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HOME AUTOMATION SYSTEM

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# DECLARARTION

I **Obia William** reg no: Bu/Ug/2011/86 hereby declare that this project proposal is my original work except where explicit citation has been made and it has not been presented to any institution of higher learning for any academic award.

Signature ………………………….

Date…………………………………………

# APPROVAL

This is to certify that the project proposal under the title “***Home Automation System***” has been done under my supervision and is now ready for examination.

Sign ……………………………….

Date ……………………………….

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# 

# LIST OF ACRONYMS

ADT Android development kit

API Application programming interface

APP Application

.apk Android package

BT Bluetooth

HAS Home Automation System

IDE Integrated development environment

OS Operating system

LCD Liquid crystal display

HVAC  heating, ventilation and air conditioning

IoT Internet of Things

IFTTT if this then that

PC personal computer

SDK software development kit

JDK Java development kit

JRE Java runtime environment

ISM industrial, scientific and medical

RF Radio frequency

EM Electromagnetic

Wi-Fi Wireless Fidelity

AC Alternating current

DC Direct current

KHz kilohertz

GHz gigahertz

LED Light emitting diodes

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# CHAPTER ONE: INTRODUCTION

1. **Introduction**

This chapter comprises of background, problem statement, justification and objective of the study**.**

* 1. **Background**

**Home Automation** is a term used to describe the working together of all household amenities and appliances. For example, a centrally-controlled LCD panel can have the capability to control everything from heating, air conditioning, security systems, audio systems, video systems, lighting, kitchen appliances, and home theatre installations [1].

With the continuous growth of mobile devices in its popularity and functionality, the demand for

advanced ubiquitous mobile applications in people’s daily lives is continuously increasing.

Utilizing web services is the most open and interoperable way of providing remote service access. IoTs can be described as connecting everyday objects like smart phones, internet televisions, sensors and actuators to the internet where the devices are intelligently linked together to enable new forms of communication amongst people and themselves [2].The advancement is leading to anyone, anytime, anywhere (AAA) connectivity for things with the expectation being that this extend and create an entirely advanced dynamic network of IoTs. The IoTs technology can be used for creating new concepts and wide development space for smart homes in order to provide intelligence, comfort and improved quality of life rational use of energy.

Sometimes people forget to turn off lights when leaving homes accidentally and a lot of power is wasted thus huge electrical bills in turn, as a result People nowadays are aware of the necessity of managing their energy consumption off-site.

With the dramatic increase in smart phone users, smart phones have gradually turned into an all-purpose portable device and provided people for their daily use. This project therefore, intends to develop a home automation system based on Arduino and an android application to remotely control lights in the house with regard to switching them on/off off-site thus avoiding energy wastage.

* 1. **Problem statement**

Saving electricity is very important to everybody since saving electricity means saving on electrical bills especially at such a time when the economic status is so pressing on everyone rich or poor and yet the affinity to accumulate more and more electronics is on the rise daily.

In Uganda there is lack of a home automation system for households, which implies amenities have got to be turned on/off manually. In the event that it’s on and there is no one on-site, high power consumption is realized, thus power wastage and huge monthly power bills which if not cleared may result in to power disconnections from essentials services. Therefore in this project I propose a system that will be used to turn on/off of lights remotely using Bluetooth technology and web service technology (IoT).

* 1. **Objective**
     1. **Main objective**

To develop a home automation system.

* + 1. **Specific objectives**

1. To study the existing literature on home automation system and energy saving.
2. To design home automation system.
3. To implement the home automation system.
4. To test and validate the operation of the system.
   1. **Scope of the study**
      1. **Subject scope**

This project is geared towards the development of a home automation system which will enable Ugandans owning android OS smart phones to control with regard to turning the off/on and monitor the status of lighting remotely using Bluetooth and the internet, be able to turn them off/on at their own convenience so as to save power hence reduced electrical bills.

* + 1. **Geographical scope**

This research will be carried out in Uganda especially in the city of Kampala with the largest number of households having electricity.

