENT**

Even though final year Information Technology Research Project is just another subject, it is the last opportunity for IT undergraduates to face the real industry in the field of Information Technology. This is totally a fresh situation for us, thus we need guidance and help from our lecturers. We gratefully acknowledge those who contributed to our project. First and foremost we would like to thank the Sri Lanka Institute of Information Technology for providing us with the knowledge and the tools to complete the project. They also initialized the requirement of the fourth year project which is vital for completing the course.

We would also like to thank the driving force behind the project, our supervisor Mr. Yasas Mallawaarachchi, providing us support in numerous ways. We would gratefully acknowledge our Lecture-in-charge, Head of the Research Groups Mr.Jayantha Amararachchi for his guidance through the course. They guided us at our difficult times, motivating and pointing out our mistakes to make the project a success. We couldn’t have been able to complete the project without the excessive support and guidance of them.

Last but not the least we would like to thank out team members, for tolerating, for sharing, for giving and mostly for all the compromising. Our collective thinking and effort is what making our system in success. The team spirit and commitment we developed towards the latter part of the project and the lasting bond of friendship was undoubtedly a positive side effect. We thank everyone who helped us to complete the project in numerous ways and who guided us in many ways.

1. **INTRODUCTION**
   1. Problem to Be Addressed

There is Bluetooth based home automation system using cell phone. Since our product is internet base we can have the ability to control the system far away from home. Which is not commercially available in the home automation systems?

In voice recognition based home automation system Hardware architecture consists of Arduino UNO and Smartphone. System comprises a DSP processor for the voice recognition function. Android OS has a built-in voice recognizing feature. This voice recognizing features is used to develop an app which control appliances from user voice command. This application converts the user voice command into text. Then it transmits that text message to Bluetooth module which is connected to Arduino. Advantage of voice controlled home automation system is that user only need to pronounce the application name and the command. A voice recognition application provided a user-friendly interface to users and it has ability to add more appliances. Drawback is this system failed to work correctly in noisy environments. That will be real disadvantage of this kind of system. Sometimes it’s only work with only one voice recognition. That will be another disadvantage. Its only work when we inside the home. Can’t remotely controlled when we are far away from home. But in our home automation system we don’t have those kinds of drawbacks since it is a web base remotely control system.

* 1. Background Context

It’s the 21st Century; the world has witnessed a major advancement in the technology perspective; and along with these improvements, we as Humans have grown accustomed to having everything ready and available at our fingertips. People are constantly finding ways to make life easier, by reducing the time, effort, and energy; they put on daily routines and activities.

A couple of inventions made in this era that has impacted the lifestyle of millions of people are *Bluetooth, Mozilla Firefox, Skype, iPod, iPad, Facebook, Youtube, Iphone, BBC iPlayer, Amazon Kindle, Google Android, Spotify, and Google Driverless cars*.

Therefore with automated driving not too far behind, neither is the ability to have control over many aspects in our homes with just a few clicks. Home Automated Systems, are systems and devices than can control elements of your home environment – the lightings, high technical appliances, entry and exit systems, controlling garage gates, home security and many more. The Popularity of Smart Homes increased in the early 2000s, once people started to consider the actual benefits of Home Automation; it became a viable and affordable technology for customers.  The main concepts that initiate the way families manage their lives and home is Interactivity and Connectivity. Due to business travels, Children’s school and extra-activates schedules as well as social or family activates, the latest smart systems provide a major contribution to the household, even if the family is far away.

Moving with the current trend, i.e The Internet of Things also widely known as IOT a major contributing factor is involved in the designing and implementing Smart Home systems, which aims to make the lives of people and their homes easier, safer, more efficient and connected than ever before.

* 1. Research Gap

In Today’s world, with the hassle of various activities in the household; Home Automation systems are used to make everyone lives simpler, more convenient, safer, by having the ability to control appliances at the tip of our fingers.

Even though there may be countless systems that are conventionally available around the globe, which are more advanced and covers a wider range of features like Front Door lock, Smart Locks, Home protection, climate control, Alarm Systems, there is always going to be even minor drawbacks in them, which we are hoping to fulfill with our Smart Home System.

The ones currently available are relatively expensive, and therefore our proposed system, would fit into the budget of many families, who want to have more independence and control over their home, and have their mind at ease when they travel for holidays, or even leave the house in a haste and suddenly experience the feeling of dread on whether they left any appliance on or left the door, window or garage open.

