DESIGN AND CONSTRUCTION OF A HOME CONTROL SWITCH AUTOMATION USING GSM COMMUNICATION

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A PROJECT REPOERT SUBMITTED TO THE DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

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DEDICATION

I dedicate this report to God, the Almighty; the All-knowing, the All sufficient, the Giver of wisdom, knowledge and understanding.

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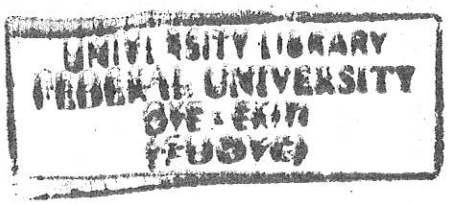

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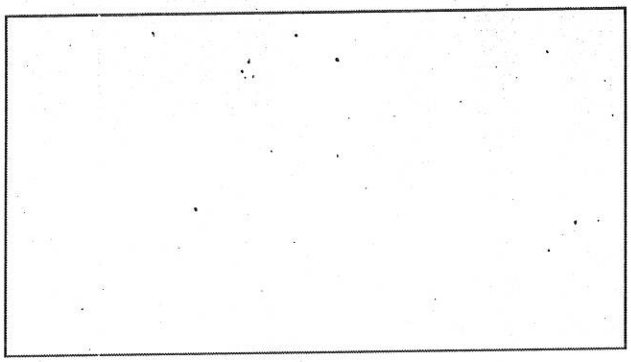

CERTIFICATION

This is to certify that **OLATODU DAMILARE JOSEPH** with **Mat No: EEE/13/1116** of the department of **ELECTRICAL AND ELECTRONICS ENGINEERING** carried out this project titled home control switch automation using GSM communication work and has satisfied the regulations governing the award of degree of BACHELOR OF ENGINEERING (B.Eng) in Federal University Oye-Ekiti, Ekiti State.

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ABSTRACT

With advancement of technology things are becoming simpler and easier for us. Automatic systems are being preferred over manual system. The purpose of this project is to design and construct A GSM based home automation using GSM Module. Using GSM networks, in this project a home power control system has been designed that will act as an embedded system which can monitor and control appliances and other devices locally using built-in input and output peripherals. The system has a delay of 30 seconds after the first SMS to initiate the next command. This project is made up of four vital units. These units are as follows: GSM module unit, peripheral interface control (PIC) unit, driver unit and a power monitoring and control unit. The GSM module is a GSM transceiver which gives the system access to the GSM service provider. The peripheral interface control (PIC) is programmed to carry out the OFF/ RESET operation according to the GSM commands while the driver and control unit consist of capacitors, resistors, diodes, regulators and electromagnetic relay is to effect power switching. The architecture consists of mobile phone and GSM modem. In the system design, incoming SMS message is sent from the user phone to the GSM module as a text message via cellular network. The GSM module then sends the commands in text mode to the PIC microcontroller using an RS232 interface. The RS232 voltage levels are at ±12V whereas both the microcontroller input and output operates at 0V to +5V. Since RS232 is not compatible with microcontroller, MAX232 is utilized to enable the communication between both the GSM modem and PIC microcontroller by converting RS232 level signals to TTL level signal. Outgoing message from the system containing the home appliances status is delivered to the mobile phone through GSM modem.

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CHAPTER ONE

1. INTRODUCTION

1.0. BACKGROUND

The analysis and implementation of the home automation technology using Global System for Mobile Communication (GSM) {home control switch system using GSM communication} modem to control home appliances such as light, conditional system, and security system via Short Message Service (SMS) text messages is presented in this project. The proposed research work is focused on functionality of the GSM protocol, which allows the user to control the target system away from residential using the frequency bandwidths. The concept of serial communication and AT-commands has been applied towards development of the smart GSM-based home automation system. Home owners will be able to receive feedback status of any home appliances under control whether switched on or off remotely from their mobile phones. 16F877A microcontroller with the integration of GSM provides the smart automated house system with the desired baud rate of 9600 bps. The proposed prototype of GSM based home automation system was implemented and tested with maximum of six loads and shows the accuracy of =98%.

The basic idea of home automation is observed since 1970s but expectations of the peoples are continuously and constantly increase due to the advancement of the technology and internet services. It has been observed that different researchers proposed architectures for various efficient and convenient home automation systems. Even the technology is entirely changed but the

function and importance of home automation systems are same as previous. In recent years, there has been a growing interest among consumers in the smart home concept. Smart homes contain multiple, connected devices such as home entertainment consoles, security systems, lighting, access control systems and surveillance. Intelligent home automation system is incorporated into smart homes to provide comfort, convenience, and security to home owners. Home automation system represents and reports the status of the connected devices in an intuitive, user-friendly interface allowing the user to interact and control various devices with the touch of a few buttons. Some of the major communication technologies used by today's home automation system include Bluetooth, WiMAX and Wireless LAN (Wi-Fi), Zigbee, and Global System for Mobile Communication (GSM).

All GSM is one of the most widely used cellular technologies in the world. With the increase in the number of GSM subscribers, research and development is heavily supported in further investigating the GSM implementation. In 2009, Das, Sanaullah, et. al. developed a cell phone based remote management and control system for home appliances. However, a few limitations for the system include not being able to control multiple appliances concurrently and the home automations system could not verify the status of the appliances. ElKamchouchi and ElShafee presented the design and prototype implementation of basic home automation system based on SMS technology using AT89C55 Atmel microcontroller. The limitations found was that Atmel AVR contains only one single source with limited processing power (it is not needed for every application), limited memory, they have lots of peripherals, that is an advantage but sometimes you will feel like you have more than what you need. The microcontroller acts as the bridge between the GSM network and sensors of the home automation system. Further researches have been conducted to analyse the performance of other home automation control

system. Internet and wireless communications have also been utilized in parallel with GSM for home automations.

Among the cellular technologies, GSM network is preferred for the communication between the home appliances and the user due to its wide spread coverage which makes the whole system online for almost all the time. Another advantage of using the GSM network in home automation is its high security infrastructure, which provides maximum reliability whereby other people cannot monitor the information sent or received. Hence, this research work implements SMS based control for home appliances using the GSM architecture without accessing the local network.

1.0.1 AUTOMATION

Automation is the use of control systems and information technology to control equipment, industrial machinery and processes, reducing the need for human intervention. In the scope of industrialization, automation is a step beyond mechanization. Mechanization provided human operators with machinery to assist them with the physical requirements of work while automation greatly reduces the need for human sensory and mental requirements as well. Automation plays an increasingly important role in the global economy and in daily experience. Engineers strive to combine automated devices with mathematical and organizational tools to create complex systems for a rapidly expanding range of applications and human activities. Many roles for human in industrial processes presently lie beyond the scope of automation. Human-level pattern recognition, language recognition, and language production ability are well beyond the capabilities of modern mechanical and computer systems. Tasks

requiring subjective assessment or synthesis of complex sensory data, such as scents and sounds, as well as high-level tasks such as strategic planning, currently require human expertise. Automation has had a notable impact in a wide range of highly visible industries beyond manufacturing. Medical processes such as primary screening in electrocardiograph or radiography and laboratory analysis of human genes, blood plasmas, cells, and tissues are carried out at much greater speed and accuracy by automated systems. Automated teller machines have reduced the need for bank visits to obtain cash and carry out transactions. In general, automation has been responsible for the shift in the world economy from agrarian to industrial in the 19th century and from industrial to services in the 21th century Office automation Office automation refers to the varied computer machinery and software used to digitally create, collect, store, manipulate, and relay office information needed for accomplishing basic tasks and goals. Raw data storage, electronic transfer, and the management of electronic business information comprise the basic activities of an office automation system, office automation helps in optimizing or automating existing office procedures. Building automation Building automation describes the functionality provided by the control of a building. The control system is a computerized, intelligent network of electronic devices, designed to monitor and control the mechanical and lighting systems of a building. A building automation system is an example of a distributed control system. The building automation system (BAS) core functionality keeps the building climate within a specific range, provides lighting based on an occupancy schedule, and monitors system performance and device failures and provides email and/or text notifications to building engineering staff. The BAS functionality reduces building energy and maintenance costs when compared to a non-controlled building.

Power automation is the automated control and monitoring of power plants, substations and transformers for effectiveness, efficiency and fault

detection. It has made it possible to have a reliable municipal or national electricity system, which often comprises remote and hard-to-reach transformers and power sub-system units. It makes it possible to monitor different power units, relay their status and health information, and even carry out fault detection and correction without human interference. Example of power automation system is the Supervisory Control and Data Acquisition (SCADA) system. Home automation Home automation may designate an emerging practice of increased automation of household appliances and features in residential dwellings, particularly through electronic means that allow for things impracticable, overly expensive or simply not possible in recent decades. Home automation includes all that a building automation provides like climate controls, door and window controls, and in addition control of multimedia home theatres, pet feeding, plant watering and so on. But there exists a difference in that home automation emphasizes more on comforts through ergonomics and ease of operation.

1.1. SYSTEM REALISATION

PROJECT BACKGROUND

The circuit design of my proposed smart GSM based home automation system is given in GSM Figure 1.1. The architecture consists of mobile phone and GSM modem. In the proposed system design, incoming SMS message is sent from the user phone to the GSM modem as a text message via cellular network. The GSM modem then sends the commands in text mode to the PIC microcontroller using an RS232 interface. The RS232 voltage levels are at ±12V whereas both the microcontroller input and output operates at 0V to +5V. Since RS232 is not compatible with microcontroller, MAX232 is utilized to enable the communication between both the GSM modem and PIC

microcontroller by converting RS232 level signals to TTL level signal. Outgoing message from the system containing the home appliances status is delivered to the mobile phone through GSM modem.

1.2. STATEMENT OF THE PROBLEM

The control of home appliances was formally done by the user switching of each appliances manually which involves the switches and sockets etc. we humans are not perfect and a user in an hurry might forget about switching off for example an electric iron or an electric cooker which causes fire hazard and damages of properties, hence the need for an inexpensive home control system is constructed and this doesn't require physical contact with switches or sockets, just the need for a mobile phone to control home appliances in a more efficient and easy way.

1.3. MOTIVATION

The design and implementation of GSM BASED AUTOMATION USING GSM MODULE brings about safety and security of human life and things present in his/her surroundings. Damages caused by overloads in power strips and outlets, leaving appliances plugged in without switching it off, unprotected electrical outlets etc. which causes major loss of life due to carelessness and misuse, home control systems are built to enable the user live a more convenient life.

