DESIGN AND CONSTRUCTION OF AN SMS-BASED REMOTE CONTROLLER OF DOMESTIC APPLIANCES.

BY

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DEDICATION

I dedicate this project to Jesus Christ who has been my Lord and best friend through all these years, to the restoration of peace in Plateau State and to my Family for their love care and support, especially my Mum.

DECLARATION

I, ADEKUNLE AMOS ADEDAYO, with matric no 2005/21991EE, declare that this work was done by me and has never been presented elsewhere for the award of a degree. I also hereby relinquish the copyright to the Federal University of Technology, Minna.

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ABSTRACT

This project is aimed at developing and testing the use of mobile phones to remotely control domestic appliances (television and computer). It is intended for use by home owners while away from home. This project is designed to allow easy use of a mobile phone to control and minimize access to television and personal computer while away. Using a mobile phone the development of the control system will be carried out using SMS. This will communicate with another mobile phone, which will in turn control the devices attached to microcontroller modules. When the action has been carried out then a response is sent to the user.

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CHAPTER ONE

1.0 INTRODUCTION

Wireless operations permit services, such as long-range communications, that are impossible or impractical to implement with the use of cables [16]. Mobile Phones technologies are becoming common day-by-day and accessible. The number of people with cell phones is on the rise. Improvements in the Networking technologies have fostered growth of very dense networks. Land line telephones have been becoming less popular and people now prefer communicating while on the move, especially in developing countries [2].

A Remote Control is perhaps the most popular gadget today. Right from the intense creativity of remotely controlling laser chip markers to the highly destructive remotely ignitable bombs, from the pins to the planes, remote control is not only occupying an omnipresence state, but is also enhancing its scope and domains[1].

When people have a good connectivity at their disposal, with tremendous power of mobile computing to supplement the same, we can think of connecting their home appliances to a mobile phone wirelessly. With this, people would be able to turn on and off, and to some extent, control the appliances at their home even from a distant place. One of the very basic examples of a utility of this is switching on the air conditioner in the room just some time before reaching home, so that the room is sufficiently cool by then. The usefulness of a long range remote control to home appliances has no limits. A setup facilitating such a thing would be to connect the home appliances to a microcontroller interfaced to a GSM modem that receives the controls from the user, the means of sending signals to the appliances being a mobile phone[3].

This paper presents one of the emerging applications of the GSM technology. We present the design of a stand-alone embedded system that can monitor and control home appliances locally using built-in input and output peripherals. Remotely, the system allows the homeowner to monitor and control his house appliances via his mobile phone set by sending commands in the form of SMS messages and receiving the appliances status as well. The system has two parts, namely; hardware and software. The hardware architecture consists of a stand-alone embedded system that is based on 8-bit microcontroller, an interface and a Driver circuit to connect the devices to the microcontroller, an LCD display, and a GSM modem. The GSM modem provides the communication media between the homeowner and the system by means of SMS messages. The system software driver is developed using an interactive C programming language platform.

1.2 METHODOLOGY

In this project, the television and computer are controlled with the help of a cell phone. The system uses SMS facility to give the commands and receive the status from the receiver. The mobile user sends a secret code with control data. In the receiver section, GSM modem receives the commands and sends the signal to the microcontroller; the microcontrollers verify the secret code and perform the command functions. The controller also triggers the relay circuit through the relay drivers. The relay drivers in turn control the load. The status is sent back to the mobile user as well as sends to pc. The personal computer send to another pc's through LAN or wireless network using TEL NET PROTOCOL.

1.3 SCOPE OF THE WORK

Using a mobile phone the development of the control system will be carried out using SMS. This will communicate with another mobile phone, which in turn controls the devices attached to

microcontroller modules. When the action has been carried out then a response is sent to the user.

1.4 OBJECTIVES

1. The system is wireless therefore more adaptable and cost-effective.

2. This system will remotely connect the user anywhere to automate and control television and computer using SMS, to minimize access.

CHAPTER TWO

LITERATURE REVIEW

The greatest invention ever made to make life easy for man, is communication over a long distance, that probable cannot be wired (wireless communication). Over time the mode of communication has included telegraphy, radio and television broadcast, point to point mobile communication, radio telemetry and radio navigation which has now improved to wireless mobile communication which is not dependent on distance. The customer handset (wireless communication) has been found that can be used beyond just to communicate with fellow men, but can also be used for industrial and domestic purpose as a remote controller. This proves the fact that telecommunication is very crucial to human existence. The following situations justify the use of wireless technology [8]:

1 To span a distance beyond the capabilities of typical cabling,

2 To provide a backup communications link in case of normal network failure,

3 To link portable or temporary workstations,

4 To overcome situations where normal cabling is difficult or financially impractical, or

5 To remotely connect mobile users or networks.

A remote controller is a component of an electronic device, most commonly a television or computer, used for operating the device wirelessly from a short line of sight distance. Remote controller will be highly efficient when not dependent on distance. Being able to control and

monitor your appliances (television and computer) from anywhere will rather make its operation much easier and effective [7].

2.10 GSM NETWORK

About four billion people worldwide used the Global System for Mobile Communications (GSM) family of technologies as of December 2009. GSM is the most widely used wireless technology in the world, available in more than 219 countries and territories worldwide, with a market share of more than 89 percent. GSM has quickly become the fastest-growing wireless technology worldwide. GSM is the legacy network of the evolution to the third generation (3G) technologies Universal Mobile Telecommunication System (UMTS), also known as WCDMA, and High Speed Packet Access (HSPA). Commonly referred to as the GSM family of technologies. The oldest member of the GSM family of technologies is GSM itself; a digital or Personal Communications System (PCS), 2G technology that provides voice and circuit-switched data services. There are several reasons why GSM is so popular among operators and their customers[13]:

1 Clear voice quality, which helps make GSM a viable alternative to wire line telephony for consumers and businesses.
2 International roaming with service available in more than 219 countries.
3 Spectral flexibility, with network infrastructure and user devices available for the 450, 850, 900, 1800 and 1900 MHz bands.
4 Tight security, including inherent protection from eavesdropping and hacking. This helps make GSM voice and data an attractive alternative to analog cellular and Wi-Fi in the eyes of users, particularly enterprises.

5 Subscriber Identity Module (SIM) cards, which allow customers to buy a new or additional phone, or a GSM PC Card modem.

6 Data support, including SMS and web browsing.

2.11 SHORT MESSAGE SERVICE

It is a known fact that SMS is indeed relevant in the advancement of GSM technology, which goes beyond voice communication. SMS has become a phenomenal success that has been a surprise to many both inside and outside the communications industry [14].

The origin of the text messaging services in GSM lies in the historical development of telecommunication services, and SMS was created by a small group of persons. The work on the standardization of services and the technical realization was approved by the CEPT Group Special Mobile. Text messaging was a known telecommunications service years before the development of GSM started in 1982. Proposals for text messaging as a service in GSM were made by Nordic, German and French operators, who were all co-operating in the task. The Nordic operators focused their work on text messaging by using an access to a message handling system, a service similar to e-mail. This service was standardized by the GSM committee and led to a technical report on the technical realization of the access to Message Handling Systems. The German and French operators focused their work on 'Short Message Transmission'. This service uses a dedicated service centre and transmits the text messages over existing signaling paths of the GSM telephony system on a lower priority basis. This transmission method obviously constrains the message to be short: the maximum length, initially estimated as 128

octets, later optimized to 160 characters, is still sufficiently long for most personal or professional purposes [14].

The first phase of work, from February 1985 to the end of 1986, saw the GSM committee specifying the service features of SMS, with most contributions coming from Germany and France. From 1987 onwards the technical realization of SMS was standardized in a small group called Drafting Group Message Handling. The first Chairman of this group and the editor of the key technical specification were provided by Norway (later replaced by the UK), and technical work was mostly provided by Finland, France, Norway, and the UK. The first phase of the SMS specifications comprised items that included service definition, network architecture, topology and protocols, acknowledgement capabilities, functionality for alerting on messages waiting, time stamping and capabilities of identifying application protocols.