During Stormy weathers, service work or the random power cuts that suddenly occur, the power gets cut immediately and as soon as it goes, there are times that it comes back as well and along with it comes a very high voltage. When the power surges back on after an outage, it typically exceeds the maximum limit, and this could create high levels of heat and potentially damage the appliance. Our proposed system would ensure to protect these appliances by acting as a surge protector; which would keep the power at a safe level instead of letting all of it flow into the appliance & electronics. Hence, giving a peace of mind when there’s a storm or power outage.

And henceforth, taking the above facts into account and many more, our aim is to develop a smart, reliable, and most importantly affordable, smart home system which would make the life of many families easy and save ample time and effort, and also increase the home efficiency.

* 1. Research Questions

1. **LITERATURE AND METHODOLOGY** 
   1. Addressing the Literature
   2. Existing Systems

According to the conducted Literature Survey on pre-existing software platforms, functionalities and technologies that has been done prior to the proposal on our research, here are some of them,

1. Bluetooth based home automation system using cell phone[1]

This technology is using smartphones, Arduino board and Bluetooth technology. The hardware architecture of this consists of the Arduino board and a cell phone. The cell phone hosts the Python script which enables the user to access the home appliances and control commands for the appliances. The communication between the Arduino board and the cell phone is wireless and using Bluetooth technology. The cell phone use a software application which allows the user to control the home appliances. The main drawback of system is that it is limited to control the home appliances within the Bluetooth range.

2. A Comparative Analysis on Home Automation Techniques [2]

This is a GSM based home automation system. Global System for Mobile communication used to implement this home automation technology. The system used a GSM modem to control electric appliances through SMS request. Home appliances are connected with PIC16F887 microcontroller via relays. One of the advantages of this system is that users will get feedback status of household appliances via SMS on their smartphones.

3. E-mail interactive home automation system [3]

In this research, turn On/Off switches by sending an email. Used LED bulbs for prototype. After processing the mail, system identifies the command and proceed it. They require much more layout effort. Their architecture covers subsystems IR sensors, burglar alarm module and fire alarm module, into a single automated architecture for practical implementation in intelligent home environments. With this system you can preset or change the control parameters of several similar devices, for example, the thermostat of several air conditioners and their ON/OFF timings

4. Voice recognition based home automation for Paralyzed People [4]

A voice recognition based home automation system proposed by a researcher. Hardware architecture of this system consists of Arduino UNO and Smartphone. System comprises a DSP processor for the voice recognition function. Android OS has a built-in voice recognizing feature. This voice recognizing features is used to develop an app which control appliances from user voice command. This application converts the user voice command into text. Then it transmit that text message to Bluetooth module which is connected to Arduino. Advantage of voice controlled home automation system is that user only need to pronounce the application name and the command. A voice recognition application provided a user friendly interface to users and it has ability to add more appliances. Drawback is this system failed to work correctly in noisy environments.

5. Web Based ZigBee Enabled Home Automation System [5]

In summary this consist of three main modules, handheld microphone module, central controller module and appliance controller module. In this system, Microsoft speech API is used as a voice recognition application. The system recorded voice at a sampling frequency of 8 Khz. Differential pulse code modulation (DPCM) is used for compressed data from 12 bits to 6 bits. These data bits were sent from the microcontroller to the RF ZigBee module. This Automation system was tested using voice commands of 35 male and female with different English accents. Accuracy of this system is limited in the range of 40 meters.

6. An overview of home automation systems [6]

This is newly developing energy harvesting technology used in transportation, building and home automation systems. This system can be built up using internet, router, automation controller, duckbill 2 EnOcean and EnOcean devices. A smart phone application is used to control and monitor the home appliances using different type of communication techniques. In this paper the working principle of different type of wireless communication techniques such as ZigBee, Wi-Fi, Bluetooth, EnOcean and GSM are studied and run applications under Linux environment. This is also a kind of voice recognition based system. If voice signal is noisy then communication can highly effect and the system will fail to show accuracy. Data rate of EnOcean is approximately 125 kbps, which is high and it is self-power device.

7. Home Automation Using Internet of Things(IoT) [7]

IOT or internet of things is an upcoming technology that allows us to control hardware devices through the internet. This technology used for connecting, controlling and managing intelligent objects which are connected to Internet through an IP address. In this paper it discuss about IoT, how it can be used for realizing smart home automation and used two prototypes namely home automation using Bluetooth and home automation using Ethernet.