* 1. **Significance of the study**

The study is important since as economic situation becomes harder and harder everyday mankind is determined to save as much power as possible and thus reduce on their electrical bills and as mobile technology continues to advance remote home automation using smart phones will be needed a lot as thus this will act a literature to those who may want to explore in the same filed.

* 1. **Justification**

In the present time, the technologically advanced world is getting more and more advance as new technology is penetrating deeper into our personal lives even in our homes as well. Home automation system concept is becoming very popular around the world. Home automation is used to control and monitor electronic security systems, lighting, climate, appliances, audio or video equipment and they are at the fore-front of energy saving in most households. Hence this calls for the development of an application that would be used to control and monitor the status of electrical appliances in homes and improve the lifestyle, standard of living, save energy and reduce occupant’s electrical bills.

* 1. **Limitations**

The following limitations could be faced during the implementation of the project and these include but not limited to the financial budget and developing the overall system in the given timeframe. In addition to the above limitation, one must be connected to a fast internet (3G/4G) network and be within the Bluetooth range.

# CHAPTER TWO: LITERATURE REVIEW

1. **Introduction**

This chapter summarizes all the related literature about existing home automation systems and concept of their operation and their limitations gaps and techniques used.

* 1. **Save energy and money with home automation**

Home automation may indeed be the next big trend in what consumers can do today to stand up for the environment. By setting up a wired or wireless system, homeowners can optimize lighting level efficiency, cut heating and cooling energy costs and deactivate energy consuming devices and appliances off-site [3]. With the difficult economic status in most of Uganda’s society saving on energy could save a lot on electrical bills and improve on the standards of living, thus home automation is the way to go.

Save money on energy use while keeping your home comfortable, energy saving is no longer just for greenies with the typical family power bills has risen by 78% in less than a decade. The cost of simply forgetting to turn off your bathroom light can really add up over time. However controlling temperature and lighting based on time day or occupancy can reduce energy costs.

Automating your heating and lighting systems allows you to hand over the routine chores to a smart system and remove the cost of human error. Approximately 55% of a home’s energy use is spent on heating and cooling and approximately 15% for lighting, thus energy efficiency through home automation can generate energy savings on all of these systems for example studies show that dimming a light by just 10% can save 10% of electricity and double the life of a bulb [4].

An automated home brings together security, fire, lighting, temperature control and anything else that you want so that these systems can work together making it comfortable, convenient and safer.

* 1. **Energy saving**

Energy saving or sometimes referred to us energy conservation refers to reducing energy through using less of an energy service.

Energy conservation can also be described as the reduction in the amount of energy consumed in a process or system, or by an organization or society, through economy, elimination of waste, and rational use [5].

Saving energy isn’t just about being environmentally conscious but also a great way to save money as we all know we could do more around home to save energy but where to start is the problem [6].

* 1. **Energy saving methods**
     1. **Turn out the Lights**

Lighting is the most commonly used item in all houses, domestic and industrial, approximately 15% of energy usage is spent on lighting alone thus not forgetting turn off the lights when one leaves the room. Remember this at the office, too. Turning out or dimming the lights in unused conference rooms, and when you step out for lunch could work along way to save electricity and save money on electrical bills too. Work by daylight when possible. A typical commercial building uses more energy for lighting than anything else [7].

* + 1. **Unplug**

Unplug seldom-used appliances, like an extra refrigerator in the basement or garage that contains just a few items.

Unplug your chargers when you're not charging. Every house is full of little plastic power supplies to charge cell phones, PDA's, digital cameras, cordless tools and other personal gadgets. Keep them unplugged until you need them.

Use power strips to switch off televisions, home theater equipment, and stereos when you're not using them. Even when you think these products are off, together, their "standby" consumption can be equivalent to that of a 75 or 100 watt light bulb running continuously [7].