1.4. SIGNIFICANCE OF THE PROJECT

This project is design so as to be able to control all your electrical home appliances with the use of your mobile phone. In a situation where by because of the epileptic power supply in the country, you forgot to put off any of your home appliances before going out, only for one of your neighbours to call you that your television set is disturbing the peace of the environment. Instead of you wasting time coming back home and risking so many thing, you can easily switch off the

Television set from the office, school or any location with the help of this project. All you need is your phone. Applications are listed: Home Automation, Industrial Automation, Office Automation, Agricultural Use, The Security System can be employed in household or any organization.

1.5. PROJECT AIM

The aim of this project is to design and construct a home automation system that will remotely switch on or off any household appliance connected to it, with the use of a mobile phone.

1.6. PROJECT OBJECTIVE

The objective of this project is design and develop a wireless communication link to monitor and control equipment's, home and industrial appliances that are far away from user and also develop a high security system to keep a check on them.

(i) To implement a low cost, reliable and scalable home automation system

(ii) To construct a circuit that can be used to remotely switch on or off any household appliance, using a microcontroller to achieve hardware simplicity, from any phone to toggle the switch state.

(iii) To implement a GSM smart system for home control

1.7. SCOPE OF THE PROJECT

This project work is complete on its own to switch on and off of any household electrical appliances. The system specification shows the description of the function and the performance of system and the user. The scope of my project "Home control switch automation using GSM communication" is immense.

The future implications of the project are very great considering the amount of time and resources it saves. The project I have undertaken can be used as a reference or as a base for realizing a scheme to be implemented in other projects of greater level such as weather forecasting, temperature updates, device synchronization, etc. The project itself can be modified to achieve a complete Home Automation system which will then create a platform for the user to interface between himself and the household.

1.8 LIMITATIONS

The project has certain limitations and a list of such is mentioned below:-

- The receiver must reside in a location where a signal with sufficient strength can be received from a cellular phone network.
- Only devices with electrical controlling input ports will be possible targets for control.
- Operation of the controlling unit is only possible through an SMS text and SIM card.
- The Control unit is limited to send and receive SMS only which isn't enough but should also be able to receive and decode phone call during future upgrades.

CHAPTER TWO

LITERATURE REVIEW

The first machines to be operated by remote control were used mainly for military purposes. Radio-controlled motorboats, developed by the German navy, were used to ram enemy ships in World War I. Radio controlled bombs and other remote control weapons were used in World War II. Once the wars were over, United States scientists experimented to find non-military uses for the remote control. In the late 1940's automatic garage door openers were invented, and in the 1950's the first TV remote controls were used. Zenith began playing around with the idea of a TV Remote control in the early 1950's. They developed one in 1952 called "Lazy Bones," which was a long cable that was attached to the TV Set. Pushing buttons on the remote activated a motor that would rotate the tuner in the set. This type of remote wasn't popular for long considering that, at the time, there were very few channels to choose from.

In 1955, the Flashomatic was invented. A flashlight was shined towards light sensitive cells in each of the four corners of the TV. Each corner had different function. They turned the TV on and off, changed the channel, and controlled the volume. However, people often forgot which corner of the TV operated which control. Also, if the set was in sunlight, the sun's rays would affect the operations of the TV. In 1957 a group of engineers developed the Zenith "Space Command, a wireless remote control using ultrasonic waves. The problem with the ultrasonic control was that clinking metal, such as dog tags, could affect the TV set. High frequencies sometimes also made dog bark. The ultrasonic remote was used for two decades until engineers discovered a better

way to operate TV's, the infrared remote control. On the infrared control, each button has its own command, and is sent to the TV set in a series of signals. There is a digital code for each button, and in the TV there is a tiny sensor called a photo detector that identifies the infrared beam, and translates the code into a command. Manufacturers used to only make remote controls that operated one TV set. However, they've recently begun making universal remote controls that can operate any TV set. Expert predicts that someday remote controls will control almost every device in the home. R.C. Goertz developed a mechanical manipulator in 1948 to aid in radioactive lab work. Goertz gave the machine mechanically and geometrically similar "master" and "slave" parts. The master was the part of the machine the Goertz controlled, and used to send the slave commands. The slave followed the master's movements exactly. In 1954 an electric machine was made to replace Goertz's machine, which was operated by cables. Since'54 better design has been developed, but the electric manipulator remains relatively unchanged to this day.

For many years now, a lot of people have worked on home automation, home automation can be described as introduction of technology within the home environment to provide convenience, comfort, security and energy saving to its occupants. Adding intelligence to home environment can provide increased quality of life for the elderly and disabled people who might otherwise require caregivers or institutional care. There has been a significant increase in home automation in recent years due to higher affordability and advancement in phones. Various works have been carried out with the use of microcontrollers to design Home Automation. Some of such works are highlighted below: Implementing of home automation system were considered by (Delgado, et. al., 2006) and (Ciubotaru, et. al., 2006) who presented designs and implementations of SMS -text based control. This work uses SMS – to control home appliances and this give the project a limitation because you will not know if the SMS gets to the phone in the project or not.

- Yun Chan Cho and Jae Wook Jeon "Remote Robot control System based on DTMF of Mobile Phone", IEEE International Conference INDIN 2008, July 2008. The limitation of this project is that it only uses Android phone, means if you don't have an Android phone, you will not be able to control the home appliances, and the component used for this project is quite expensive.
- Chen Peijiang Xuehua, "Design and Implementation of Remote Monitoring System Based on GSM", 2008 IEEE Pacific-Asia Workshop on Computational Intelligence and Industrial Application.
- Afif Mghawish, Akram A. AbdelQader, Mahmoud A. Al-Jezawi, Mohammad Abu Mahfouz. Multi-Function Control System using GSM modem Based SM5100B Module. ICITST-2012 London, Technical Cosponsored by IEEE UK/RI Computer.
- Mobile-Based remote control by (Afif Jadalla Al Mghawish, June 2013) edition volume 9, No 18.

REVIEW OF RELATED WORKS

Here, some research such as Home Automation system and its application, Tone recognition devices {DTMF} (brief history of tone recognition device), Automatic Speech recognition, the technical detail of GSM will be looked into as they relate to remote control systems and the differences

1. One is only used for status reporting such as power failure
2. The speech recognition only uses voice of the user.
3. The dual tone involves the user dialling the GSM number inbuilt in the project
4. The present project involves the use of GSM module which involves the sending and receiving of SMS to the module inbuilt in the project which makes it accurate and faster because it doesn't require verification of speech, dial tones or codes.

2.1. HOME AUTOMATION SYSTEM

A common definition of Home Automation is of an "electronic networking technology to integrate devices and appliances so that the entire home can be monitored and controlled centrally as a single machine" (Pragnell et al., 2000). Another term that describe the same technology is "domotics", which was derive from the Latin word domus, meaning home, and informatics, meaning the study of the processes involved in the collection, categorization, and distribution of data. However, since this technology is still very much in flux, other terms are also used in the literature with equivalent meaning, such as: "smart home", "smart house", "digital home" or electronic home".

Furthermore, note that although the terms "house" and "home" have different meaning in the English language, they are often used alike in this context. (Delgado, et al., 2006) consider the problems with the implementation of home automation systems. Furthermore the possible solutions are devised through various network technologies. Several issues affecting home automation systems such as lack of robustness, compatibility issue and acceptability among the old and disabled people are discussed. (Ciubotaru-Petrescu, et al., 2006) present a design and implementation of SMS based control for monitoring systems. The paper has three modules involving sensing unit for monitoring the complex applications. A processing unit that is, microcontroller and a communication module that uses GPRS modem or cell phone via serial port RS-232. The SMS is used for status reporting such as power failure. In their paper, (Scaradozzi et al., 2003) view home automation systems as multiple agent systems (MAS). In the paper home automation system has been proposed that includes home appliances and devices that are controlled and maintained for home management. The major task is to improve performance. In their paper, (Alkar et al., 2005) propose an Internet Based Wireless Home Automation System for

Multifunctional Devices. This paper proposes a low cost and flexible web-based solution but this system has some limitations such as the range and power failure. Murthy (2008) explores primary health-care management for the rural population. A solution proposes the use of the mobile web-technologies providing the PHC services to the rural population. The system involves the use of SMS and cell phone technology for information management, transactional exchange and personal communication. (Jawarkar, et al., 2008) propose remote monitoring through mobile phone involving the use of spoken commands. The spoken commands are generated and sent in the form of text SMS to the control system and then the microcontroller on the basis of SMS takes a decision of a particular task. (Potamitis, et al., 2003) suggest the use of speech to interact remotely with the home appliances to perform a particular action on behalf of the user. The approach is inc lined for people with disability to perform real- life operations at home by directing appliances through speech. Voice separation strategy is selected to take appropriate decision by speech recognition.

2.2. BRIEF HISTORY OF TONE REGONITION DEVICE

Despite the fact that the largest stride in the development of tone recognition devices has occurred in the past two decades, this aspect of technology really began with Alexander graham bell's invention at about 1870. In his discovery, conversion of sound waves into electrical signals started the process of exploring scientific and mathematical basis for understanding bell laboratories in the 50's developed the first effective tone recognition for numbers. At about 2970, the American Research Project Agency (ARPA) after various researches on speech understanding developed the technology further focusing particularly on the fact that the objective of automatic tone recognition is the understanding of speech not merely words. By the 80's distinct types of products are available, they offered speaker independent recognition systems such that document could

be created by voice dictation. The last two decades has invariably a development of voice recognition to the point of real-time continuous speech systems with exceptional high accuracy.

2.3. HISTORY OF HOME AUTOMATION

Although the term "home automation" was first used in 1980s, the concept is far from new. The early documented attempt to envisage something very similar dates back to the 1960s, with Walt Disney's Experimental Prototype Community of Tomorrow (EPCOT), presented in 1966. A smart home will not be able to accomplish much without appliances to control, nor will it be able to communicate to these devices in the absence of a control network ("home network"). Since appliances and home network are so interlinked with a smart home, the following sections provide a brief history on how these come into being.