*Home 365 Automation System Comparison with existing systems*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***FEATURES*** | Bluetooth home automation | GSM | Email interactive | Voice recognition | ZigBee | EnOcean | **Home 365 AUTOMATION** |
| Garage Door Automated Control. |  |  |  | ✔ |  |  | ✔  *Opens and Close by monitoring the vehicle* |
| UV Light Detection and Switch on/off Light accordingly |  |  |  | ✔ |  |  | ✔ |
| Indoor Temperature Monitoring to operate AC or Fan. |  | ✔ |  | ✔ | ✔ | ✔ | ✔  *Depending on the people count, the AC and Fan is controlled.* |
| Detect Open Doors or Windows, and Control Locking them remotely. | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Detect On Lights and Off them accordingly, *vise versa.* | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Manage High tech appliance, during power failures and avoid circuit burns. |  |  |  |  |  |  | ✔ |
| Send Alert Notifications to the mobile app | ✔ | ✔ |  |  |  |  | ✔ |

* 1. Methodology

This part of the document explains how the proposed system going to be designed and implemented. Functionalities and the flow will be explained clearly with the tools and technologies which are going to be used in order to achieve the objectives of the proposed system.

* + 1. **System overview**

The entire proposed system consists of two main stages as Software and Hardware. Control center of the home appliances for the user is implementing as a web application which will be hosted in an online server. Web application has the interfaces to handle specific appliances within the house. The web server directs the request about the appliance that user need to handle towards the Raspberry pi 3 via Internet. Raspberry pi 3 will receive the request send by the server and sent it into the device that meant by the user.

The proposed home automation system can control the following appliances,

-Home lightning system

-Home door, window system

-High tech appliances (Fridge, washing machine etc)

-Garage (Door, lightning)

Development of the proposed system will be consisting of,

* + 1. **User Interface:**

This is the part where user get access to contact graphically with the home appliances. Web application will be developed with all the functionalities to fulfill the objectives of the proposed system.

* + 1. **Hardware Interface:**

This interface is the place where that redirects the requests to the home appliances which are made at the frontend of the system by the user. The appliances may act according to the responses that coming out of the hardware interface.

Raspberry pi 3 is the main device runs on the hardware interface. Many other electronic components and sensors are implementing at this part.

* + 1. **Functionalities**
       1. **Remote Controlling Doors and Windows**

People are forgetting to lock the doors and windows sometimes. And only remembers after they travel a distance that they can’t return home just to lock the doors and windows. Below shown features can be provided to cover up the above functionality by using the proposed web application,

-       Interface to control doors

-       Interface to control windows

To fulfill the above requirements in the web application, there has to be a circuit that connects app and the appliances.  Circuit would be connected to the door lock with a servo motor device. Only one click in the web app would be needed in order to lock the door. A Wi-Fi module will handle the communication between android app and the Raspberry pi 3.

* + - 1. **Controlling high tech appliances and detect circuit burnings.**

When people want to control their high tech appliances when they are far away from home, our app will provide a user friendly interface to control all the necessary appliances. User just needs to select the appliance name from the app and give the command to On or Off. This will helpful when the user can’t reach the home when thundering. For an example if meat or fish inside the refrigerator people can’t switch off the refrigerator when they are leaving home. There should be a way to control the refrigerator when they want to off.

So our proposed application will provide,

-        Interface to select the home high tech appliance

-        Interface to select the command.

-           Detect flame and avoid circuit being damaged by burnings.

* + - 1. **Automated Garage gate Controlling and Surrounding Light Control**

* + - 1. **Image processing and IOT server communication**

Wireless Garage Gate Controllers may currently be available across the world, but with the latest IOT advancements; Our system through Image Processing, will detect the home resident’s license plate number and automatically open the garage gate when the vehicle is couple of meters from the garage. Furthermore, once the car has entered the garage, it will monitor the distance and once it’s in a safe distance, the gate sensor will close the Garage Gate. Hence saving ample time, and effort of the user.

That is not all that our system will handle, Through UV light sensor detection, a light outside the Home (Porch Light) will switch on when it gets closer to dusk (Evening). This light detection mechanism will also handle the lighting system inside the Garage, i.e if there is limited light supply inside the garage, and if a person or the vehicle is entering the garage, a light will be turned on; this would not only save the person some time from finding the light switch but also avoid causing any injury.

With so little time and so much errands to run, we as humans are always at haste with our routines, and we tend to forget to check if the garage door is closed or the light is left on; our Smart System will detect these minor details and send notifications via Server Communication to the residents, and henceforth have the ability to do the needful.

All this Communication will be handled between the app and the Arduino, through a secured Internet Connection, that is not easily penetrable for cyber attacks.

* + - 1. **Lighting controlling and temperature controlling automation system**

Detect the time and environmental condition and automate the light controlling system by machine learning. Once the user of the system is away from house he or she must be able to control (ON/OFF/Dim) the lighting system of the house via the application.

Also detect the number of people in the room and environmental condition via sensors, by that controlling the temperature in the room by adjusting the fan or the AC. providing an interface to control system by user.