* + 1. **Set Computers to Sleep and Hibernate**

Enable the "sleep mode" feature on your computer, allowing it to use less power during periods of inactivity. Configure your computer to "hibernate" automatically after 30 minutes or so of inactivity. The "hibernate mode" turns the computer off in a way that doesn't require you to reload everything when you switch it back on. Allowing your computer to hibernate saves energy and is more time-efficient than shutting down and restarting your computer from scratch. When you're done for the day, shut down [7].

* + 1. **Use Appliances Efficiently**

Most of the household amenities use electricity with each having their energy consumption levels. However, ensuring that they are efficiently used when on could save on their energy consumption. For example using the power-save switch if your fridge has one, and make sure the door seals tightly is one way of efficiently utilizing your refrigerator or Setting your refrigerator temperature at 38 to 42 degrees Fahrenheit, your freezer set between 0 and 5 degrees Fahrenheit.5

This would ensure that the amount of power consumed by this appliance is kept at minimum thus energy saving leading to less utility bills.

* + 1. **Home automation**

Home automation (also known as domotics) refers to the automatic and electronic control of household features, activity, and appliances. Various control systems are utilized in this residential extension of building automation. Some components of an automated home may include the centralized control of security locks on doors and gates, appliances, windows, lighting, surveillance cameras and HVAC systems [8].

With home automation, you dictate how a device or appliance should react, when it should react, and why it should react.

* + - 1. **Existing home automation systems and related works**

This section describes already existing home automation systems, their operations and limitations. Smart home is not a new term for science society however, it is still far more away from people’s vision and audition. As electronic technologies are converging, the field of home automation is expanding. Various smart systems have been proposed where the control is via Bluetooth [9], internet [10], short message service (SMS) based [11], etc. Bluetooth capabilities are good and most of current laptop/notebook, tablets and cell phones have built-in adaptor that will indirectly reduce the cost of the system. However it limits the control to within the Bluetooth range of the environment while most other systems are not too feasible to be implemented as low cost solution.

* + - 1. **Wi-Fi Based Home Automation System**

In [12], Wi-Fi based home automation system is presented. It uses a PC (with built in Wi-Fi card) based web server that manages the connected home devices. The users can manage and control the system locally (LAN) or remotely (internet). The system supports a wide range of home automation devices like power management components and security components.

The system utilizes a PC which leads to a direct increase in cost and power consumption and limits mobility. On the other hand, the development and hosting of the web page will also result in additional costs.

* + - 1. **Microcontroller based voice activated wireless automation system**

The user speaks the voice commands through a microphone, which is processed and sent wirelessly via radio frequency (RF) link to the main control receiver unit.

Voice recognition module is used to extract the features of the voice command. This extracted signal is then processed by the microcontroller to perform the desired action. The drawback is that the system can only be controlled from within the RF range [13]. The drawback is that the system can only be controlled from within the RF range.

* + - 1. **Internet controlled systems**

It consist of dedicated web server, database and a web page for interconnecting and managing the devices in the house [14] [15].

These systems utilize a PC which leads to a direct increase in cost and power consumption. On the other hand, the development and hosting of the web page will also result in additional costs.

* + - 1. **Synco living-the energy-saving home automation system**

Synco living is a comprehensive home automation system designed to control and operate lights, blinds, and heating, ventilation and air-conditioning systems to suit occupants’ needs and requirements. It also incorporates a range of security and safety features – to monitor doors and windows, simulate occupancy as a safeguard against break-ins, and detect water-leaks and smoke. In addition, Synco living makes it easy to read out consumption data for heating, cooling, hot and cold water, gas and electricity, enabling occupants to keep track of their energy and water use and helping them to economize [16].

* + - 1. **Webee android home automation system**

Webee is an android home automation that allow home owners to control and monitor their homes from anywhere over the internet. Webee runs on Android 4.0 and is the first system that learns from you and programs itself accordingly to your preferences. The system allows users to control their homes while also learning about a user’s lifestyle, habits, and schedules. It then makes suggestions to allow for savings, comfort, and efficiency.