2.3.1. THE MECHANICAL EVOLUTION

The first question that might come to mind is why we would need a Smart Home and why we would want to find different ways of doing ordinary things, such as washing clothes, cooking, or even turning a light on or off. A similar question could have been asked at the beginning of the 20th Century, at the dawn of what can be called the "mechanical revolution". In late 1800's, the middle class was experiencing a shortage of domestic servants which created the need to find new ways to provide help in the home (Harper, 2003). Such necessity was the initial driving force behind the inventions of the first domestic appliances, which had the purpose of making household chores easier and do more with less. In 1911, Frederick Winslow Taylor published "The Principles of Scientific Management", which advocated the use of efficiency to maximize results through

minimal effort. This theory is today known as Taylorism and, though it was originally intended to be applied in industrial settings, this concept soon spilled over into the domestic realm due to the need at hand. Christine Frederick (1911) was one of the first to recognize that the challenges tackled by Taylorism were also directly applicable to domestic issues and captured these in her book "Household engineering: Scientific Management in the Home", published in 1915. In her book, Frederick predicts that mechanical appliances would be the ones which were to take up the work originally performed by servants "where every possible purely manual task is done by arms of steel and knuckles of copper". She also puts forward the idea of a Smart Home where she foretells that "such machinery will be far more unified than at present with various pieces related to one another", as reported by D. Heckman (2008).

2.3.2. THE ELECTRICAL EVOLUTION

In spite of the first inventions, most of this new domestic technology would have still been easily recognized by people who had lived in the previous Century. However, electricity, the driving force behind the electrical revolution, would soon change this familiar landscape beyond recognition. Electrical energy first arrived in the homes around 1920s and, although initially used for lightning purposes only, by 1940s mains electricity was readily available to around 65 per cent of the total of houses in the UK. (Harper, 2003). Soon after it reached a critical mass, producers of electrical appliances inundated the market with all sorts of items. Although some of them were nice-to-have-devices, such as electric popcorns poppers, egg cookers and waffle irons, others were really life changing for the household: refrigerators, washing machines, electric cookers, vacuum cleaners, just to mention the most important. Regardless of their importance, all these electrical appliances were still made with the original need in mind, which was often reminded to people as producers marketed these products with time-

saving slogan such as "no longer tied down by housework" or "automatically gives you time to do those things you want to do" (Heckman, 2008). It is interesting to note how some later devices could be hardly classified as time savers and how, in spite of this, they were still quite readily adopted. By early 1980s, around 65 per cent of UK homes had a colour television set and half of them a video recorder (Harper, 2003). More interesting still, the adoption curve was different from one to another, sometimes regardless of the comfort that they could bring.

2.3.3. THE INFORMATION REVOLUTION

Disney's original vision for EPCOT was to create both a laboratory for new technology and a home for its inhabitants with the promise of offering an "integrated living environment" (Heckman, 2008). Due to his untimely death, just a few months after the official presentation of the project, EPCOT was never implemented, at least not in its original idea. The concept behind the original vision was however to live on. In the 1960s, a number of hardware and software innovations made possible for home owners to have access to the first computer like appliances in their homes. Perhaps the first attempt to create a "home automation" system occurred in 1966 when Westinghouse proposed the experimental – and quite bulky – Electronic Computing Home Operator (ECHO) IV. Although the original system was supposed to automate the family finances, it was soon extended to include recipes, shopping lists, family inventory, and, in its final versions, added home temperature control and the ability to control appliances. In 1975, it was the turn of the Altair 8800, followed by the Apple I in 1977 and the IBM PC in 1981. While these computers were slowly finding their ways into the home, they also contributed to the creation of the idea of "smart machines". In 1978, after a few years of experimentation and refinement, PICO Electronics patented the X10

technology. This technology can be considered the first "home network" as, differently to other networks available at the time, it enabled the existing electrical wiring in anyone's home to also be used as the media for the communication network. By doing so, X10 made home automation a reality for the majority of the household at an affordable price. Nowadays, an increasing number of houses have home computers, game consoles and always-on Internet connections that extend the availability of services and resources to the household beyond the physical boundaries of the home.

2.4. SMART HOME TODAY

The Oxford Dictionary defines "smart" as both "stylish and fresh in appearance, having a quick intelligence", and "being fashionable and up market". Sony was among the first companies to attach the "smart" buzzword to a computer when, in 1982, it marketed the "Smart Sony" computer: no longer advertised simply as "home" computer, but tried to cash in on the smart concept by selling it as a device which could "help you make smarter business decisions" (Heckman, 2008). The "smart" concept has become since a marketing catchword, still employed today, to sell a wide range of products, hence: "smart phones", "smart cameras", "smart design", "smart bombs" and "smart homes". Usually, the word define devices that are reportedly based on cutting-edge design that unite innovation with practical simplicity, However, as this would soon be demonstrated, sometimes marketing buzzwords alone cannot guarantee the sell. Xanadu was the first example of a mass-produced Smart Home. Built throughout the 1980s in the US around the original EPCOT idea, these houses were commercially built dwellings that made extensive use of Smart Home technologies. To look even more futuristic, the actual house was made entirely of polyurethane foam. The Xanadu home had a computer that monitored and controlled all its systems: the kitchen, living room, bathrooms, and bedrooms all

had their own electrical and electronic devices to control the appliances present in the house. For example, the shower could be set to be turned on at a specific time and a set temperature. The ad campaign eloquently described the house as "Xanadu: the Computerized House of Tomorrow" and its peculiar appeal was set by the advertisement campaign: a "house with a brain – a house you can talk to, a house where every room adjusts automatically to match your changing moods" (Heckman, 2008). As the time moved on, and most of the house were still unsold, the technology contained soon became obsolete. One by one, these Xanadu houses started to get demolished to make space for more "commercially viable" projects and, by October 2005, they were all gone. In spite of the commercial setback provided by the Xanadu homes, the concept was sound and a combination of elements such as computers, robotics and Artificial Intelligence (AI) were to push the Smart Home concept further, even if sometimes only in research laboratories. Throughout the 1980s, several innovative ideas provided a clear indication that the technology might have been finally mature enough to deliver commercially viable solutions. As an example, a device named Waldo, which interfaced with an Apple computer, could use voice recognition and speech synthesis technology to control appliances.

2.5. ASPECTS OF AUTOMATIC SPEECH RECOGNITION (ASR) DEVICE

Automatic speech recognition (ASR) is the process by which a computer maps an acoustic speech signal to some form of abstract meaning of the speech. Automatic speech recognition (ASR) applications focus on public services such as operator automatic operator assistance voice activated information retrieval, voice doing and many other similar tasks. Speech recognition should not be

confused with a dial tone (DTMF) application where the user must select from numbered options or spell out and account number using the telephone keypad. A speech recognition application allows the user to answer questions and provide information using a normal speaking voice many companies have already invested easily in human powered call centres or DTMF (touch- tone) interactive voice response (IVR) systems. They are changing or adapting to ASR applications, because of cost savings and improvement in customer satisfaction and experience. It has been shown that automatic speech recognition application are far more popular with callers than DTMF menu systems. In general, ASR system consist of:

- A signal processing front-end
- Acoustic modelling
- Language modelling.

2.6. TECHNICAL DETAILS OF GSM

GSM is a cellular network, which means that mobile phone can be connected to it by searching for cells in the immediate vicinity. GSM network operate in four different frequency ranges. Most GSM network operates in the 900Mh2 or 1800MHz bands. In 900 MHz band, the uplink frequency band is between 890-915 MHz and the downlink frequency band is 935-960 MHz In the 1800mz band, the uplink frequency is between 1710-1785 MHz and the downlink is between 1805-1880Mh2. also in 1900 MHz band, the uplink frequency band is 1850 MHz- 1950MHz in GSM 900 MHz, the band allocation is 25 MHz band width which is subdivided into 24 carrier frequency channels, each spaced 200 kHz apart. Time division multiplexing is used to allow eight-fall rate to sixteen half-rate speech channels per radio frequency channel. There are eight-radio time slots (giving eight burst penods) grouped into what is called TOMA frame. Half rate channels use alternate frames in the same time slot. The channels data rate is

270 833kbit/s and the frame duration is 4.615ms. The transmission power in the handset is limited to a maximum of 2 crafts in GSM 900 and I waH in GSM 1800/1900.GSM has used a variety of voice codes.

2.7. SUBSCRIBER IDENTITY MODULA (SIM) AS A GSM FEATURE

One of the key features of GSM is the subscriber identity module (SIM). It is usually known as SIM card. The SIM is detachable smart in appearance and is used for the subscription of information and phonebook. This allows the retrieval of information after switching handset on. The SIM card also enables users to link each other irrespective of different network operation. For the purpose of this project work to be achieved a SIM card on any network is required to establish link between a user and its household equipment's to squeeze 3.1Kh2 audio between 5.6 and 13kbit/s.

CHAPTER THREE

SYSTEM DESIGN METHODOLOGY AND ANALYSIS

INTRODUCTION

This chapter will shed more light and also give sufficient insight on the theory and principles upon which the components used in this microcontroller projects are based. This involves the essential description of the PIC 16F microcontroller which comes from the PIC family and all other components like relays, resistors, diode, transistor, transformer etc. used in this project will be explain.

3.1 HARDWARE SUBSYSTEMS

The project was designed and implemented using top to bottom design method just as shown in the block diagram in figure 3.1. The system starts form the following units:-

- GSM module unit
- Peripheral interface control (P.I.C) unit
- Driver unit.
- Power surge monitoring and control unit , (AVR)

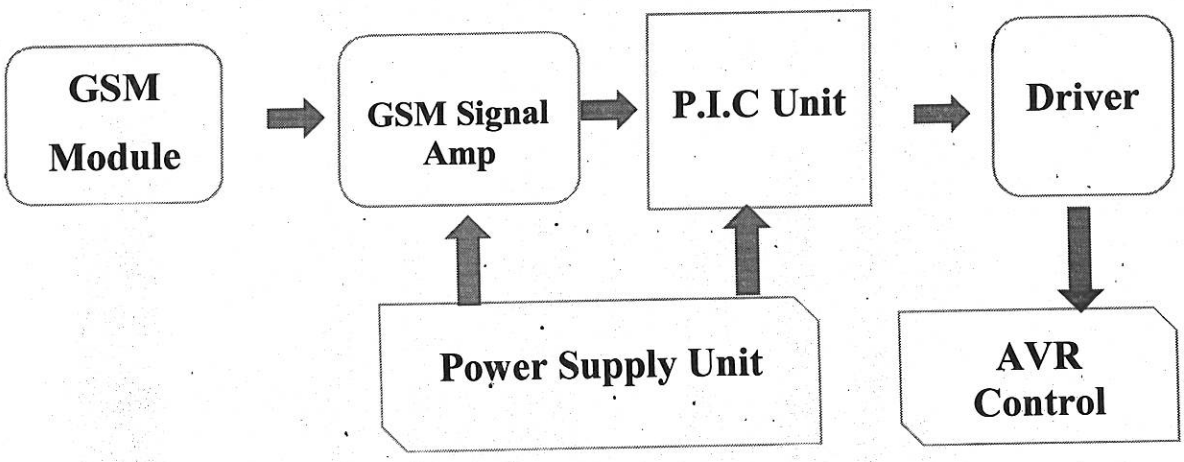


Figure 3.1: Simple block diagram of the project

In the methodology, the overall system design is in two parts: hardware design and software design. The hardware design is the physical parts of the system while the software design treats the programs that were written to control the microcontroller at the processing centre of the system. The hardware design is the heart of the project. This is the physical implementation where the various components used for the design were incorporated together on a Vero board through soldering. It consists of many units which includes a GSM module, a PIC unit and other units listed above.