The further evolution of the SMS was standardized in the same small group, led by the UK (where the technical work was mostly provided by the UK). Examples of enhancements from this period are automatic replacement of messages, so-called 'flash SMS' and voicemail icons, followed by color and picture capabilities, and long SMS.

2.12 DATA COMMUNICATION

The engineers were looking beyond the second generation i.e. GSM towards a 'third generation', which would employ a different radio access technology to give higher data rates (Earlier analogue technologies were considered to be 'first generation'). GSM had originally been developed purely for voice telephony, but a data capability had been added to cater for a sudden increase in dial-up modem used on fixed lines. A maximum data rate of 9600 bits per second was

offered, which matched or indeed exceeded that available over fixed line modems at the time. However, by the mid-1990s, dial-up data rates had surpassed this, and the performance of GSM circuit-switched data connections was now perceived as inadequate. Since a third generation digital cellular system was now envisaged, SMG decided not to call the next phase of the GSM specifications Phase 3: this might have been confused with 3rd Generation. Instead, it was decided to use the term 'Phase 2+', and the specification set was completed in 1996 [14].

2.13 SUBSCRIBER IDENTITY MODULE (SIM)

The phone is not active without the SIM card inserted in it. SIMs are used to activate or for network reception from the GSM operator. The SIM is a detachable smart card containing the user's subscription information and phone book. Every operator has its unique SIM, which differs from other operators, the user can change operator by changing the SIM in the handset [2].

2.20 MICROPROCESSOR AND MICROCONTROLLER

At the modern stage of scientific and technological development, microelectronics is rapidly gaining ground and its advances today largely determine progress in many branches of industry. The need for lighter, compact, flexible and more reliable radio electronics equipment capable of performing the functions of growing complexity has led to research into ways and means of achieving the set goals. Since discrete transistors could not meet the above requirement, search for principal new approaches to microminiaturization, low-cost and reliable electronic system has brought the concept of producing circuit in only one tiny die or chip. I C technology allow building space communication and various remote control systems, also airborne and radar

systems, using microwave circuits. It is quite clear that microwave circuit as self-contained devices cannot find such versatile application as say digital I C [3].

The creation of microprocessor is the most significant achievement in micro circuitry, which has given birth to new concept of realization of logic functional devices. A microprocessor sequentially executes instructions specified by the program for realizing a definite algorithm. A microprocessor can perform the following;

Receive coded instruction,

Collect, process, store and issue coded information,

Receive and issue signals controlling the operation of microprocessors and other circuits or specifying their state.

The structure of a microprocessor must be flexible, ensure high speed and economically efficient realization of specified tasks.

Microprocessor is a complex electronic chip which is the essential part of a microcomputer making the central processing unit of a system. It serves as the communicator between the microcontroller and the microcomputer, which performs general integration. The CPU is the brain of a microprocessor where all the arithmetic and logical operations are performed.

Microcontroller is a single chip microcomputer system which contains information and program memory, input and output, analog to digital converter, internal and external interrupt used for control purposes. They were developed from semi-conductor devices in mid – 1970s, these were basically calculator based processors with inbuilt memories and having limited RAM memories. As the technology developed, 8 bit microcontrollers were manufactured [15].

2.21 THE AT89C MICROCONTROLLER

The AT89C52 is a low-voltage, high-performance CMOS 8-bit microcomputer with 2 Kbytes Of Flash programmable and erasable read only memory (PEROM). The device is manufactured Using Atmel's high-density nonvolatile memory technology. By combining a versatile 8-bit CPU With Flash on a monolithic chip, the Atmel AT89C52 is a powerful microcomputer which provides a highly flexible and cost effective solution to many embedded control applications. It included an instruction set (opcodes), 32 input and output lines, 3 user controllable timers, an integrated and automatic serial port, and 256 byte of on chip RAM [3].

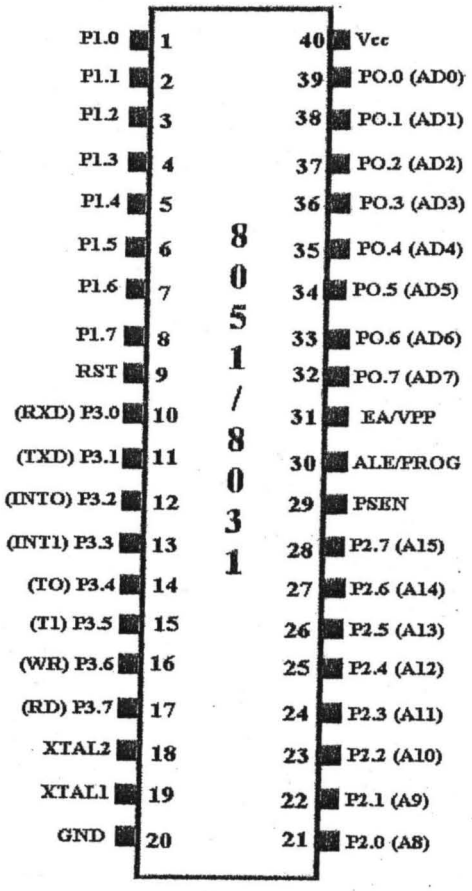


Fig 2.1

2.22 Programming a Microcontroller.

The process of programming a microcontroller in which software is transferred from a computer to the hardware is dependent on whether one is using an EPROM (Electrically Programmable Read Only Memory) or transferring the program directly to the microcontroller. EPROM programmer is used to program EPROM, which is a device that connects to the computer via the USB port or the serial port. The blank chip is placed into a socket on the device, and then software programs are sent from the computer to the EPROM programmer. The process at times might be called burning of chip. Programming a microcontroller that stores programs within the microcontroller requires a serial port to be available for constant downloading of updates to the program. The programs for a microcontroller are normally stored on a memory integrated circuit. Thus the program is made available to the microcontroller without the need of an external drive or other circuit necessary to access such devices. Thus, rather than having a circuit that includes both microcontroller and an external EPROM chip, it's best having a single microcontroller chip which stores the program code internally [15].

2.30 RELAYS

A relay is an electrically 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 most have double throw switches.

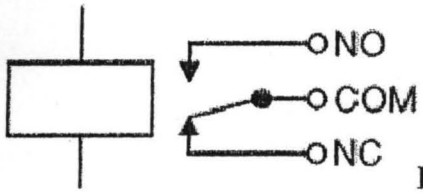


Fig 2.2

Relays are the predecessors to transistors. Solenoids are relays also but the very large types carry huge amounts of current. Relays are the smaller types. Relays come in three types: electro mechanical, solid-state, and so-called hybrids [5].

Joseph Henry (1797-1878), a brilliant US scientist invented and used the electro-magnetic relay in his university laboratory. The low-power electro magnet could control a make-and-break switch in a high-power circuit. Samuel Morse later used Henry's relay device, after re-designing it using thinner wire, to carry Morse-code signals over long kilometers of wire.

