DESIGN AND CONSTRUCTION OF A GSM BASED HOME SECURITY SYSTEM

BY

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DEDICATION

To the Almighty God who has been ever gracious and mindful of me

DECLARATION

I, OKUYELU OLANREWAJU MORAYO, hereby declare that this work was done by me under the supervision of Mr. J.A. AJIBOYE, 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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ACKNOWLEDGEMENT

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I also wish to express my profound gratitude to all my friends, colleagues and every other person who in one way or the other contributed to my stay in this school and the success of this work. God bless you all.

ABSTRACT

Home security has been a major issue where crime is increasing and everybody wants to take proper measure to prevent intrusion. This project presents the design and construction of a GSM based home security system. This system unlike the traditional magnetic switch alarms equipped on doors and windows, has incorporated in it fire detectors and motion sensors so that a short message service, SMS is sent to the house owner on any attempt of a break in or possible smoke or fire. The system is built using a programmed microcontroller interfaced with mobile phone (NOKIA 1209) such that their three major buttons are switched at intervals to send a message to three different people anytime there is an intruder or fire accident. The intruder sensor is also connected to one of the microcontroller pin and is accomplished by the use of laser and LDR arrangement

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CHAPTER ONE

INTRODUCTION

1.1 General Introduction

The need for security in our homes has been an instinct from the earliest humans down to those in our contemporary world. This ranges from the use of padlocks, alarm systems, animals, like dogs, parrots and even human beings. It is obvious that the methods vary as well as the amount of intelligence required to achieve the desired result. Motion detecting sensor can be used in different applications including security systems and door control.

Communication is and has always been an important aspect of life with the growing technological advances and the growing need for these technologies, communication has still been able to withstand the hands of time. We are now more than ever able to communicate over incredible distances almost instantly. Considering how one can communicate as far and as fast as possible, why not make it possible for people to secure their lives and properties with the same method of communication.

The concept of this project is to design an automated security and fire alert system capable of reporting theft and other forms of security bridges via SMS. The purpose is to design a system such that when there is an intrusion in the area of surveillance the device automatically senses it and sends it to the monitoring system with the help of mobile phone which is able to send an SMS to another mobile phone automatically, thereby alerting various security offices to get immediate response from the fastest or the nearest office.

1.2 AIM AND OBJECTIVE

This project is designed to build a GSM based home security. Besides traditional magnetic switch equipped on doors and windows, fire detectors and motion sensor have also been incorporated hence an SMS will be sent when there is an attempt to break in or if there is possible smoke or fire.

1.3 METHODOLOGY

The project was accomplished by the use of hardware design for microcontrollers and how it can be interfaced with mobile phones. This was achieved with the use of a microcontroller chip to switch at intervals the three major buttons of the NOKIA (1209) phone to send a text message to three different people any time there is an intruder or fire accident. The intruder sensor is connected to one of the microcontroller pin and is accomplished by the use of a laser and LDR arrangement. The fire sensor on the other hand is based on the fact that any time there is fire, the temperature rises and thus a thermistor was used as the sensing element.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 HISTORY

Way back in the olden days, people would rely on simple means to alert others of a breach of security, little bells were attached to a door that rang when it was opened. One day, someone placed a large bell into a metal enclosure and placed four lantern batteries inside it with a relay and mounted it outside the building. From the enclosure, there were two sets of wires, one for the door contacts and one for the key switch that turned the bell on and off. This technology was commonly referred to as a "**local bell**." Maintenance was a snap. Depending on the usage, these batteries could last up to a year. When the bell rang weakly, the batteries were replaced.

This simple system used a relay to monitor the door contacts. The switch was located outside, and the owner would close all doors and turn the key at night. If the doors were opened with the key switch on, the bell would ring, closing the door would not stop the bell, only by turning the key could it be silenced. The local bell uses a wiring scheme that latches the relay contacts into an alarm condition.

This was very popular for a while until it was discovered that the bell could be yanked from the wall and quickly silenced. The other flaw was the locations of some of these businesses, which were in the outskirt of the city. The bell could ring all night and bother only the local night critters.

So, someone came up with the idea that a pair of wires from the premises could be tied into the local police station through the telephone lines. These lines were dedicated to alarm panel only. In the police station, there was a rack of modules that had dials and meters on them. The security

panel back at the premise uses a series of large resistors, and the police station had a room with a whole slew of car batteries that pumped voltage on the telephone line to create a current source. The resistors will be turned to send back a specific current level. This level was reflected on the dials at the police department. If the lines were to be compromised (cut/bypassed), the dial would drop its reading and the police would be dispatched. This was referred to a DLPD (Direct Line Police Department). These systems were popular with managers of jewelry stores, and high – security – minded business owners. The problem was lots of phone lines were used up and the police department received tonnes of false alarms on a daily basis.

After this, came "The McCulloh." It worked on the same principle as the DLPD but with a twist. Instead of a dedicated pair of phone wires from the premises to the police department, the phone company ran a pair of wire out to a location and allows multiple premises unit to be wired in series with the main feed. The main feed was routed to a secure location which will be referred to as the monitoring center from there on (it still had a room full of car batteries) and tied into a machine with spools of paper and little probs with ink at the end. The premise units were replaced with the device that used a wheel with spokes protruding from it. At the wheel turn it opens and closes a set of contact that sends a series of Morse code-like pulses to the monitoring center. At the monitoring center, each pulse will cause the probs to release ink unto a thin spool of paper. For example, the premise unit code wheel had two spokes followed by three spokes, followed by one spoke on it, the monitoring center will see lines of ink that when counted, identify premise unit number 2-3-1.