3.2 SYSTEM ANALYSIS AND DESIGN

The system uses GSM signal system which allows its users to effectively control their house/office appliances simply by texting the device. The SMS receive by the device is processed by a microcontroller to perform an OFF or ON operations. The type of the operation performed is based on the nature of the GSM signal sent. An encoded GSM signal via command through an SMS that the GSM module understands is generated and sent from the GSM base station to the device.

In this project two GSM module are involved:

- The GSM transmitter module which is the user's cell ph8ne
- The GSM receiver module which is the cell phone connected to the project.

There are lots of remote controls methodology like infrared, RF, DTMF and more but in this project I prefer the SMS system using GSM network. DTMF control system uses the GSM network as well but the problem with it is that SMS can been sent even if the signal strength is weak but the DTMF signal can't be achieved sometimes in cases of poor network contacts. In the design methodology, GSM network was used because of its wider coverage. The relay driver is used to drive the relay circuits which switches the different appliances connected to the output of the project.

Complete simulation of circuit diagram

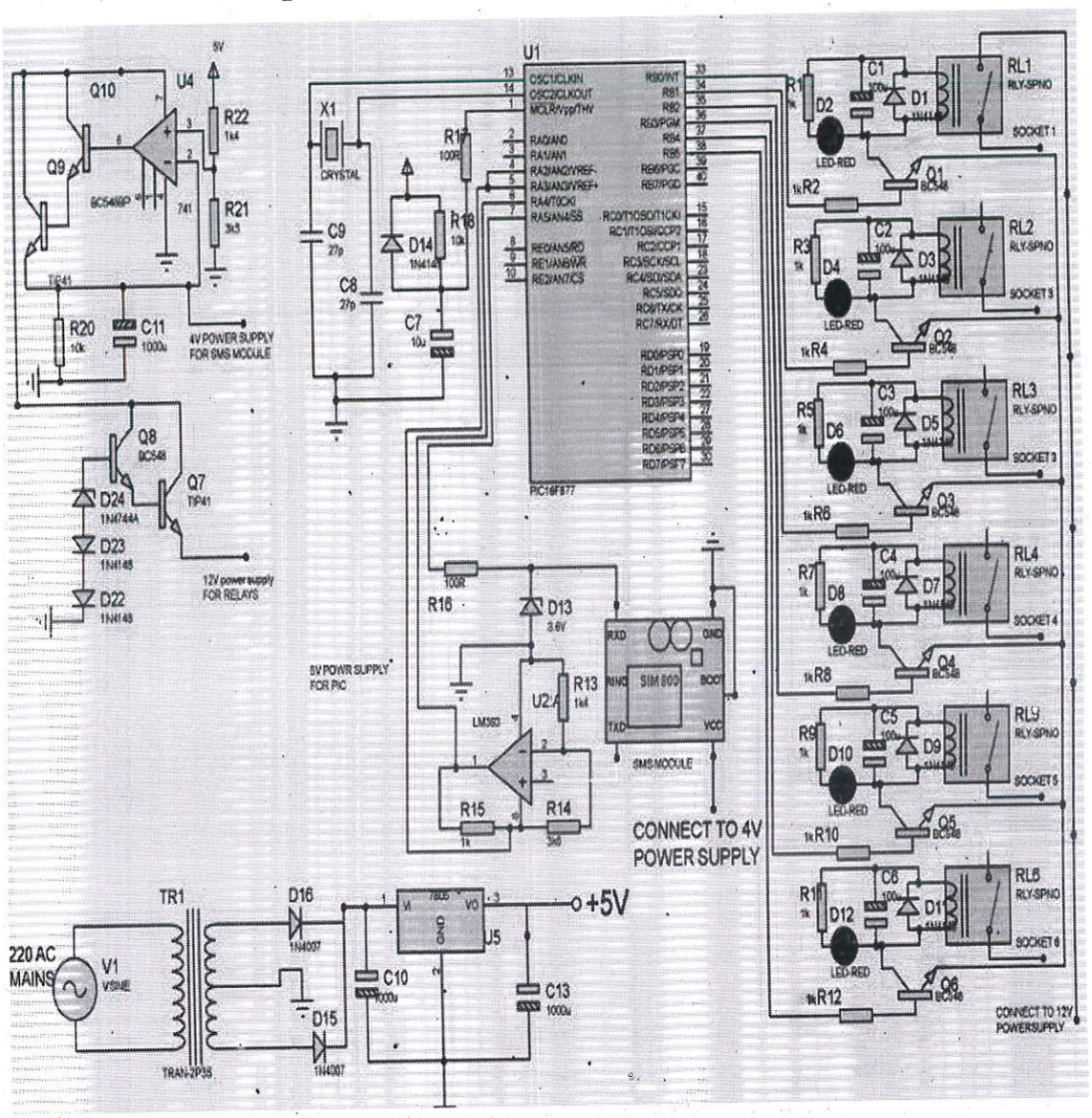


Figure 3.2 Schematic Diagram of the Project

The figure shown above is the schematic diagram of my project. It is a simple illustration of how I have implemented my project and the various parts involved in it. From the above representation, the first Mobile station is used as a transmitting section from which the subscriber sends the SMS which is the command or instruction for the second mobile station. A SIM card is inserted in the receiver cell phone.

3.3 REGULATION UNIT

Regulation is a measure of the difference in voltage provided by the transformer's secondary winding when it is on load and off load. It is expressed as a percentage relative to the full load voltage and, basically, the lower the value, the less the voltage difference. Strictly speaking, the transformer's datasheet (or supplier) should state the output voltage when the transformer is under its full rated load.

For example, a transformer rated at 12v, 50VA should provide 12v to a load which takes 4 amps.

$$50VA\ at\ 12volts = {}^{50}/_{12} = 4.1\ Amps$$

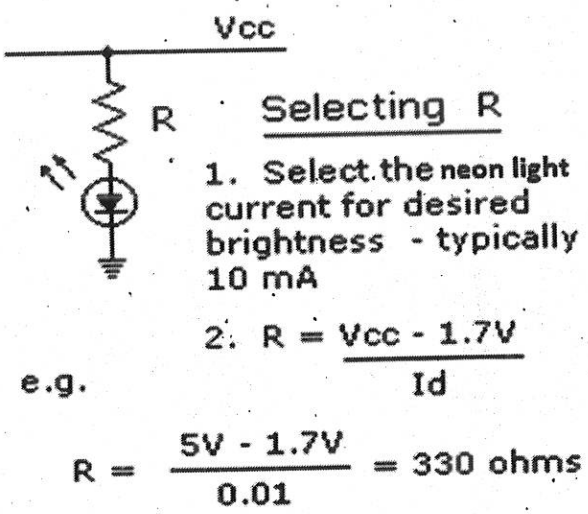
The transformer provides 12.5 volts off load so, unless the regulation is exceptionally good, the "nominal" 12 volts hasn't been specified as the on-load voltage at all.

$$\%\ regulation = \frac{off\ load\ voltage\ -\ on\ load\ voltage}{on\ load\ voltage} \times 100$$

$$\frac{12.5 - 12}{12} \times 100 = 4\%$$

Later tests proved that the output voltage dropped to less than 11.4 volts when presented with a load of just 2 Amps. At best, this is a regulation of around 14% even at just 2 Amps. The disadvantage of using a transformer with too high an output voltage is that the regulator will need to work harder and dissipate even more surplus energy and, as the maximum off load voltage will be higher, the voltage monitoring circuit will need to take the higher voltage into account.

NEON LIGHT: A red neon light indicator and voltage meter is used in this project to indicates when there is voltage supply in the system and when the system shutdown the house appliances. A neon light is a solid-state lamp that emits light just as a light-emitting diode.



The resistance of the neon light is 330 ohms while the voltage is 3v.

3.4 THE POWER SUPPLY

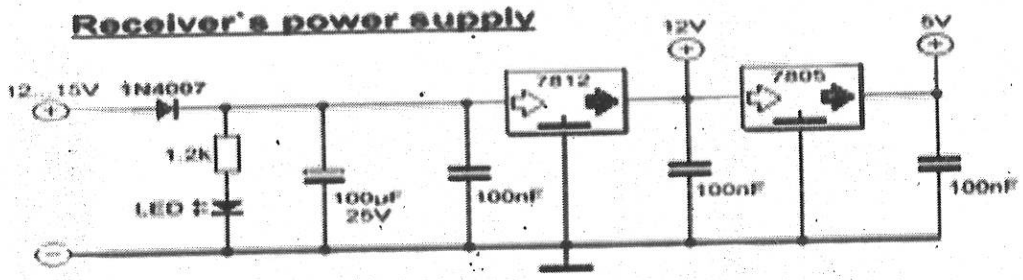


Figure 3.4a: The power supply of receiver

The power supply of this project is constituted by 2 voltage regulator; LM7812 and LM7805. The first 12V is only to power the relay and the second 5V is to power the microcontroller.

Figure 3.4b: The power supply of receiver

3.5 THE MICROCONTROLLER

The microcontroller used in this project is the 16F877A microcontroller. Its pins are shown below. It comes in a 40 pin DIP pinout and it has many internal peripherals. The only disadvantage that you could level at it is that it does not have an internal clock source like most of the other more modern PIC's. However using an external clock usually results in faster operation since you can select a 20MHz crystal instead of the usual internal 8MHz oscillator.