2.40 PARTS OF THE SYSTEM

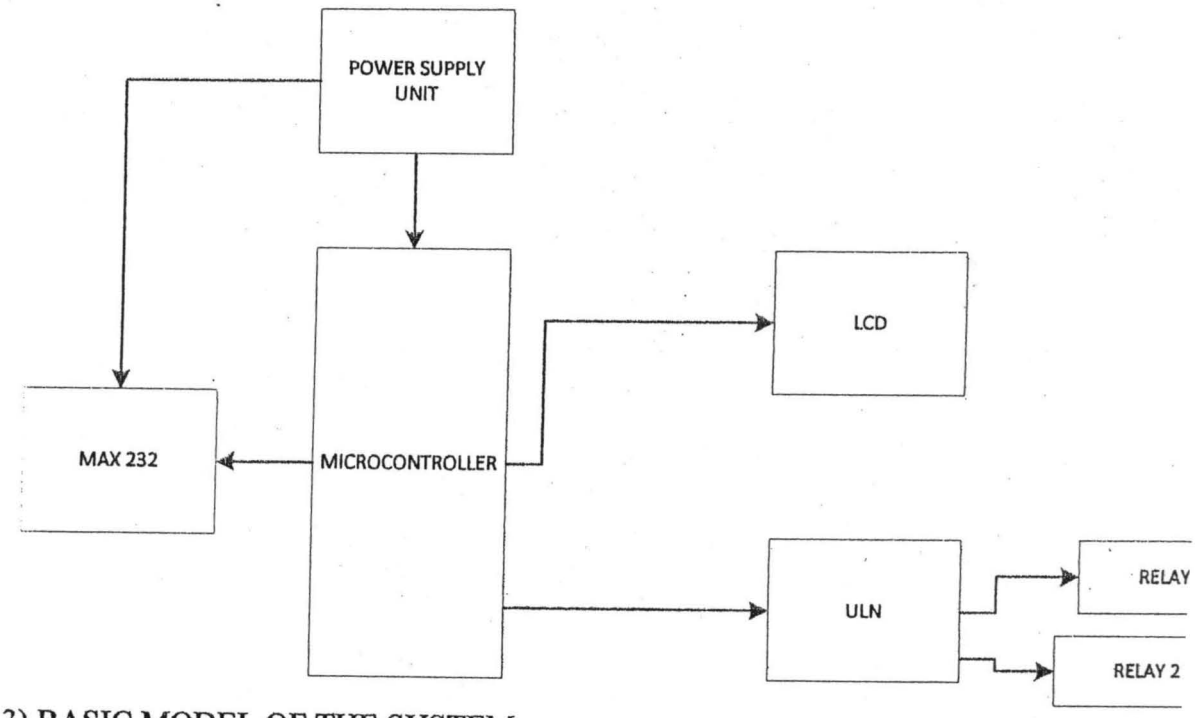


Fig (2.3) BASIC MODEL OF THE SYSTEM

MICROCONTROLLER: The microcontroller forms the heart of the system. Its responsibilities include reading the message from the GSM modem and displaying it. Reading of message from the SIM card inserted into the modem is done by sending the appropriate AT command to the modem. Here we make use the 8051 based AT89C52 manufactured by Atmel [3].

GSM MODEM: A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate. A time a phone can function as a GSM modem [10].

A GSM modem can be an external unit or a PCMCIA card (also called PC Card). An external GSM modem is connected to a PC through a serial cable, a USB cable, Bluetooth or Infrared. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate [9].

PC's use AT commands to control a modem.GSM modems and normal Hayes modems support a common set of AT commands. You can use a GSM modem just like a Motorola phone compatible modem.GSM modems support an extended set of AT commands. These extended AT commands are defined in the GSM standards. With these we can:

- Send SMS messages.
- Monitor the signal strength.

- Monitor the power supply.
- Read, write and control appliance.

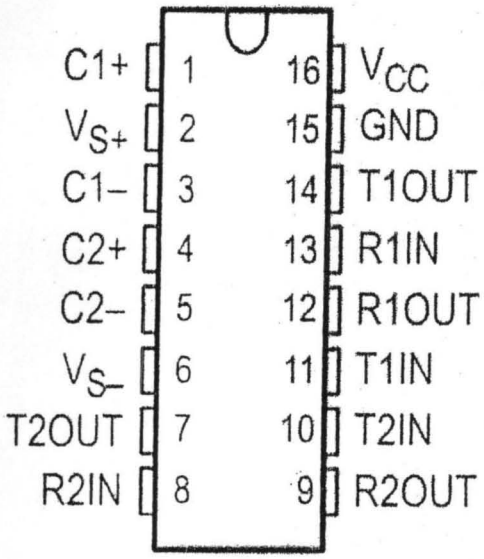
The number of SMS messages that can be processed by a GSM modem is pretty low, approximately six messages per minute.

MAX232 DRIVER

The **MAX232** is an integrated circuit that converts signals from an RS-232serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals. The drivers provide RS-232 voltage level outputs from a single + 5 V supply via on-chip charge pumps and external capacitors. This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to + 5 V range, as power supply design does not need to be made more complicated just for driving the RS-232 in this case [3].

Pin diagram

Function Tables



EACH DRIVER

INPUT TIN	OUTPUT TOUT
L	H
H	L

H = high level, L = low level

EACH RECEIVER

INPUT RIN	OUTPUT ROUT
L	H
H	L

H = high level, L = low level

Fig 2.4

RS232 Line Type and Logic Level	RS232 Voltage	TTL Voltage to/from MAX232
Data Transmission (Rx/Tx) Logic 0	+3V to +15V	0V
Data Transmission (Rx/Tx) Logic 1	-3V to -15V	5V
Control Signals (RTS/CTS/DTR/DSR) Logic 0	-3V to -15V	5V
Control Signals (RTS/CTS/DTR/DSR) Logic 1	+3V to +15V	0V

POWER SUPPLY

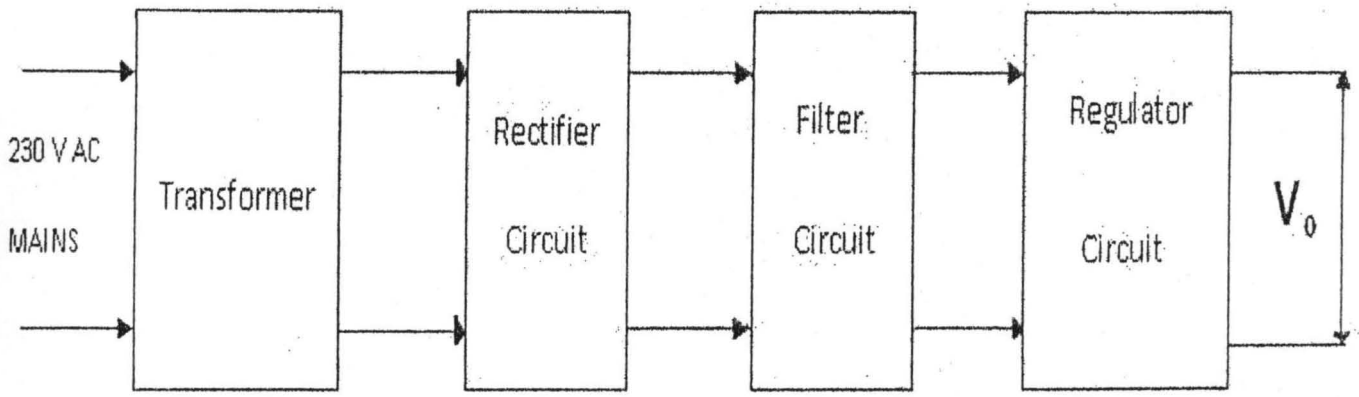


Fig 2.5: Block diagram of power supply

The power circuit has dual output with +5v and +12v to supply power to the various parts of the system, that will be fully discussed in chapter 3 (three).