Any home electrical device can be controlled by the Webee hub called the “Boss” and an accompanying Android app that is installed in a mobile device. Light switches, TV, stereo, air condition, and sprinklers are just some of the few household devices that can easily be controlled. To allow the Boss to communicate with a user’s non-smart appliances several “Bees” have been made which are used to facilitate the connection. These include smart plug, smart lamp holder, and smart host open/close sensor In addition to allow one control and monitor their homes from anywhere, webee also provides notifications to users on how to save energy usage and water as well [17]. Though webee home automation system allow control from anywhere, it has a lot of external components such as smart plugs which the user must buy to make their houses smart, this increases the overall cost.

* + - 1. **Technologies used by these existing systems**

Existing systems above use a number of technologies, which in RF, Wi-Fi and internet of things with a client side being with a mobile phone or Pcs and some use both.

1. **RF**

Radio frequency is a term that refers to alternating current (AC) having characteristics such that, if the current is input to an [antenna](http://searchmobilecomputing.techtarget.com/definition/antenna), an electromagnetic (EM) field is generated suitable for [wireless](http://searchmobilecomputing.techtarget.com/definition/wireless) broadcasting and/or communications. These frequencies cover a significant portion of the [electromagnetic radiation spectrum](http://searchcio-midmarket.techtarget.com/definition/electromagnetic-radiation-spectrum), extending from nine kilohertz (9 [kHz](http://searchnetworking.techtarget.com/definition/kHz)),the lowest allocated wireless communications frequency (it's within the range of human hearing), to thousands of gigahertz(GHz) [18].

1. **Wi-Fi**

Wi-Fi is a type of wireless networking protocol that allows devices to communicate without cords or cables. Wi-Fi is technically an industry term that represents a type of wireless local area network (LAN) protocol based on the 802.11 IEEE network standard. It's the most popular means of communicating data wirelessly, within a fixed location [19].

1. **Internet of Things**:

The Internet of Things is the network of physical objects accessed through the Internet, as defined by technology analysts and visionaries [20]. These objects contain embedded technology to interact with internal states or the external environment. In other words, when objects can sense and communicate, it changes how and where decisions are made, and who makes them. Internet of things can connect every appliances in households to the internet and owners can be able to access the home premises from everywhere in the world on any mobile phone or PC that has the client application installed on it.

The above technology have their different limitations which also impact on the existing systems, for example RF works within a short range thus remote control outside the RF range will be impossible, with Wi-Fi, the client device must be with the wireless network coverage, this therefor limits the mobility of the users and finally with internet of things using web services, additional cost is involved in hosting the web pages. Though some of the existing systems may be using the internet, the have additional external components the user must buy in order to make their houses smart thus increasing cost. These systems utilize a PC which leads to a direct increase in cost and power consumption.

* 1. **Bluetooth**

Bluetooth technology is the global wireless standard enabling, convenient, secure connectivity for an expanding range of devices and service​s. It is an essential element for bringing everyday objects into the connected world. Bluetooth wireless technology was originally conceived as a wireless alternative to RS-232 data cables. Bluetooth technology exchanges data over short distances using radio transmissions. Bluetooth technology operates in the unlicensed ISM band at 2.4 to 2.485 GHz, using a spread spectrum, frequency hopping, full-duplex signal at a nominal rate of 1600 hops/sec. The 2.4 GHz ISM band is available and unlicensed in most countries [21]. The Bluetooth wireless technology is set to revolutionize the way people perceive digital devices in our homes and office environment. Now they are no longer just the individual devices; instead, with the embedded Bluetooth technology, they form a network in which appliances can communicate with each other. This wireless technology is especially useful in home environment, where there exists hardly any infrastructure to interconnect intelligent appliances. It could be suitably used for home automation in a cost-effective manner. Operating over unlicensed, universally available frequency of 2.4 GHz, it can link digital devices within a range of 10 m (expandable to 100 m, by increasing the transmitted power) at the speed of 1 Mbps. Building upon this theme; we propose a home automation system based on Bluetooth technology [22] [23]. Bluetooth may be working within short range but some of the benefits is that it’s free i.e. user will not incur any charges for the provider and most of the mobile devices have Bluetooth embedded it them and so user will not have to buy a separate Bluetooth component.