The 16F877A is a capable microcontroller that can do many tasks because it has a large enough programming memory (large in terms of sensor and control projects) 8k words and 368 Bytes of RAM.

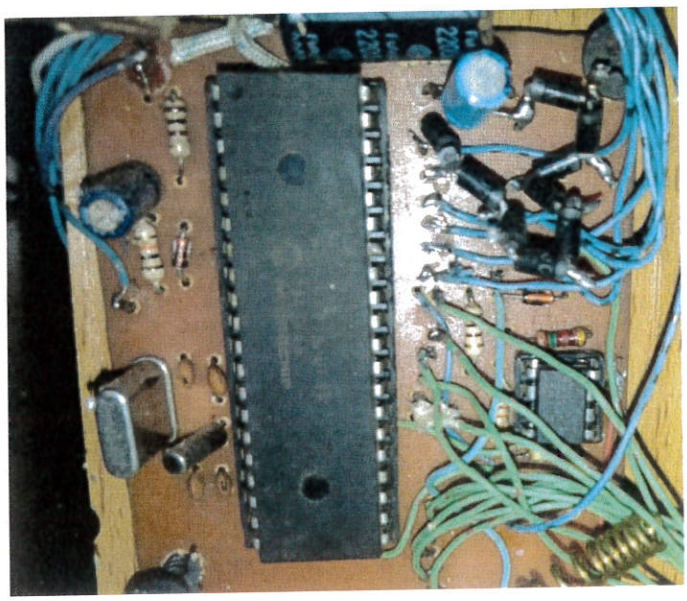


Figure 3.5a: The PIC 16F877A microcontroller

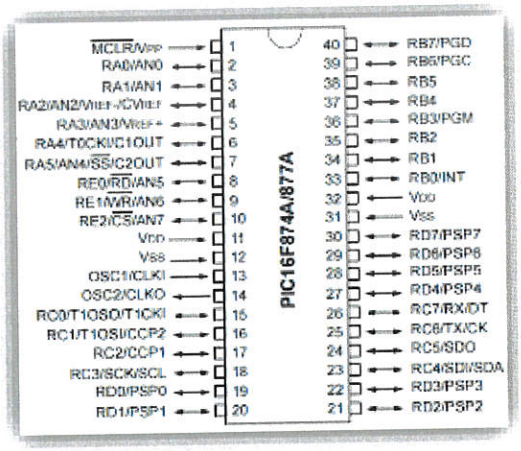


Figure 3.5b: The pin configuration of the PIC 16F877A microcontroller

3.6 SYSTEM FLOW CHART

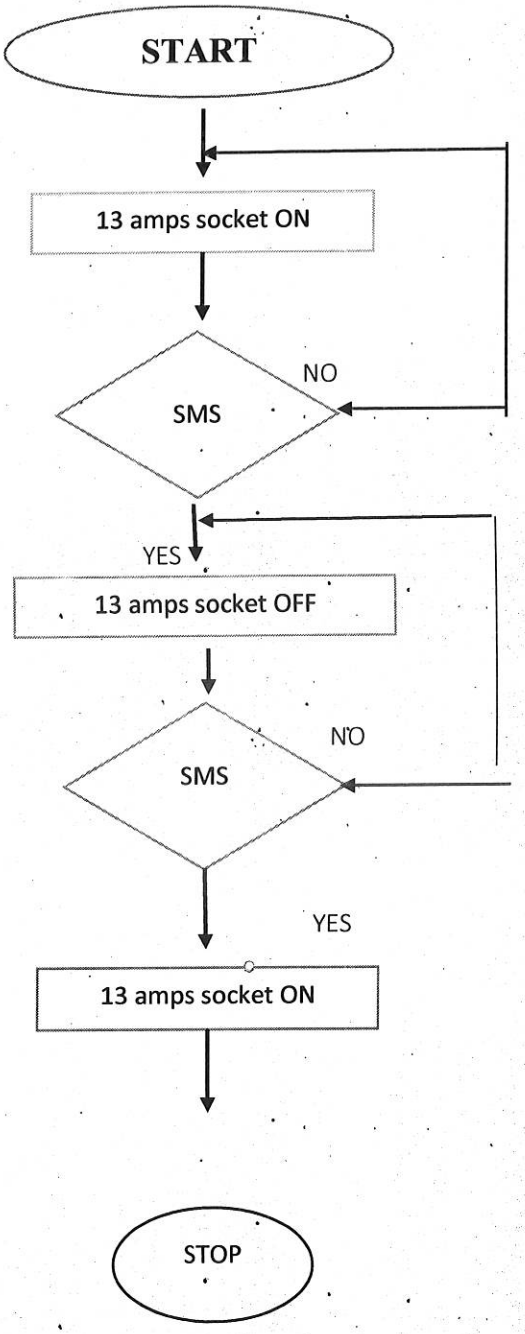


Figure 3.6: The flow chart showing how the operation works

The process to operate this project is first make a mobile to mobile connection wirelessly or with a single mobile on-board wired. But here we are using two mobiles to make a wireless application. Start with making a connection

with the on-board mobile from a remote distance, then when connection is established lets control the project with the data as follows:

To control appliances, make a "SMS", to switch ON, and also, to switch OFF again, make another "SMS". This ON/OFF condition of the device is through the relay, where switching is very fast and accurate.

3.7 HARDWARE COMPONENTS

TRANSFORMER

A transformer is an electrical device that transfers energy between two more circuits through electromagnetic induction. A varying current in the transformer's primary winding creates a varying magnetic flux in the core and a varying magnetic field having a negative effect on the secondary winding.

The step down transformer is an electrical device that steps down voltage and current in a circuit. Step-down transformer is one whose secondary voltage is less than its primary voltage. It is designed to reduce the voltage from the primary winding to the secondary winding, this kind of transformer steps down the voltage applied to it. As a step-down unit, the transformer converts high-voltage, low-current power into low-voltage, high-current power. The larger-gauge wire used in the secondary winding is necessary due to the increase in current. The primary winding, which doesn't have to conduct as much current, may be made of smaller-gauge wire. It receives its input power source from the 220v ac mains supply and steps it down to 12v. The transformer primary is shown connected only to the line cord and plug in which the first block diagram represents. This power supply is double-insulated. There is no electrical connection between the primary and secondary sides of the transformer so most jurisdictions do not require a grounding plug. Figure 3.2 shows the picture of transformer used in the project.

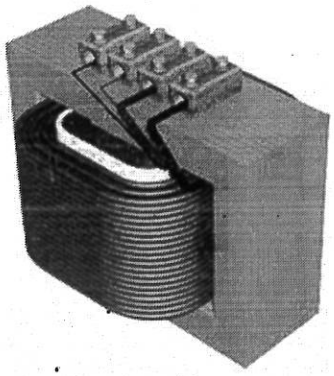


Figure 3.7a: sample of a transformer

The voltage induced across the secondary coil may be calculated from Faraday's Law of induction, which states that:

$$V_S = N_S \frac{\partial \Phi}{dt}$$

Where V_S is the instantaneous voltage, N_S is the number of turns in the secondary coil and F is the magnetic flux through one turn of the coil. If the turns of the coil are oriented perpendicularly to the magnetic field lines, the flux is the product of the magnetic flux density B and the area A, through which it cuts. The area is constant, being equal to the cross-sectional area of the transformer core, whereas the magnetic field varies with time according to the excitation of the primary. Since the same magnetic flux passes through both the primary and secondary coils in an ideal transformer, the instantaneous voltage across the primary winding equals

$$V_p = N_p \frac{\partial \Phi}{dt}$$

Taking the ratio of the two equations for V_S and V_P gives the basic equation for stepping up or stepping down the voltage

$$\frac{V_S}{V_p} - \frac{N_S}{N_p}$$

N_p / N_s is known as the turn ratio, and is the primary functional characteristic of any transformer. In the case of step-up transformers, this may sometimes be stated as the reciprocal, N_p / N_s. Turns ratio is commonly expressed as an irreducible fraction or ratio: for example, a transformer with primary and secondary windings of, respectively, 100 and 150 turns is said to have a turns ratio of 2:3 rather than 0.667 or 100:150.

A step-down transformer with a primary voltage of 220V and a secondary voltage of 12V is the one that I used for this project.

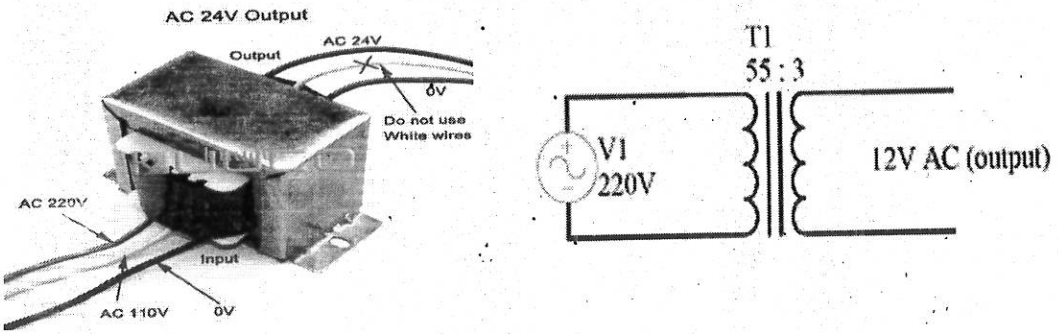


Figure 3.7b: A typical diagram of step down transformer

FULL WAVE BRIDGE RECTIFIER

A bridge rectifier is an arrangement of four or more diodes in a bridge circuit configuration which provides the same output polarity for either input polarity. It is used for converting an alternating current (AC) input into a direct current (DC) output. A bridge rectifier provides full-wave rectification from a two-wire AC input, therefore resulting in lower weight and cost when compared to a rectifier with a 3-wire input from a transformer with a center-tapped secondary winding.

The primary application of bridge rectifiers is to transform an AC supply into DC power. Full Wave Bridge Rectifier is a type of single phase rectifier that uses four individual rectifying diodes connected in a closed loop "bridge" configuration to produce the desired output. The main advantage of this bridge circuit is that it does not require a special center tapped transformer, thereby

reducing its size and cost. The single secondary winding is connected to one side of the diode bridge network and the load to the other side as shown below.