CHAPTER THREE

SOFTWARE AND HARDWARE DESIGN

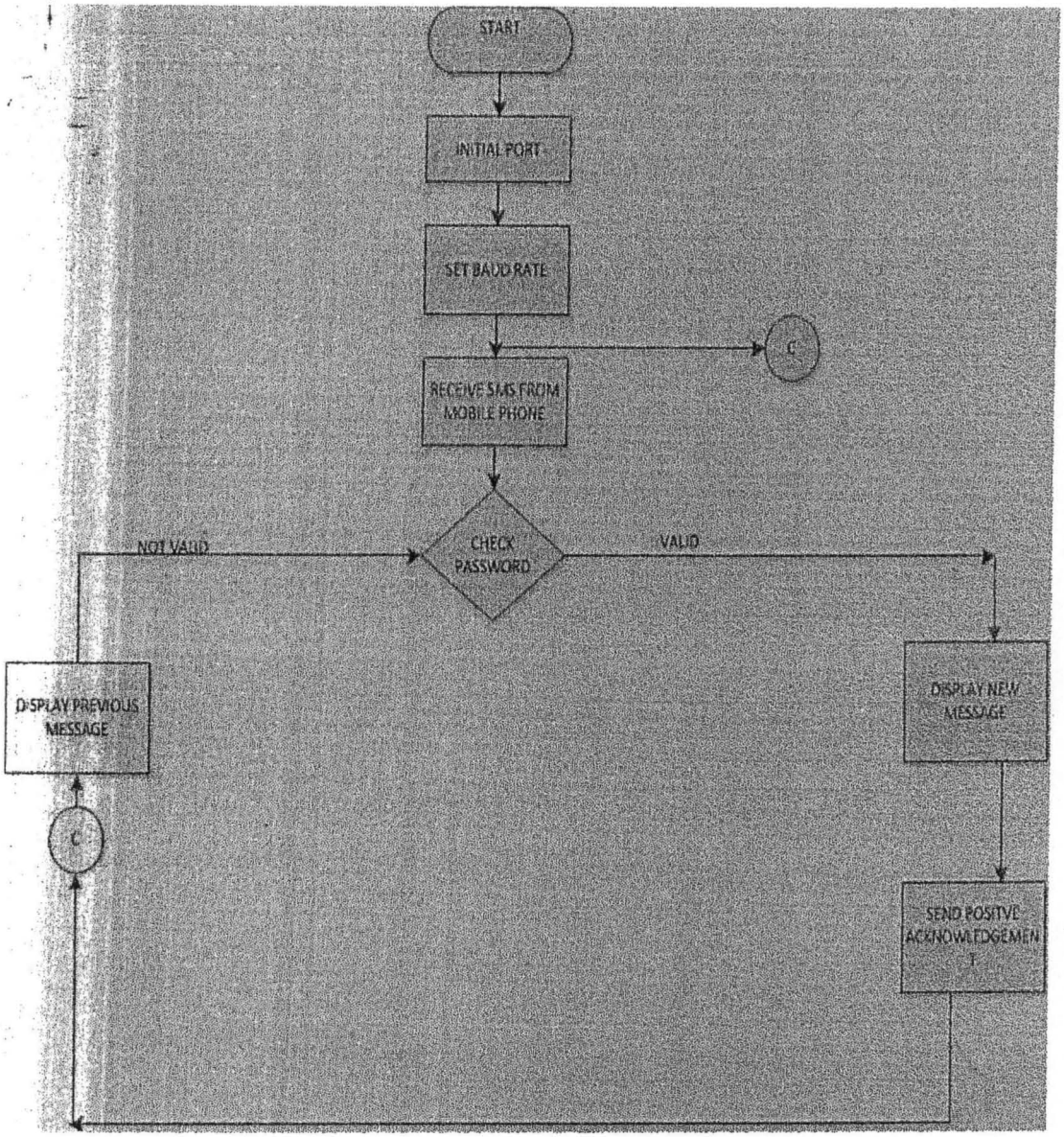
310 HARDWARE USED

1. AT command supporting GSM mobile phone.
2. 8051 Microcontroller
3. Max 232 IC.
4. 2 Relays
5. Relay driver IC ULN 2003
6. Voltage regulator 7812 AND 7805.
7. Diode IN4007
8. GSM Phone
9. LCD

3.11 SOFTWARE USED

1 Embedded C programming

The system flow chart is as shown below



3.12 CIRCUIT DESIGN AND ANALYSIS

3.13 ARCHITECTURE OF MICROCONTROLLER

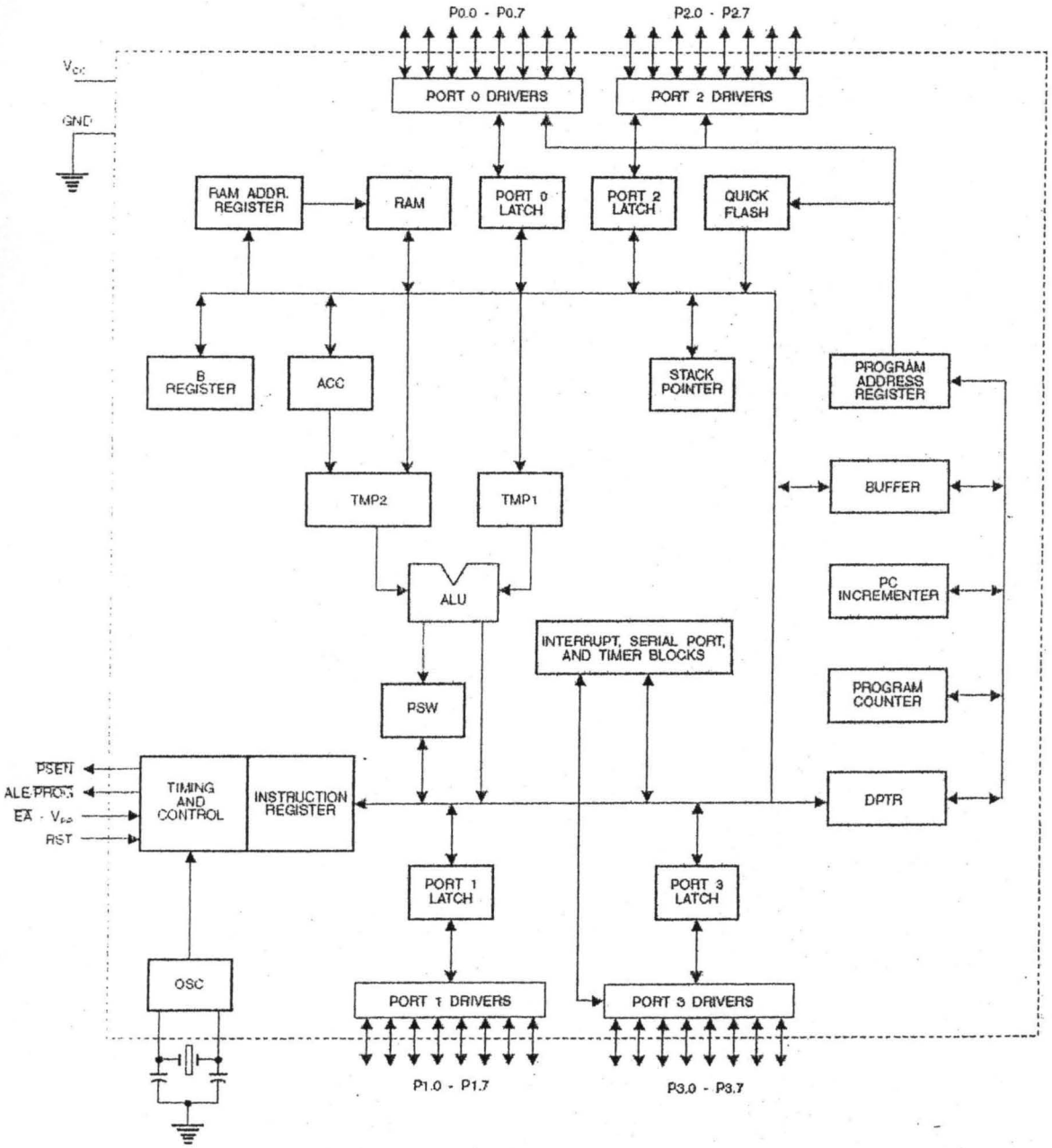


Fig 3.1

3.20 PIN DESCRIPTION FOR MICROCONTROLLER

Pin 1- pin 8 Connection of data line LCD

Pin 9 Reset button

Pin 10 Serial output to phone

Pin 11 Serial input from phone

Pin 16- pin 17 display of LCD

Pin 18- pin 19 connected to crystal oscillator

Pin 20 connected to ground

Pin 21- pin 24 relay driver uln2003

Pin 31 Vcc +5v

Pin 40 Vcc +5v

3.21 CONNECTION OF MOBILE PHONE WITH 8051.

A hands-free is used to take signal from a mobile phone to communicate to microcontroller. Max 232 IC is used to adjust the difference in operating voltage of a mobile phone and the microcontroller. The Max 232 IC working principle has been discussed in the previous chapter.