The user within the Bluetooth range will be able to remote operate lightings in the house so not to waste internet bundles.

* 1. **Internet**

The internet is a global network of computers that works much like the postal system, only at sub-second speeds. Just as the postal service enables people to send one another envelopes containing messages, the internet enables computers to send one another small packets of digital data [24]. This will allow the user of my system access and control of lighting in the house if they are outside the Bluetooth range.

* 1. **Conclusions**

In this project, an internet based smart home system that can be controlled remotely upon user authentication is proposed and implemented. The Android based smart home app communicates with the micro web-server via internet using the REST full based web service. Any android supported device can be used to install the smart home app, and control and monitor the lights in home environment. A low cost remote home light monitoring system has been developed which does not require a PC as all processing is handled by the microcontroller. The system also uses Bluetooth wireless communication in case the user in within BT range (within the home premises) so as to save on data bundles. Prospective future works include incorporating SMS and call alerts, adding other home appliances onto the system, and reducing the wiring changes for installing the proposed system in pre-existing houses by creating a wireless network within the home environment for controlling and monitoring the smart home environment.

# CHAPTER THREE: METHODOLOGY

1. **Introduction**

Finding appropriate research methodologies is of paramount importance in drawing up model solutions/systems to the identified problems (Finkelstein, 1994). Simply put, it’s impossible for one to come up with a system without having good research methodologies. This chapter explains the techniques, tools and procedures that will be used in order to realize the problem.

* 1. **Requirements elicitation**

The sources of requirements and data needed for the success of the project will include

* **Document review:** this will involve se of library books, internet, journals and publications which relate to home automation systems in general.
* Sample questionnaires.

System analysis will be done to identify and obtain the functional requirements and non - functional requirements of the system.

* 1. **Requirement Analysis**

Data analysis means of making sense of data before presenting it in an understandable manner. “The purpose of data analysis is to organize, provide structure to, and elicit meaning from research data” (Polit and beck 2008). Requriements analysis will be ongoing in conjunction with requirmens elicitation as Polit and Hunglar (1999) state as interviews are conducted, gathered data is synthesized, interpreted and communicated to give meaning to it.

* 1. **System design and development**

The design of a home automation system will compose of several modules including; android app to provide the user interface for off-site control, Arduino board with a microcontroller which is the brain of the system, Bluetooth module and a relay circuit where all of the different room lights will be connected.