The Diode Bridge Rectifier

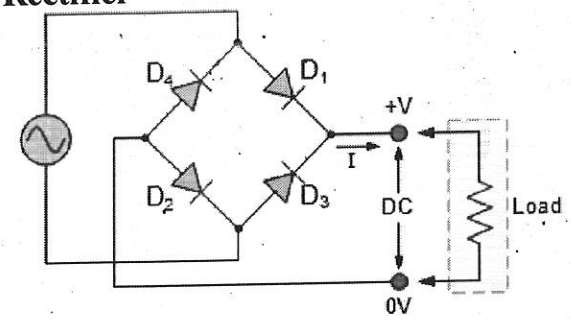


Figure 3.7c: Circuit of a full wave rectifier

The four diodes labelled D_1 to D_4 are arranged in "series pairs" with only two diodes conducting current during each half cycle. During the positive half cycle of the supply, diodes D1 and D2 conduct in series while diodes D3 and D4 are reverse biased and the current flows through the load as shown below.

The Positive Half-cycle

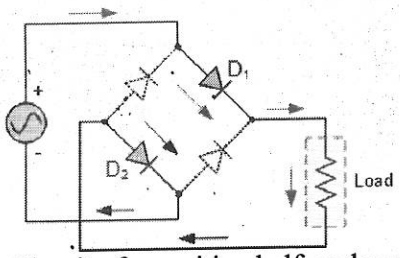


Figure 3.7d: Circuit of a positive half cycle wave rectifier

During the negative half cycle of the supply, diodes D3 and D4 conduct in series, but diodes D1 and D2 switch "OFF" as they are now reverse biased. The current flowing through the load is the same direction as before.

The Negative Half-cycle

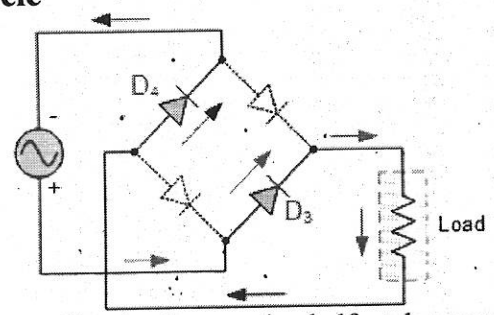


Figure 3.7e: Circuit of a negative half cycle wave rectifier

As the current flowing through the load is unidirectional, so the voltage developed across the load is also unidirectional the same as for the previous two diode full-wave rectifier, therefore the average DC voltage across the load is $0.637V_{max}$.

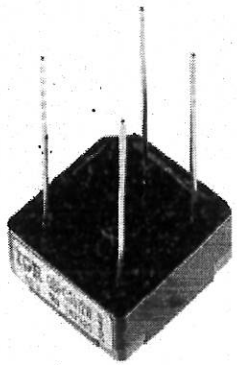


Figure 3.7f: Typical Bridge Rectifier

During each half cycle the current flows through two diodes instead of just one so the amplitude of the output voltage is two voltage drops (2 x 0.7 = 1.4V) less than the input V_{MAX} amplitude. The ripple frequency is now twice the supply frequency (e.g. 100Hz for a 50Hz supply or 120Hz for a 60Hz supply.)

Although we can use four individual power diodes to make a full wave bridge rectifier, pre-made bridge rectifier components are available "off-the-shelf" in a range of different voltage and current sizes that can be soldered directly into a PCB circuit board or be connected by spade connectors.

DIODES: A diode plays an important role in the project. It allows the battery voltage to flow into the circuit only in one direction (called the diode's forward bias direction) and also block any back electromotive force that may damage the driver transistors. The diode is a two-terminal electronic component with a nonlinear current–voltage characteristic. This unidirectional behaviour of diode is called rectification and it is used in the project to convert alternating current from the GSM Module to direct current which is used to bias the switch transistor used in the project.

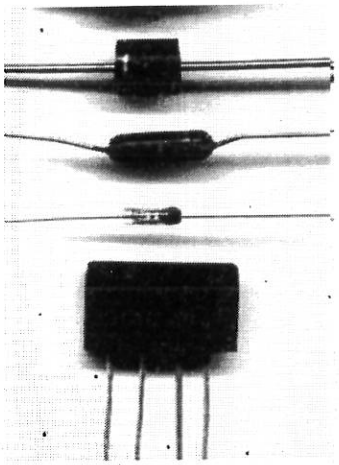


Figure 3.7g: Picture of four types of diodes

CAPACITOR: Capacitors are used in the project to blocking direct current from the GSM Module and allow alternating signal to pass into the system. It is also used for filtration and smoothing of unwanted A.C ripples in the power supply unit. A capacitor is a passive component consists of a pair of conductors separated by a dielectric (insulator). When there is a potential difference (voltage) across the conductors, a static electric field develops across the dielectric, causing positive charge to collect on one plate and negative charge on the other plate.

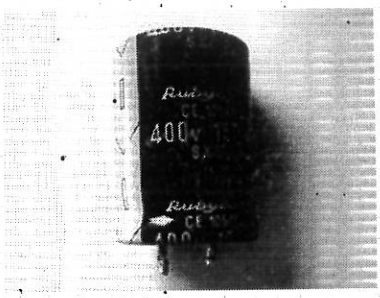


Figure 3.7h: Picture of the electrolytic capacitor

RESISTORS: A resistor is used to bias the switching transistor that energizes the relay. It also used to limit the amount of current flowing into the project. A linear resistor is a linear component that implements electrical resistance as a circuit element. The current through a resistor is in direct proportion to the voltage across the resistor's terminals. Thus, the ratio of the voltage applied across a

resistor's terminals to the intensity of current through the resistor is called resistance. This relation is represented by Ohm's law:

$$I = \frac{V}{R}$$

Figure 3.7i: Sample of a resistor used in the project

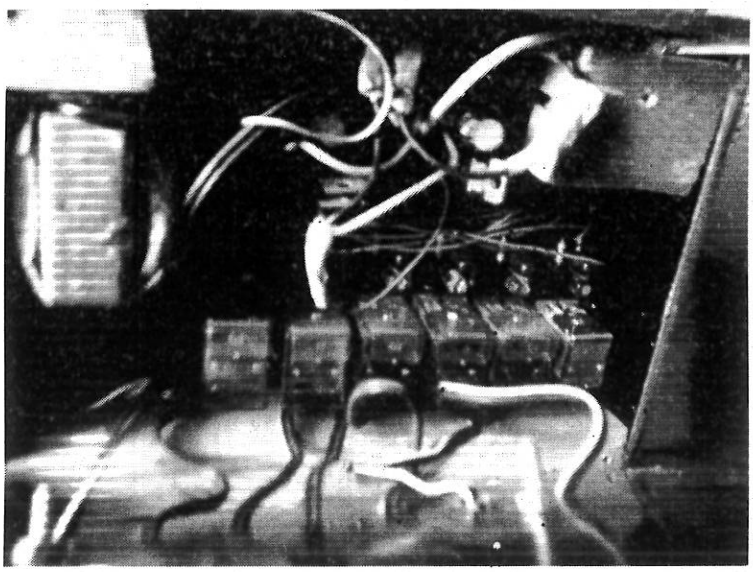
RELAY: Relay is the main control switch that shutdown the house appliances when a call is made. A relay is an electromagnetic operated switch. Current flowing through the coil of the relay creates a magnetic field, which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw switches. To prevent damage to the relay a diode must be connected across the relay coil. The relay's switch connections are usually labelled **COM, NC and NO:**

PIN CONFIGURATION	MEANING
COM	Common, always connect to this: it is the moving part of the switch.
NC	Normally closed, COM is connected to this when the relay coil is off.
NO	Normally open, COM is connected to this when the relay coil is on

The pin configuration of a relay

RELAYS AND TRANSISTORS COMPARED

Like relays, transistors can be used as an electrically operated switch. For switching small DC currents (< 1A) at low voltage they are usually a better choice than a relay. However, transistors cannot switch AC (such as mains electricity) and in simple circuits they are not usually a good choice for switching large currents (> 5A). In these cases a relay will be needed, but note that a low power transistor may still be needed to switch the current for the relay's coil!



The main advantages and disadvantages of relays are listed below:

ADVANTGES OF RELAYS:

- Relays can switch AC and DC, transistors can only switch DC.
- Relays can switch higher voltages than standard transistors.
- Relays are often a better choice for switching large currents (>5A).
- Relays can switch many contacts at once.

DISADVANTAGES OF RELAYS:

- Relays are bulkier than transistors for switching small currents.
- Relays cannot switch rapidly (except reed relays), transistors can switch many times per second.

- Relays use more power due to the current flowing through their coil.
- Relays require more current than many ICs can provide, so a low power transistor may be needed to switch the current for the relay's coil.

ULN2803A DARLINGTON TRANSISTOR RELAY

The ULN2803A device is a DIP IC having high-voltage, high-current Darlington transistor array. The device consists of (Single Output) eight NPN Darlington pairs that feature high-voltage output with common cathode clamp diodes for switching inductive loads.

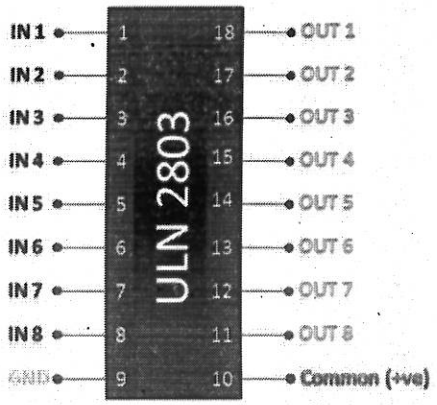


Figure 3.7j: diagram of a Darlington transistor

Features of ULN2803 Darlington Transistor Arrays includes:

- It is rated at 500-mA Collector Current.
- It also has High-Voltage Outputs of about 50 V.
- It has Output Clamp Diodes.
- The Inputs are Compatible With variable types of logic.
- It has a Relay-Driver Applications.