3.22 CRYSTAL OSCILLATOR

A crystal oscillator is an electronic oscillator circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a very precise frequency. This frequency is commonly used to keep track of time, to provide a stable clock

signal for digital integrated circuits, and to stabilize frequencies for radio transmitters and receivers [15].

An oscillator crystal has two electrically conductive plates, with a slice or tuning fork of quartz crystal sandwiched between them almost like a capacitor. When a crystal of quartz is properly cut and mounted, it can be made to distort an electric field by applying a voltage to an electrode near or on the crystal.

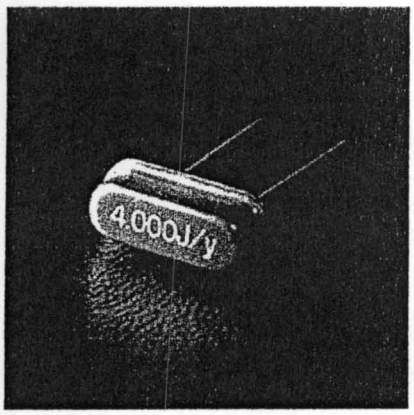


Fig 3.2

The crystal used is 11.0592MHz

3.23 Calculation of baud rate

Baud rate is the communication protocol between the microcontroller and the GSM phone.

GSM modem/phone standard baud rate = 9600bps

11.0592/12 (12 instruction cycles make 1 second)

== 0.9216MHz

At 360 cycle

0.9216/32 =0.0288MHz

28800/3

= 9600 (baud rate)

3.40 POWER SUPPLY UNIT

This is a device or system that supplies electrical or other types of energy to an output load or group of loads. The power supply unit is +5VDC and +12VDC.

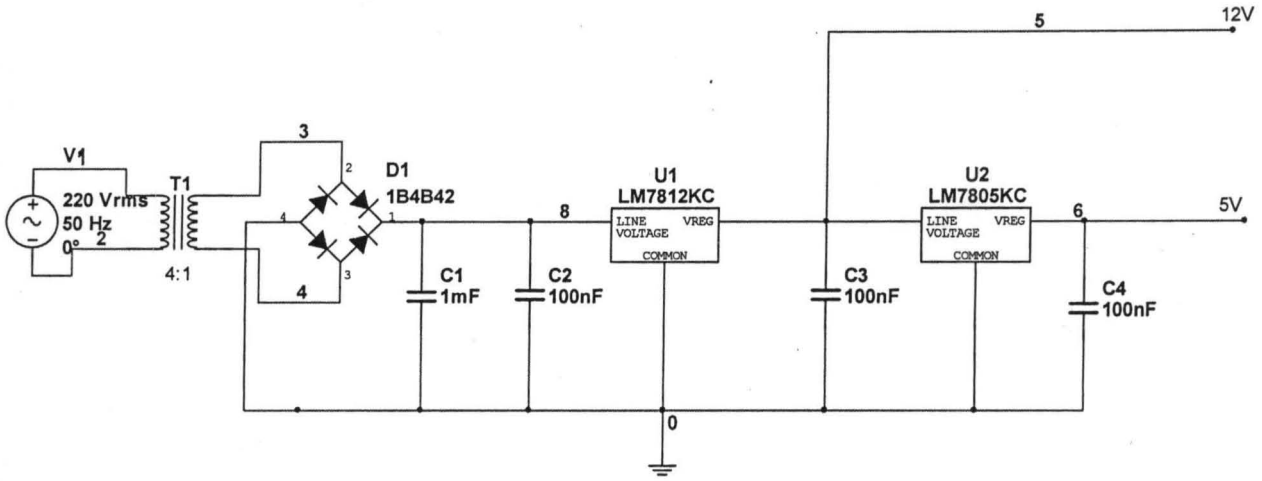


Fig 3.3

Circuit diagram of power supply

3.41 Transformer

In this project, a transformer of 230v/15-0-15v is used to perform the step down operation. A transformer is a stationary piece of apparatus by which electric power in one circuit is transformed into electric power of same frequency in another circuit. It accomplishes its operation by electromagnetic induction, the simple element of a transformer consists of two coils having mutual inductance and a laminated steel core [5].

3.42 Rectifier

operation by electromagnetic induction, the simple element of a transformer consists of two coils having mutual inductance and a laminated steel core [5].

3.42 Rectifier

Many semiconductor devices and system require a negative dc source or both positive and negative dc source. Rectifiers employ one or more diodes to convert ac supply voltage into pulsating dc voltage. A diode is a two-terminal semiconductor device consisting of a P-N junction formed either in Si or Ge crystal. A P-N junction diode is a one way device offering low resistance when forward biased and acting like an insulator when reverse biased.

Full wave rectification is usually achieved using four diodes connected as shown in the circuit above [5].

3.43 Filters

Capacitors are used to achieve filtering in a power circuit, its function is to remove the pulsation present in the output voltage supplied by the rectifier. The output of a filter is almost rippling free as that of a dc battery. A capacitor consists of two conductive plates with a dielectric material. The dielectric constant is the relative strength of a material against the flow of electrical current [5].

3.44 Voltage Regulator

The voltage regulators play an important role in any power supply unit. The primary purpose of a regulator is to aid the rectifier and filter circuit in providing a constant DC voltage to the device. Power supplies without regulators have an inherent problem of changing DC voltage values due to variations in the load or due to fluctuations in the AC line voltage. With a regulator connected

to the DC output, the voltage can be maintained within a close tolerant region of the desired output. IC7812 and 7805 is used in this project for providing +12V and +5V supply respectively.

Parameters used

Frequency (f) = 50Hz

Capacitor = 100μF

Load resistance = 100Ω

$Xc = \frac{1}{2\pi fc}$

$= 1/(50 \times 2\pi \times 100\mu)$

Xc= 31.83Ω.

3.50 THE MOTOROLA AT COMMAND

This briefly describes how AT commands are used to communicate with mobile phone. AT commands are used to control phones and modems to do their specified functions [12].

AT Command	Response from Phone	Description of command
AT+GMM	+GMM: Motorola CDMA V3c Rev2 Phone	Display phone model information

AT+MODE?	+MODE: 0	Display current phone mode
AT+MODE=0	OK	Put phone in Modem Mode
AT+MODE=2	+MBAN: Copyright 2000-2004 Motorola, Inc.	Put phone in Phonebook Mode. On some models, for instance the ROKR Z6m, this allows voice dialing and SMS messages to be sent.
AT+MODE=8	OK	On some P2K or P2K05 phones, puts the phone into P2K mode. This causes the current serial connection to the phone to be closed. The phone can be returned to the Modem mode by reconnecting it.
AT+MODE=24	No response	Put phone in USB mass storage mode. On some models, for instance the ROKR Z6m, this allows using the phone as a USB key.

From MODE:2, an AT+CLAC command shows the following valid commands: AT+CLAC

AT Command	**Response from Phone**	**Description command**
AT+CIND?	+CIND: 1,1,0,0,5,0,0	Shows current (Indicator status
AT+CIND=?	+CIND: ("Voice Mail",(0,1)),("service",(0,1)),("call",(0,1)),("Roam",(0-2)),("signal",(0-5)),("callsetup",(0-3)),("smsfull",(0,1))	Sets current Indicator status

AT+CKPD ?	?
AT+CMER=? +CMER: (0,3),(0,1,2),(0),(0,1,2),(0)	Default Value: +CME 0,0,0,0,0
AT+CMUT=? +CMUT: (0,1)	Default Valu +CMUT: 0
AT+COLP? +COLP: 0	Does not appear to be settable parameter
AT+MAFVL? +MAFVL: 0	Does not appear to be settable parameter
AT+MAPC ERROR	
AT+MAPS=? +MAPS: (0-2),(0-1)	+MAPS: 0,0 +MAPS: 1,0 +MAP 2,0
ATS	?
AT+CBC	+CBC: 1,60 (1 = connect to external power, 60 = battery cha percentage
AT+CCLK	+CCLK: "09/10/15,19:33:42+00"
AT+CCWA	?
AT+CGMM	+CGMM:

	"GSM900","GSM1800","GSM1900","GSM850","MODEL=V63
AT+CGMR	+CGMR: "R474_G_08.48.4BR.8_RG"
AT+CGSMS	?
AT+CGSN	+CGSN: IMEI123456789012345
AT+CHUP	?
AT+CHV	?
AT+CLAC	?
AT+CLIP	?
AT+CLIR	?
AT+CMEE?	+CMEE: 0
AT+CMGD	
AT+CMGF=?	+CMGF: (1)
AT+CMGF?	+CMGF: 1
AT+CMGL=?	+CMGL: ("REC UNREAD", "REC READ", "STO UNSEN "STO SENT", "ALL")
AT+CMGS	+CMGS: number
AT+CMSS	?
AT+CNMA	?
AT+CNMI	?
AT+CNUM	+CNUM: ,"2035551212",129

3.60 RELAY DRIVER (ULN 2003)

A ULN2003 is an Integrated Circuit (IC) chip with a High Voltage/High Current Darlington Transistor Array. It allows you to interface TTL signals with higher voltage/current loads. A TTL signal operates from 0-5V, with everything between 0.0 and 0.8V considered "low" or off, and 2.2 to 5.0V being considered "high" or on. The maximum power available on a TTL signal depends on the type, but generally does not exceed 25mW (~5mA @ 5V), so it is not useful for providing power to something like a relay coil. On the output side the ULN2003 is generally rated at 50V/500mA, so it can operate small loads directly.

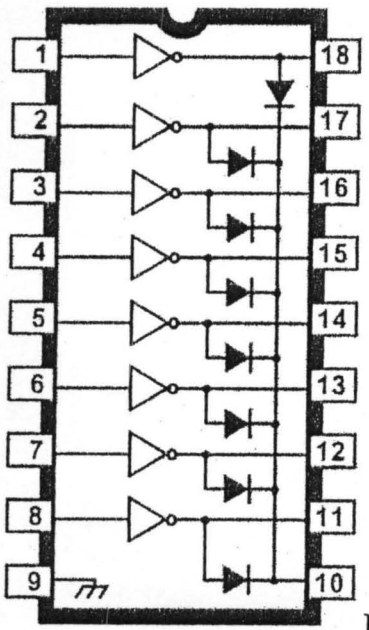


Fig 3.4

ULN 2003

Two 12v relays are used to switch the computer and television.

3.70 LCD (LIQUID CRYSTAL DISPLAY)

The liquid - crystal display consists of a liquid crystal material that will flow like a liquid but whose molecular structure has some properties normally associated with solids, It does not generate its own light but depends on an external or internal source.

The LCD has the distinct advantage of having a lower power requirement than the LED. It is typically in the order of microwatts for the display, as compared to the same order of milli watts for LEDs. LCD is limited to a temperature range of about 0° to 60° C. Lifetime is an area of concern because LCDs can chemically degrade [15].

3.71 PIN DESCRIPTION FOR LCD

Pin	Symbol	I/O	Description
1	Vss	--	Ground
2	Vcc	--	+5V power supply
3	VEE	--	Power supply to control contrast
4	RS	I	RS=0 for command register, RS=1 for data register
5	R/W	I	R/W+0 for write, R/W+1 for read
6	E	I/O	Enable
7	DB0	I/O	The 8-bit data bus
8	DB1	I/O	The 8-bit data bus

8	DB1	I/O	The 8-bit data bus
9	DB2	I/O	The 8-bit data bus
10	DB3	I/O	The 8-bit data bus
11	DB4	I/O	The 8-bit data bus
12	DB5	I/O	The 8-bit data bus
13	DB6	I/O	The 8-bit data bus
14	DB7	I/O	The 8-bit data bus

The interface used by LCD is a parallel bus, allowing simple and fast reading/writing of data to and from the LCD.

3.80 SYSTEM OPERATION

The system is turned ON by connecting it to the power supply, and a welcome message is displayed on the LCD with the setup initialization code. An SMS (secret code) is sent to the configured phone number to control the set appliance needed either computer or television, to either put them on or off. The SMS is simple just, secret code ON1or ON2 and a feedback is received to state the status of the appliance. After the execution of the message the system is expected to delete the message immediately.

CHAPTER FOUR

4.0 INTRODUCTION

This chapter focuses on the construction procedure followed in the implementation of the circuit design. Detailed tests were carried out on the final circuit and the results obtained were stated.

4.01 PROGRAMMER

The programmer used is a powerful programmer for the Atmel 89 series of microcontrollers that includes 89C51/52/55, 89S51/52/55 and many more.

It is simple to use and of low cost, yet powerful flash microcontroller programmer for the Atmel 89 series. It will Program, Read and Verify Code Data, Write Lock Bits, Erase and Blank Check. All fuse and lock bits are programmable. This programmer has intelligent onboard firmware and connects to the serial port. It can be used with any type of computer and requires no special hardware. All that is needed is a serial communication port which all computers have.

All devices also have a number of lock bits to provide various levels of software and programming protection. These lock bits are fully programmable using this programmer. Lock bits are useful to protect the program to be read back from microcontroller only allowing erase to reprogram the microcontroller.

Major parts of this programmer are Serial Port, Power Supply and Firmware microcontroller. Serial data is sent and received from 9 pin connector and converted to or from TTL RS232 signal levels by MAX232 chip. All the programming 'intelligence' is built into the programmer so you do not need any special hardware to run it. Programmer comes with windows based software for easy programming of the devices.

11 HARDWARE CONSTRUCTION

After the purchase of the various components used, they were tested using a multi-meter. The circuit was bread boarded after a satisfactory test and result were obtained, the components were soldered on Vero-board. The voltage from the power supply was between 4.67 to 4.98V, for the 5V supply while for 12V it ranges between 11.56 to 11.94V, from the multi-meter.