* 1. **Research Findings**

1. **RESULTS & DISCUSSION**

This section will explore the results of the each function steps taken as detailed in the Methodology section. When comparing the proposed Home Automation System with the existing systems currently available, is the minimum consideration of User Experience concepts, Network Security measures, Usability of the existing applications; furthermore when the homeowners purchase a new sensor, the users will have to control and operate multiple remotes controls, which would result in misplacement of the controls and possible security threats. To test the various functions of the members, a miniature model Home is constructed and then tested continuously to ensure the functions is operating smoothly; each member would take turns to test their functions accordingly. Once the System is stabilized, the functions will be tested in real world, further modifications and adjustments will be implemented accordingly.

* 1. **Evidence**
  2. **Discussion**

Home automation system is that in which the various appliances within the home are remotely controlled. There are different technologies exist which are used for home automation. By using Bluetooth or ZigBee we can remotely control all appliances within home but both of them having area limit. In our system we are using Wi-Fi based IoT (Internet of Things). So we can control home appliances from anywhere around the world. Due to IoT people and things to be connected any-time, anyplace, with anyone, ideally using any network and any service. Automation is an important application of IoT technologies. The Smart homes are known as Home automation, with the use of new technology, to make the housing activities more easy, accessible, secured and efficient. Home automation systems face some main challenges, these are high cost of ownership, inflexibility, difficulty in achieving security and poor manageability. The main intention of this research is to design and implement a home automation system using IoT that is able to controlling and automating most of the house appliances through an easy possible web interface. By using Wi-Fi technology to interconnect its distributed sensors to home automation server the proposed system has a great flexibility. This will decrease the deployment cost and will increase the ability of upgrading, and system reconfiguration. We have studied different techniques for home automation system. Various authors give various techniques with flowchart, block diagram and their explanation with proper layout of successful execution with adequate strengths and imperfection. Finally we built a low cost, effective, fully function home automation system.

1. **CONCLUSION**

Expectation is to provide marketable product to the industry by including automated devices that can be accessible remotely. Following the residential market and lead it by making the product easy to install by any person who have average knowledge of technology. Our Product has the added advantage of being relatively cheaper than the similar products that are already in the market and the security implemented into the system, is far more reliable that the current Home automation appliances. WPAN connected devices are accessible from anywhere virtually using web application, tablets or smartphones provided there is an internet connection. Ability of controlling lights from wherever the user wants, Controlling doors and windows locking system whenever wanted, Giving the access only to the whitelist people, Save time and effort by controlling indoor and landscape lighting and having automated garage door functionality, Reduce electrical wastage and risk of fire by controlling the high tech appliances are major features of the IOT smart home system. The unique feature of this home Automation system, is the ability for the user to bring a new sensor into their home and configure and synchronize it with the web application, this will then give the user control of all the sensors and devices, old and new through a single application. Main technology that is used in the project is Raspberry Pi 3. It acts as the heart of the system with connected sensors into it. User is connected to the system using a responsive web application.

1. **REFERENCES**

[1]  Rajeev Piyare, M Tazil,"Bluetooth based home automation system using cell phone " *in IEEE Transactions on Consumer Electronics*,2011.

[2] Mirza Qutab Baig, Junaid Maqsood, Muhammad Haris Bin Tariq Alvi, “A Comparative Analysis on Home Automation Techniques”  in *Artificial Intelligence, Modelling and Simulation (AIMS), 2014 2nd International Conference on,* Madrid, Spain,2015.

[3] Sirisilla Manohar, D. Mahesh Kumar,” E-mail interactive home automation system” *in International Journal of Computer Science and Mobile Computing,*2015.

[4] Mukesh Kumar, Shimi S.L,”Voice recognition based home automation for Paralyzed People” *in International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE),*2015

[5] Ali Ziya Alkar, H.Selcuk Gecim, Muharrem Guney,“Web Based ZigBee Enabled Home Automation System” *in Network-Based Information Systems (NBiS), 2010 13th International Conference,* Takayama, Japan,2010.

[6] Muhammad Asadullah, Ahsan Raza,“An overview of home automation systems”*in Robotics and Artificial Intelligence (ICRAI), 2016 2nd International Conference,* Rawalpindi, Pakistan, 2016.

[7] Kumar Mandula, Ramu Parupalli, CH.A.S. Murty, E. Magesh,Rutul Lunagariya,”Mobile based home automation using Internet of Things(IoT)” *in Control, Instrumentation, Communication and Computational Technologies (ICCICCT), 2015 International Conference*, Kumaracoil, India.2015.

**GLOSSARY**

**APPENDICES**