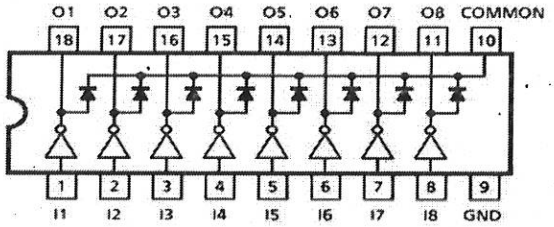


Figure 3.7k: Top view of the pin connections of a Darlington transistor

Figure 3.7l: Typical diagram of ULN2803 Darlington Transistor Arrays

CHAPTER FOUR

CONSTRUCTION, TESTING, ANALYSIS OF RESULTS AND DISCUSSION

4.1 CONSTRUCTION

The term stage is associated to a group of components, which is aimed at achieving a specific purpose. This has been broken down in the previous chapter. Each of the stage will now be treated more elaborately.

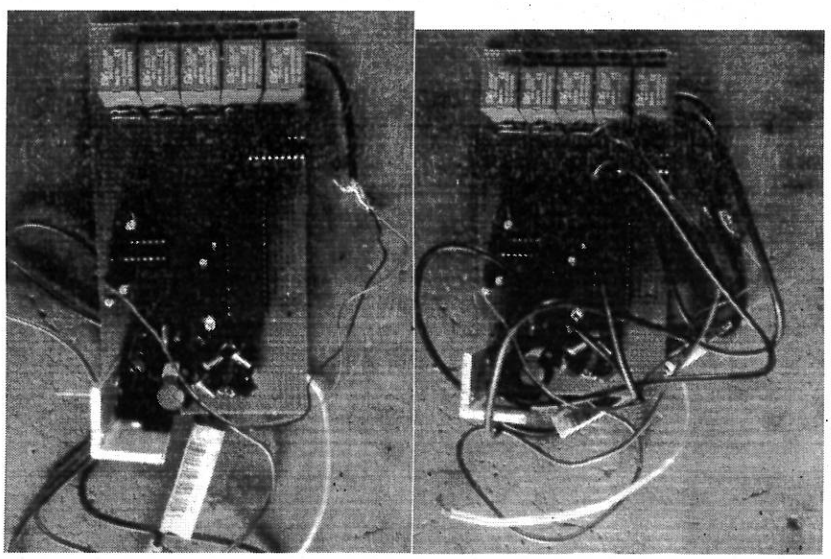
4.2 CONSTRUCTIONAL METHOD

The construction of this project was done on a vero board. Vero board is called strip board. It is a widely-used type of electronics prototyping board characterized by a 0.1 inch (2.54 mm) regular (rectangular) grid of holes, with wide parallel strips of copper cladding running in one direction all the way across one side of the board. In using the board, breaks are made in the tracks, usually around holes, to divide the strips into multiple electrical nodes. With care, it is possible to break between holes to allow for components that have two pin rows only one position apart such as twin row headers for ICs.

The physical realization of the project is very vital. The designer will see his or her work not just on paper but also as a finished hardware. After carrying out all the paper design and analysis, the circuit was first constructed temporarily on a breadboard and after loading the program source code on the microcontroller to confirm that its operation was according to the design specification and necessary adjustments were made whenever they are required. The project was implemented and tested to ensure it's working ability, and was finally constructed to meet desired specifications

The construction commenced with the soldering of the components to the board and testing. For the soldering the following steps were taken;

- All jumper wires were soldered first
- Followed by IC sockets
- The tip of the soldering Iron was tinned to avoid dry solder joints
- Each stage on the Vero-board was tested as soldering progressed



CASING

The Circuit was housed in a rectangular box, which served as protection as well as for mechanical support. The case has a dimension of 22.5cm by 5.5cm with a switches connected to the side of the case. The indicator LEDS was also placed on top of the case with an array of connectors outside the case and the switch on the case.

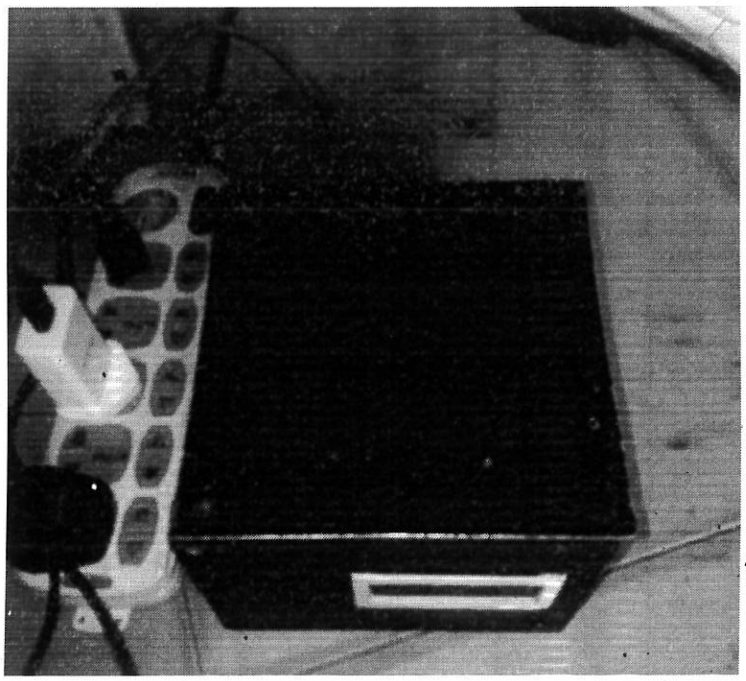


Figure 4.2 Diagram showing the project work casing

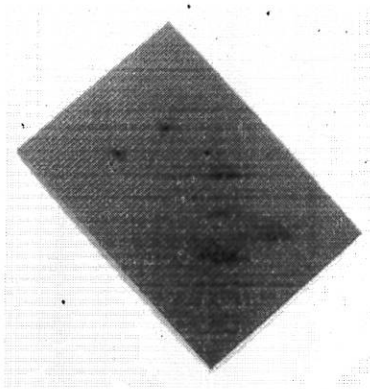
4.3 POWER SUPPLY UNIT (PSU)

The transformer is connected to mains of 220v/50Hz through a power cord of R ohm resistance. The transformer's (12v/500mA) secondary output is connected to the bridge rectifier source inputs. An output is taken from the negative and positive terminals of the rectifier and connected to the corresponding pins in the 1000uF/35v capacitor. This bridge rectifier the supply while the capacitor filters the A.C voltage lefts and equally smoothens the signal into a pure D.C voltage of 12vDC. The positive terminal of the capacitor is connected to pin 1 of the 7805 voltage regulator, while the negative terminal connects to pin 2 of the regulator. This regulator produces an output of +5v between pin 3 and pin 2 (Ground).

Figure 4.2 Diagram showing the power supply unit

Vero board: The construction of this project was done on a vero board and the procedure methods used are: -

- The vero board was inspected of wrong linkages of its line which may be mistake from the producers. The holes of the board were made sure to be through for passing the terminals of the components for soldering.
- An abrasive paper was used on the soldering section of the board for easy binding of the terminals on the board.



The picture of the Vero board used in the project

Components are usually placed on the plain side of the board, with their leads protruding through the holes. The leads are then soldered to the copper tracks on the other side of the board to make the desired connections, and any excess wire is cut off. The continuous tracks may be easily and neatly cut as desired to form breaks between conductors using a 5mm twist drill, a hand cutter made for the purpose, or a knife. Tracks may be linked up on either side of the board using wire. With practice, very neat and reliable assemblies can be created, though such a method is labour-intensive and therefore unsuitable for production.

4.4 MOUNTING OF THE COMPONENTS

The mounting of the components were placed according to block diagram below.

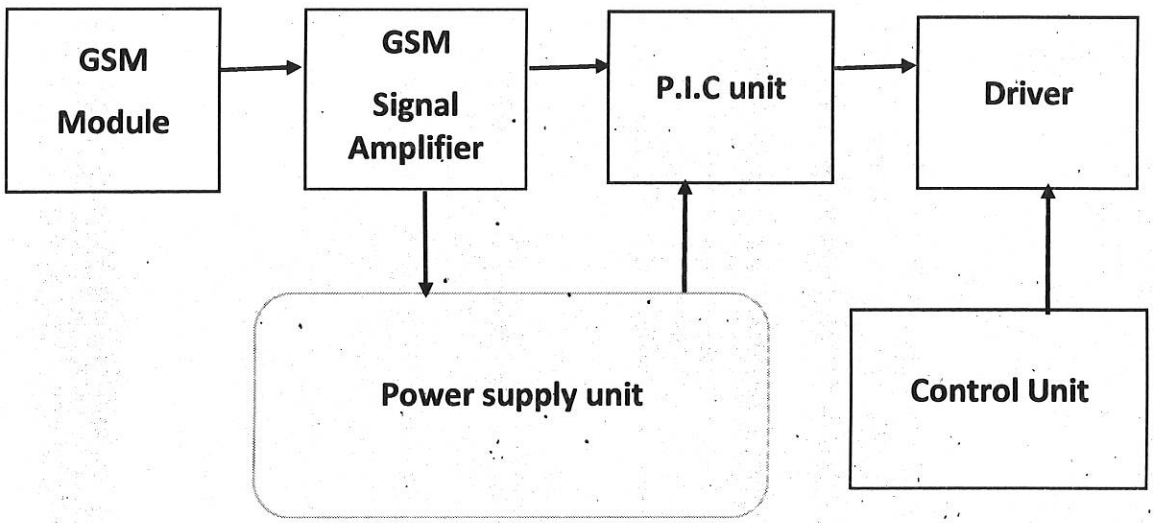


Figure 4.4: Block diagram of the project

The soldering process was carried out using a lead and soldering iron. This was done by joining the supposed terminals together before soldering. And after soldering each unit, test was carried out using a meter to ensure good contact. A patrax box was used for the enclosure of the project. Patrax is an electrical installation box used for housing electrical/electronic components. It is made of plastic material, 50×20mm rectangular shape with 10mm thickness.
This box houses the control unit.

4.5 INTERCONNECTION OF COMPONENTS

The interconnections of the circuit were done using a PVC connecting wire. This enabled the necessary connections at different sections of the circuit to be made by extending the terminals or connection made with a wire to a deserved point in the circuit. Connecting wires is a flexible wire made from copper and will be used to connect component or subsystems.

4.6 SOFTWARE AND HARDWARE DESIGN

The steps taken to write and design of the component used is discussed, the software that will control the hardware aspects of the embedded application in assembly language using the PIC instruction. The hardware design involves the integration of selected and designed sub-units together with analysis and calculations made at various stages of the design all these are presented in this chapter.