* + 1. **Block diagram of the system**

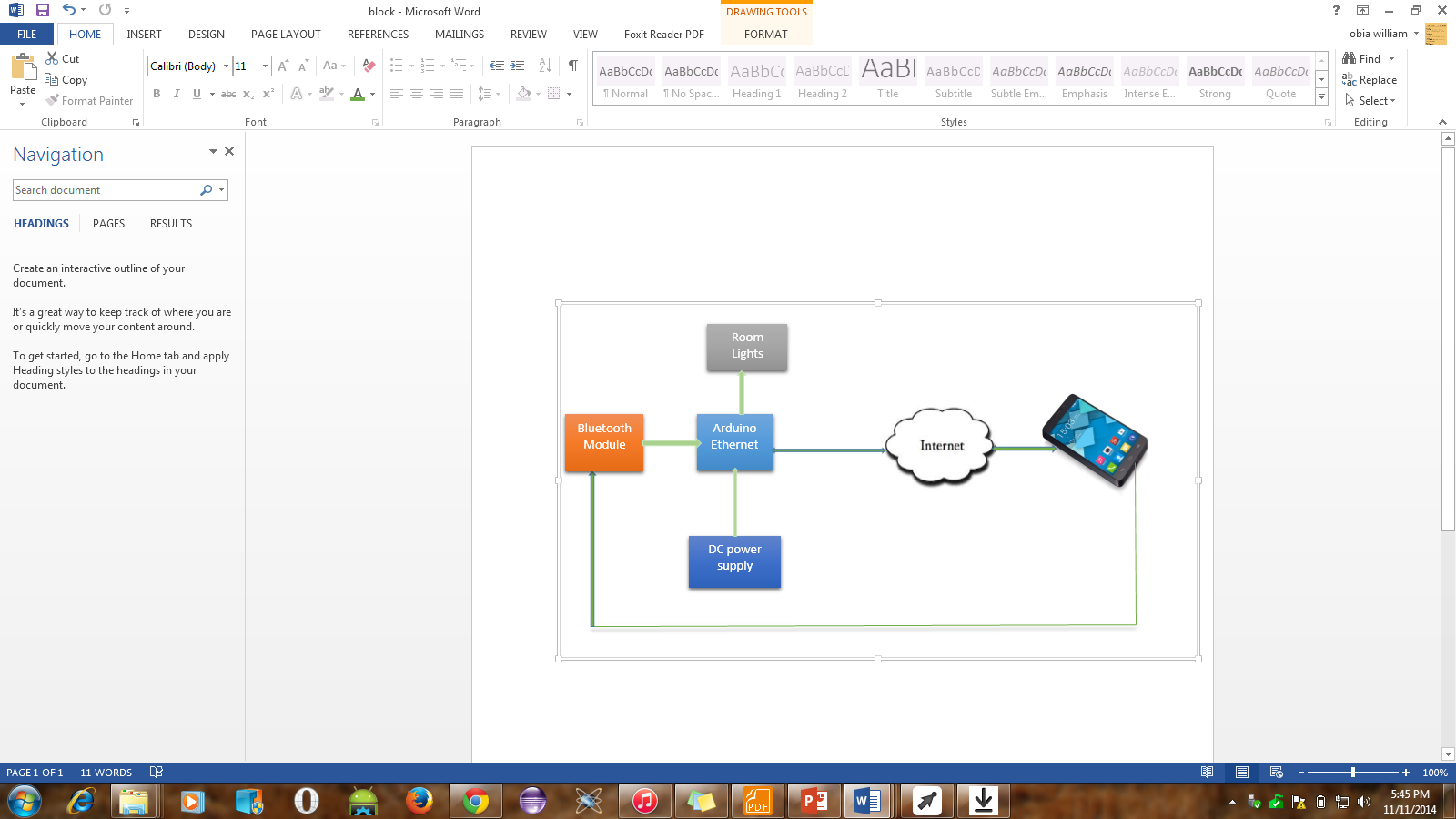


Figure 3.1 Proposed system block diagram

* + 1. **Tools to be used**

The successful development and implementation of the home automation and the mobile application will require the following major tools;

1. ADT (Android Development Tool) or android studio

ADT will be the development environment and it will be used because of its rich variety android libraries and easy integration or interaction with external libraries. Android studio performs the same task but it has more libraries compared to eclipse.

1. Java Programming Language

This will be used as the core programming language to implement the functionality of the application. Because Java is easy to run, object-oriented and independent the development platform able to be transfer the programs from one computer to the other, it will be used.

1. Embedded C programming and java script. This will be used to write programs for the microcontroller on the Arduino board.
2. Arduino board: Arduino board is a small computer with which you can read information from a variety of sensors as well as control lights, motors and other things.
3. Arduino IDE: Arduino IDE is an integrated development for Arduino programming language. The Arduino development environment contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions, and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.
4. Android mobile phone where the client app will be installed.
5. Bluetooth module to connect Arduino board to the android phone.
6. Light emitting diodes (LED) to represent the lights in the different rooms.
7. Arduino Ethernet shield (micro-web server) to connect entire system to the internet.
   1. **System implementation**

The mobile app will be simulated using the android virtual device embedded in eclipse or android studio, it will then be compiled and the APK downloaded and installed on to the real android phone where it will be used and all the C programs will be downloaded to the microcontroller on Arduino board, Arduino board will be connected together using Bluetooth wireless technology while in Bluetooth range and the internet in case the user in out of Bluetooth range via Arduino Ethernet on main Arduino board.