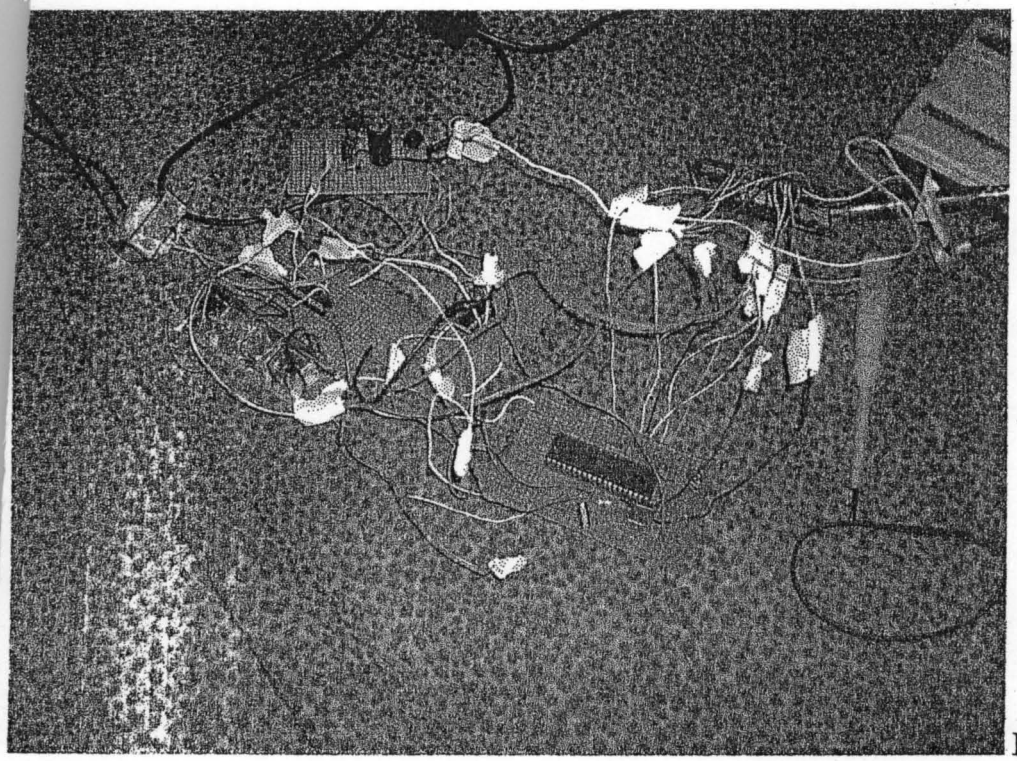


Plate 4.1

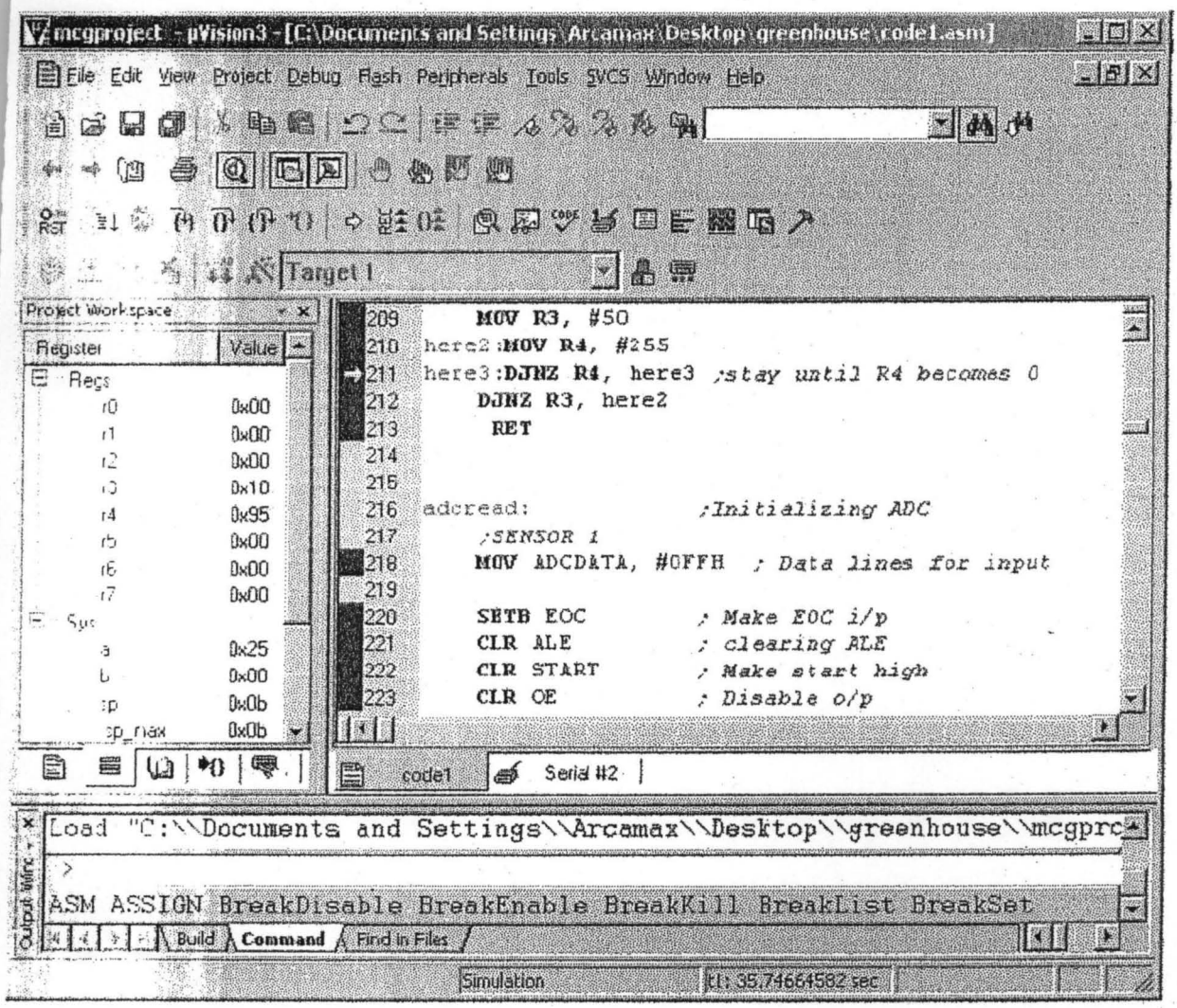


Plate 4.2

4.21 TESTING

The device is very easy to use, each appliance is connected to a relay, which in turns gets it signal from the ULN2003 connected to the micro controller. When the device is powered a message (AT command) is sent from the micro controller to the mobile phone, for initialization and a display is run on the LCD (welcome note and AT commands). A plain text or SMS is sent to either switch ON appliance 1 or 2 or switch OFF.

30 RESULT

he program codes were simulated using micro vision3, and no error was obtained. The device vas able to switch ON and OFF any appliance without power switch or power switch, that is isable. The current text is displayed on the LCD indicating which appliance is ON

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

This project demonstrates the design and construction of an SMS-Based remote controller, showing how a microcontroller can be used in GSM remote switching of appliances and devices. It establishes communication between the user and the appliance at a distance, to facilitate monitoring and minimize access.

It can therefore be seen that wireless technology may supplement or replace hard wired implementation in security systems for homes or office building, and can also compliment the general or conventional infrared remote controllers to have access to appliances from a distance.

Relays can be used as an electrically operated switch-to-switch AC and DC with ability of switching higher voltages and a better choice for switching large currents.

The project can be further integrated or developed to control home appliances, monitor the operation of devices or systems and as a security system when home owner is not around.

The project is recommended to the Federal Ministry of Science and Technology for further development and commercial production for domestic and industrial use, especially in Machine-to-Machine Systems that include devices that are able to reply to requests for data from devices that can transmit autonomously

[16] Andreas F. Molisch, Wireless Communications. John Wiley and Sons Ltd. The Atrim, Southern Gate, Chichester, West Sussex PO19 8SQ, England. 2005

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SMS (Short message service) A text message service permitting the transmission of about 160 characters to a mobile phone.

RTS Request to send. An EIA232 signal sent from the computer to the mobile phone, usually indicating that the computer is ready to send data to the mobile phone.

CTS Clear to send. EIA232 signal sent from the mobile phone to the computer, usually indicating that the phone is ready to receive data.

RS-232 interface. A communication standard established by the Electronics industry Association

AT command set The commands used to control and configure the mobile phone

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[13] http://www.mobilegpsonline.com/downloads/GM28-29%20Datasheet%20R1G.pdf

[14] http://www.visualgsm.com/wire_sms_index.htm

[15] The 8051Microcontroller by Kenneth J. Ayala

APPENDIX A

```
#include<reg52.h>

sbit RS=P3^7;
sbit EN=P3^6;

sbit RLY1=P1^0;
sbit RLY2=P1^1;
sbit RLY3=P1^2;
sbit RLY4=P1^3;

#define LCD_PORT P2

//---------------------------------------
// Forward function declaration
//---------------------------------------
void Txmsg(unsigned char k);
unsigned char Rxmsg(void);
void lcdinit(void);
void lcdData(unsigned char l);
void lcdcmd(unsigned char k);
void DelayMs(unsigned int count);
void InitModem(void);
void initdisplay(void);

//---------------------------------------
// Main rotine
//---------------------------------------
void main()
{
unsigned char ret;
TMOD=0x20;              // Configure UART at 4800 baud rate
TH1=0xFD;
SCON=0x50;
TR1=1;

lcdinit();              // Initialize LCD
initdisplay();
DelayMs(5000);
InitModem();            // Initialize Modem
lcdinit();              // Initialize LCD

Txmsg(0);             // Welcome Message send

P1=0x00;

while(1)
{
ret=Rxmsg();
if(ret>0)
Txmsg(ret);
}
```