4.6.1 THEORY OF OPERATION

The figure above shows the complete diagram of the home automation. All intelligence is vested on the PIC16A and other IC used, the connection is done by the use of connected instead of using wire that will make the circuit very complex and difficult to interpret. A fair amount of executable code run from the on-chip memory is able to take total control of the circuit, requiring just a 12-V

supply voltage. The GSM module SIM 900a where the SIM card is mounted is duly interfaced to the microcontroller through the level shifter IC Max232. The SIM card mounted GSM modem upon receiving digit command by SMS from any cell phone that data to the microcontroller through serial communication. While the program is executed, the GSM modem receives command either 'ON' or 'OFF' to develop an output at the microcontroller, the contact point of which are used to disable the ignition switch. The command so sent by the user is based on an initiation received by him/her through the GSM modem 'ALERT' a programmed message only if the input is driven low. The complete operation is displayed over 16*2 LCD display. In this technology, as the names says is based on GSM network technology for transmission of SMS from sender to receiver. SMS sending and receiving is used for ubiquitous access of is D-8870-02 which as input pin connected to the phone inside the circuit. Four output pins were used in the module which is connected to the Microcontroller. Four (4) output pins was used from the module and they are Q_1, Q_2, Q_3, Q_4 ,one of the pins in the module is refer to as the STD pin),the initial state of the STD pin changes ,and when such happens, the initial state of the four output pins used also changes. The Microcontroller used is PIC 16A. The pins has been group we have group A, B, C and D, 12V power supply coming from the transformer will move from the module to the MICROCONTROLLER

Then to the ULN 2803 (bank of transistor) and it will move to the Relay to energize it, it has a voltage suppress diode in it that will reduce the coming 12V to 5V to changes the initial state of the relay.

COMMANDS FOR SMS OPERATION

Device ON

- **(PASSWORD) SYSTEM1 ON 1#**

Device OFF

- **(PASSWORD) SYSTEM1 OFF 1#**

Device ON

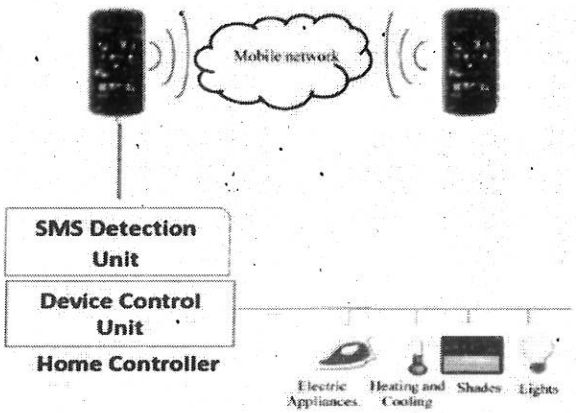
- **(PASSWORD) SYSTEM2 ON 2#**

Device OFF

- **(PASSWORD) SYSTEM2 OFF 2#**

CHECK THE STATUS

- **(PASSWORD) STATUS#**



This project conatins 6 slots for controlling 6 six different appliances and if one of the six slots is used to control the microwave oven in the users kitchen, the user then sends a SMS command as shown above ON 1 to switch the device on and OFF 1 to switch the device off. Future upgrades to be constructed and design is to create a more advance and self explanatory way to control such home appliances by showing the various sections in the home and then for example selecting the kitchen and the various devices in the kitchen connected to control unit will be listed out and the user then select the particular applainces he/she wants to switch ON or OFF.

4.6.2 MICROCONTROLLER SELECTION

This is the first aspect of the hardware design. This depends on the application and amount of memory required that determines the type of microcontroller used. In this case, PIC 16A is preferred for this particular application because of its low power consumption, flexibility, reprogrammable flash memory and high speed technology makes it suitable as a control module for the intended application.

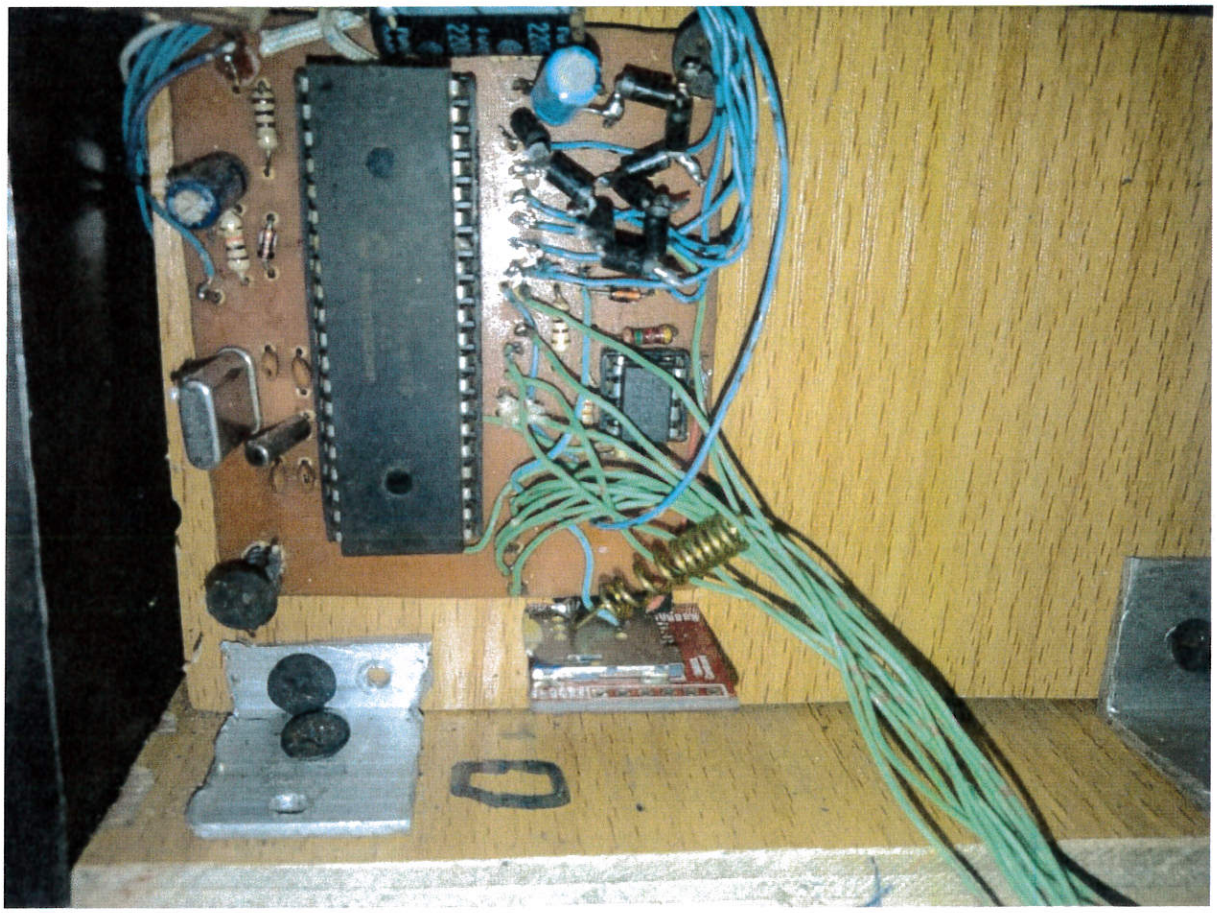


Figure 4.6.2 Diagram showing the microcontroller

1	D-8807 1C	1	2,000	2,000
2	PIC 16A	1	2,500	2,500
3	LED	7	30	210
4	CAPACITOR	2	80	160
5	RECTIFIER	1	200	200
6	BREADBOARD	1	750	750
7	CASING		1000	1000
8	JUMPER WIRES	10	50	500
9	CONNECTORS	7	50	350
10	PLUG WIRE	1	200	200
11	VOLTAGE REGULATOR	1	250	250
12	VERO BOARD	1	250	250
13	SWITCHE	1	200	200
14	ULN 2803AN TRANSISTOR	1	180	180
15	RESISTOR	9	50	450
16	TRANSPORT			3000
	TOTAL			12,200

4.6.3 TESTING

The complete circuit was build and tested for a period of time and it worked according to specifications. When the circuit was switched on, another was used to call the phone inside the project, the ON (2,4,6,8,0) and OFF (1,3,5,7,9) button was press and it function according to specification, and the circuit was repeatedly tested and found efficient and reliable.

Finished Project and Testing

COST OF COMPONENTS

The following Component were used in the construction of this project work. The table 4.1 below shows the list of component with their respective prices:

Table 4.1 Components Cost

S/N	COMPONENT	QUANTITY	UNIT PRICE (N)	TOTAL AMOUNT

CHAPTER FIVE

RECOMMENDATION, CONCLUSION AND CONSTRAINTS

5.1 CONCLUSION

The GSM based home automation using GSM communication was designed and constructed to CONTROL 230 - 240 V +5% ac load. It is rated 2500VA 50Hz. This project has really exposed me to the use of electronic component. To a large extent I have come to appreciate the theories learned over the years.

5.2 RECOMMENDATION

It is a fact that this is not exhaustive. It can still be improved to get a more sensitive and precise output voltage control. For this reason I recommend the following.

1. Two layers circuit board can be designed and used in place of single layer circuit board for easier soldiering work and neatness.

2. Further research in the field of electronics switching will go a long way in getting better house control system.

3. Engineering students need early exposure to the use of electronic components for practical work; this will enable them to be more innovative.

5.3 FUTURE WORKS

The project "GSM BASED HOME CONTROL" is intended to automate the certain functions of home appliances. Smart home technologies have been around for about 30years, mostly relying on some proprietary technologies and applications. With the recent expansion of communication networks, smart home applications can be further enhanced with new dimension of capabilities that were not available before. In particular, wireless access technologies will soon enable exotic and economically feasible applications.

The device is much helpful in controlling home. It reduces the wastage of valuable time and our daily life become easier and flexible.

Other Future works includes:

i. It can be used for high security in banks and other organizations.
ii. Using real time clock, the appliances which need response in real time can also be controlled through the wireless link.
iii. Connecting more devices.
iv. Provision to store several mobile numbers.
v. Video recording.

5.4 MAJOR CONSTRAINTS

Along the course of project completion we encountered various problems and obstacles. Not everything that we had planned went smoothly during the project development span. Also we had a limited amount of time due to some materials which are scarce in the market for its completion so we were under a certain amount of pressure as well. We had to start from the research phase at the beginning and needed to gain knowledge on all the devices and components that