* 1. **Testing and validation**

In this testing and validation phase testing of individual unite (unit testing) will be done first and then they will be integrated and tested. The prototype of the mobile application and the embedded circuit will then be tested to ensure that the two are communicating and performing the task as intended and as stated in the objectives. In case of system failure necessary steps and measures will be taken to ensure to correct the problem.

# REFERENCES

|  |  |
| --- | --- |
| [1] | "Home Automation," 12 feb 2012. [Online]. Available: http://www.engineersgarage.com/articles/home-automation. [Accessed 5 10 2014]. |
| [2] | F. K. D. F. a. V. S. G. Kortuem, " "Smart objects as building blocks for," *Internet Computing,* vol. 14, no. IEEE, pp. 44-51, 2010. |
| [3] | R. Goodman, "Save energy and money with home automation," [Online]. Available: http://www.emagazine.com/earth-talk/saving-energy-and-money-with-home-automation. [Accessed 14 10 2014]. |
| [4] | "Energy Saving with Home Automation," [Online]. Available: http://www.smarthomeautomation.co.nz/energy-efficiency-control-home.htm. [Accessed 12 10 2014]. |
| [5] | "energy conservation," [Online]. Available: http://www.businessdictionary.com/definition/energy-conservation.html. [Accessed 10 11 2014]. |
| [6] | "free-energy-saving -tips," [Online]. Available: www.uswitch.com/energy-saving/guides/free-energy-saving -tips. [Accessed 12 10 2014]. |
| [7] | "How to Reduce Your Energy Consumption," [Online]. Available: http://www.nrdc.org/air/energy/genergy.asp. [Accessed 12 10 2014]. |
| [8] | "Home Automation," [Online]. Available: http://www.comcast.com/resources/home-automation.html. [Accessed 15 10 2014]. |
| [9] | S. A. a. S. V. Altaf, "RTOS based Home Automation System using Android," *International Journal of Advanced Trends in Computer Science and Engineering,* vol. 2, no. 2013, pp. 480-484, January 2013. |
| [10] | B. M. C. S. H. V. R. C. D. C. Y. Z. e. a. C. C. Ko, "IEEE Transactions on Systems, Man and Cybernetics," *Part C: Applications and Reviews,* vol. 31, no. 2001, pp. 295-303. |
| [11] | A. K. a. E. S. M. S. H. Khiyal, "SMS Based Wireless Home Appliance Control System (HACS) for Automating Appliances and Security," *Issues in Informing Science and Information Technology,* vol. 6, no. 2009, pp. 887-894. |
| [12] | A. E. a. K. A. Hamed, " "Design and Implementation of a WiFi Based Home Automation System," *World Academy of Science, Engineering and Technology,* vol. 68, no. 2012, pp. 2177-2180. |
| [13] | P. R. a. V. S. K. P. Dutta, " Microcontroller Based Voice Activated Wireless Automation system," *VSRD Internation Journal of Electrocal, Electronics & Communication Engineering,* vol. 2, no. 2012, pp. 642-649. |
| [14] | A. Z. A. a. U. Buhur, ""An internet based wireless home automation system for multifunctional devices," *IEEE Transactions on Consumer Electronics,* vol. 51, no. 2005, pp. 1169-1174. |
| [15] | L.-C. F. a. C.-L. W. N.-S. Liang, ""An integrated, flexible, and Internet-based control architecture for home automation system in the Internet era,"," *in IEEE International Conference on Robotics and Automation,* no. Washington, DC 2002, p. Robotics and Automation. |
| [16] | "Synco living – the energy-saving home automation system," [Online]. Available: http://www.siemens.com/about/sustainability/en/environmental-portfolio/productssolutions/building-technology/home-automation.htm. [Accessed 14 10 2014]. |
| [17] | C. Buenaflor, "Webee is an Android Home Automation System," 13 Feb 2014. [Online]. Available: http://thedroidguy.com/2014/02/webee-android-homeautomation-system-85024. [Accessed 15 10 2014]. |
| [18] | M. Rouse, "radio frequency," [Online]. Available: http://searchnetworking.techtarget.com/definition/radio-frequency. [Accessed 10 11 2014]. |
| [19] | M. Pinola, "What is Wi-Fi?," [Online]. Available: http://mobileoffice.about.com/od/glossary/g/wi-fi.htm. [Accessed 10 11 2014]. |
| [20] | "Internet of Things,"What Is the Internet of Things?"," [Online]. Available: http://www.cisco.com/web/solutions/trends/iot/overview.html. [Accessed 10 11 2014]. |
| [21] | "Bluetooth Fast Facts What is Bluetooth technology?," [Online]. Available: http://www.bluetooth.com/Pages/FastFacts.aspx. [Accessed 5 11 2014]. |
| [22] | "The official Bluetooth website from Bluetooth SIG," [Online]. Available: www.Bluetooth.com. [Accessed 5 11 2014]. |
| [23] | "Bluetooth Committee, Specifications of the Bluetooth System (Core)," vol. 1.0B, no. December 1999. |
| [24] | W. Team, "WebWise," 10th October 2012. [Online]. Available: http://www.bbc.co.uk/webwise/guides/what-is-the-internet. [Accessed 29 10 2014]. |
| [25] | H. C. Y. W. S.-C. a. L. C.-M. C. Chiu-Chiao, "Bluetooth-Based Android," *in 2nd International Conferenceon Innovations in Bioinspired Computing and Appplications(IBICA 2011),* pp. 309-312, 2011. |
| [26] | J. P. a. S. Sukittanon, ""Exploiting Bluetooth on Android mobile devices for home security "," *in Southeastcon,* F2012. |
| [27] | A. R. M. a. Z. F. J. A. Rajabzadeh, "A Mobile Application for Smart House Remote Control System,," *World Academy of Science, Engineering and Technology ,* vol. 62, no. 2010.. |