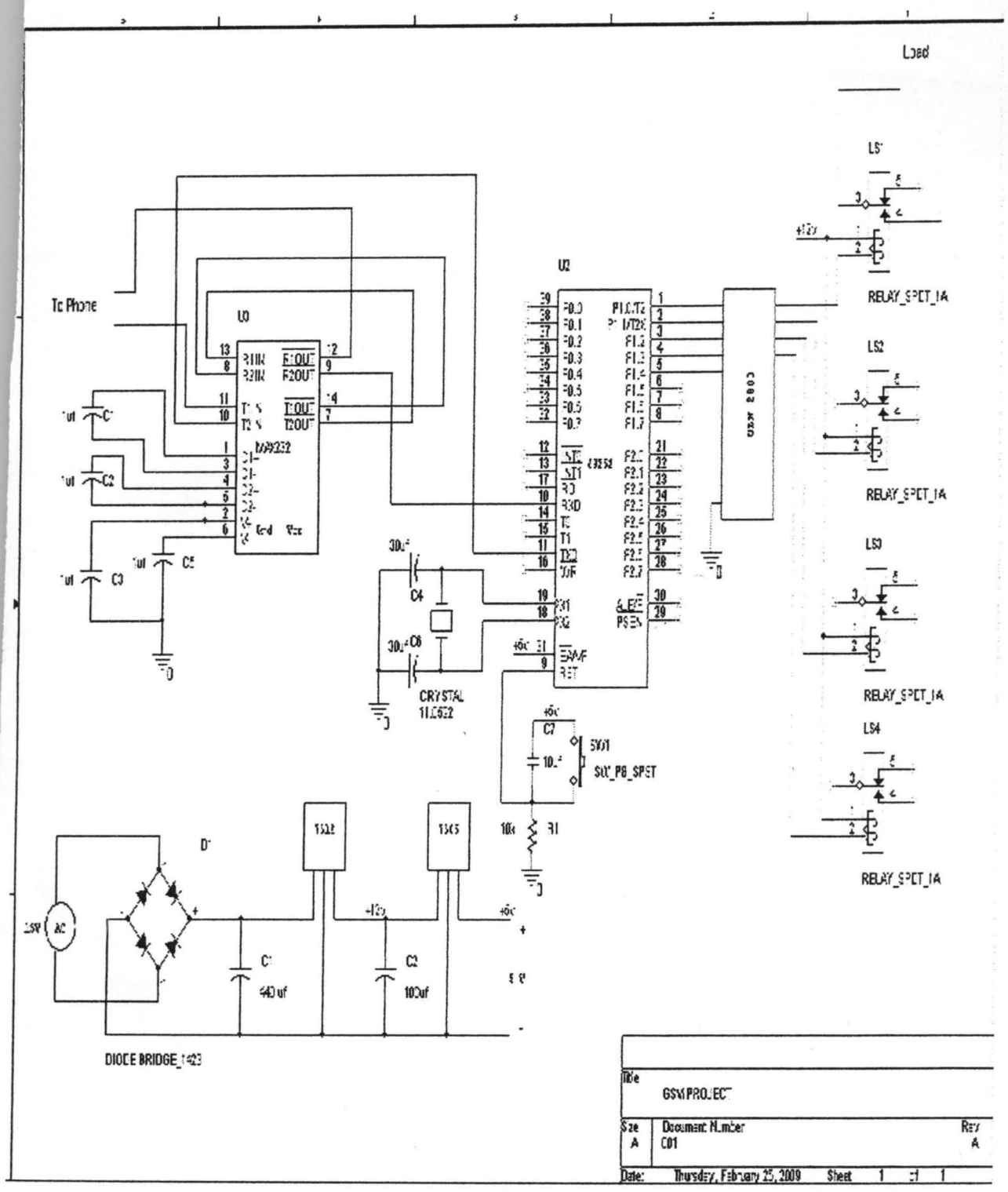
```
}

//--------------------------------------
// Modem initialization subroutine
//--------------------------------------
void InitModem(void)
{
unsigned int j=0;
unsigned char i=0,k=0;
unsigned char a[]="at+cmgf=1";
unsigned char b[]="at+cpms=\"ME\",\"ME\",\"ME\"" ;
unsigned char c[]="at+cmgd=" ;
unsigned char d[6];

ReInit:

for(i=0;i<6;i++)
d[i]=0x00;

i=0;
while(a[i]!='\0')
{
SBUF=a[i];
while(TI==0);                          // ATE0 sending  to turn off
the echo
TI=0;
lcdData(a[i]);
i++;
}

lcdData(' ');                          // Enter
SBUF=0x0d;
while(TI==0);
TI=0;

for(i=0;i<4;i++)                       //command to recv data
{
j=0;
while(RI==0)
{
if(j>=1000)
goto ReInit;
DelayMs(1);
j++;
}
d[i]=SBUF;
RI=0;
lcdData(d[i]);
}

for(i=0;i<4;i++)                       //command to compare data
{
```

```
if((d[i]=='E') || (d[i]=='R'))
goto ReInit;
if((d[i]=='O') || (d[i]=='K'))
goto InitS;
}

InitS:
for(i=0;i<6;i++)
d[i]=0x00;

lcdcmd(0x01);
DelayMs(10);
lcdcmd(0x80);
DelayMs(10);

i=0;
while(b[i]!='\0')
{
SBUF=b[i];
while(TI==0);                          // sending AT+CPMS  to set the
preffered memory location
TI=0;
lcdData(b[i]);
i++;
}

lcdData(' ');                          // Enter
SBUF=0x0d;
while(TI==0);
TI=0;

for(i=0;i<5;i++)                  //command to recv data
{
j=0;
while(RI==0)
{
if(j>=1000)
goto ReInit;
DelayMs(1);
j++;
}
d[i]=SBUF;
RI=0;
lcdData(d[i]);
}

for(i=0;i<5;i++)                  //command to compare data
{
if((d[i]=='E') || (d[i]=='R'))
goto ReInit;
if((d[i]=='+') || (d[i]=='C'))
goto InitS2;
```

```
}

InitS2:
for(k=0;k<10;k++)
{
for(i=0;i<6;i++)
d[i]=0x00;

lcdcmd(0x01);
DelayMs(10);
lcdcmd(0x80);
DelayMs(10);

i=0;
while(c[i]!='\0')
{
SBUF=c[i];
while(TI==0);                          // sending AT+CMGD to delete
message
TI=0;
lcdData(c[i]);
i++;
}

lcdData(k + 0x30);                          // Enter
SBUF=k + 0x30;
while(TI==0);
TI=0;

lcdData(' ');                          // Enter
SBUF=0x0d;
while(TI==0);
TI=0;

for(i=0;i<5;i++)                    //command to recv data
{
j=0;
while(RI==0)
{
if(j>=1000)
goto ReInit;
DelayMs(1);
j++;
}
d[i]=SBUF;
RI=0;
lcdData(d[i]);
}
DelayMs(100);
}
return;
}
```

```
//---------------------------------------
// Recieve message subroutine
//---------------------------------------
unsigned char Rxmsg(void)
{
unsigned char i=0,ret=0;
unsigned int j=0;
unsigned char c[102];

for(i=0;i<102;i++)
c[i]=0x00;

lcdinit();

lcdData('a');
SBUF='a';
while(TI==0);
TI=0;

lcdData('t');
SBUF='t';
while(TI==0);
TI=0;

lcdData('+');
SBUF='+';
while(TI==0);
TI=0;

lcdData('c');
SBUF='c';
while(TI==0);
TI=0;

lcdData('m');
SBUF='m';
while(TI==0);
TI=0;

lcdData('g');
SBUF='g';
while(TI==0);
TI=0;

lcdData('r');
SBUF='r';
while(TI==0);
TI=0;

lcdData('=');
SBUF='=';
```

APPENDIX B


Load
LS1
LS2
LS3
LS4
RELAY_SPDT_1A
RELAY_SPDT_1A
RELAY_SPDT_1A
RELAY_SPDT_1A
To Phone
U3
U2
MAX232
AT89S52
CRYSTAL
11.0592
C1
C2
C3
C4
C5
C6
C7
10uf
30pf
SW1
SW_PB_SPDT
R1
10k
D1
1522
1545
AC
440 uf
100uf
DIODE BRIDGE_1423
Title
GSM PROJECT
Size
A
Document Number
001
Rev
A
Date:
Thursday, February 25, 2009
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1
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1