# APPENDICES

## **Appendix A: Time Frame**

Table 3.2 Time Frame

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Tasks** | **Months** | | | | | | | | | | |
|  |  | 2014 | | | | | 2015 | | | | | |
|  |  | Aug | Sept | Oct | Nov | Dec | Jan | Feb | March | April | May | June |
| 1 | Identify Title |  |  |  |  |  |  |  |  |  |  |  |
| 2 | Identify problem |  |  |  |  |  |  |  |  |  |  |  |
| 3 | Literature review |  |  |  |  |  |  |  |  |  |  |  |
| 4 | Consultation |  |  |  |  |  |  |  |  |  |  |  |
| 5 | Proposal writing |  |  |  |  |  |  |  |  |  |  |  |
| 6 | Proposal presentation |  |  |  |  |  |  |  |  |  |  |  |
| 7 | Field findings |  |  |  |  |  |  |  |  |  |  |  |
| 8 | Implementation |  |  |  |  |  |  |  |  |  |  |  |
| 9 | Final report writing |  |  |  |  |  |  |  |  |  |  |  |
| 10 | Project presentation |  |  |  |  |  |  |  |  |  |  |  |
| 11 | Finalize report and submit |  |  |  |  |  |  |  |  |  |  |  |

## **Appendix B: Proposed Budget**

Table 3.3 Proposed Budget

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No.** | **Item** | **Activity** | **Quantity** | **Price** | **Cost** |
| 1 | Android Mobile Phone | Testing the application | 1 | 450,000/= | 450,000/= |
| 2 | Arduino UNO Kit |  | 1 | 260,000/= | 260,000/= |
| 3 | Arduino Ethernet |  | 1 | 52,000/= | 52,000/= |
| 4 | Bluetooth Module |  | 1 | 26,000/= | 26,000/= |
| 5 | LEDs |  | 8 | 65000/= | 65,000/= |
| 6 | Stationary | Report printing and binding |  |  | 150,000/= |
| 7 | CD/DVD | Storage | 1 | 2,000/= | 2,000/= |
|  | Total | | |  | 100,5000/= |