Sleek enough, but easy to compromise. If you go to an unsecured premise unit, cutting the phone will disable the entire premise unit on that field. Another hurdle to overcome was if more than one premise tripped at the same time, you will see a clash of pulses that was hard to

decipher, even more of a concern was maintaining all of these car batteries. Then next to evolve were the digital communicator, these devices used the same principle as a phone call to the police, but better. Digital communicators were programmed to call the digital receiver at the monitoring center, the premise units were assigned premise number that were programmed into these dialers. when the alarm tripped, the digital dialer will call the digital receiver and report the location and area of protection violated, this information will be first displayed on a small LED screen and later printed out to a spool of paper for later reference.

No more rooms full of car batteries or dedicated phone lines which came as a bonus, this also allowed the monitoring center to analyze the alarm signal before dispatching the police. This reduced the number of false alarm, much to the relief of the local police officers. One further note, the digital dialer was able to send alarm signals that alert the monitoring center to dispatch the fire department or paramedics as well.

Since the introduction of the digital dialers, the phone company has raised the cost of a dedicated phone line to the point of discouraging further request for the line. The police department no longer offers DLPD service and car battery sales have dropped off significantly.

As the technology grew, so the ingenuity of the burglar, all they had to do was cut the phone lines. If the line is unprotected, it is just a matter of cutting the right pair that the alarm uses. Actually, they take out full banks of phone wires, hoping the right pair is included in there somewhere.

Now the need for a backup communicator was needed. How do you make a phone call without phone lines? The use of cellular dialer came to being. Cellular was expensive at first but the cost has been coming down as the public embraces cellular phones. There is also a line of

long range radius that can transmit alarm signal across the country in seconds. Microwave technology is also used in some areas.[1]

The next section delves into an explanation of the various types of detection that have been developed till date.

2.1.1 SENSORS – DETECTING DEVICE AND TECHNIQUES

LIGHT DEPENDENT RESISTOR (LDR)

Light dependent resistors (LDR) are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1000ohms, but when they are illuminated with light, resistance drops, allowing current to pass through it. When the light level is low the resistance of LDR is high. This prevents current from flowing to the base of the transistors. However when light shines onto the LDR its resistance falls and current flows into the base of the transistor and then into the second transistor.

The preset resistor can be turned up or down to increase or decrease resistance, in this way it can make the circuit more or less sensitive[2]

METAL DETECTOR

Metal detectors are devices that use electricity and magnetism to detect metals buried in the ground or hidden from view. A metal detector produces electromagnetic fields by passing an electric current through a coil of wire. He current creates an associated magnetic field around the coil. When the magnetic field passes over a nearby metal object, the field induces a current within the metal. The detector senses the induced magnetic field and registers the presence of metal. A metal detector can sense the induced magnetic field of a metallic object even if the object is hidden inside a coat, buried underground, or lost in the bottom of the sea [3]

MOTION DETECTOR

Motion detector is a type of electronic security device that senses movement and usually triggers an alarm. Many types of motion detectors can sense motion in total darkness, without an intruder becoming aware that an alarm has been triggered. Motion detectors are an important part of most burglary alarm systems. They help alert security personnel, especially in situations where no obvious break-in has occurred. For instance, an intruder steals a key and gain access to a protected site or hides within the site during normal business hours, the intruder's entrance or presence could go unnoticed. A motion detector will detect the intruder's movement as he or she walks otherwise moves within the area protected by the detector. Some types of motion detectors include; infrared, ultrasonic, microwave and video [4]

2.2 WIRELESS COMMUNICATION

Wireless is a term used to describe telecommunications in which electromagnetic waves (rather than some form of wire) carry the signal over part or the entire communication part[5]. The earlier security systems used hard wired technique in establishing a link between the sensor and the monitoring point. This involves physically laying cables, though using this technique the connection was still established, it became difficult to establish long distance connection and in some cases impossible when the distance between the two points are very far apart besides that, it is also very unattractive. Wireless communication is now a growing trend in security industry. Technology has allowed wireless systems to function as reliable as wired system. But not until now has GSM been used as wireless connection for security industries.

2.3 GSM BASICS

The acronym GSM originally stands for Groupe Special Mobile but it's now known as Global System Mobile. It is the most popular standard for mobile phones in the world. GSM is not only

meant for the elite but has become a something of necessity, even in Nigeria it has brought so many advantages like foreign capital inflow, increased access to telephony system, job creation [6]. The range of frequencies of GSM falls between the range of 300MHz (lower range) and 3000MHz (upper range). Other applications that utilize this frequency range are television broadcasts, microwave ovens, wireless LAN (WLAN), Bluetooth, GPS and two-way radios. These frequencies are a portion of the electromagnetic spectrum in which electromagnetic waves can be generated.[7]

HISTORY OF GSM

In the early 1980s, most mobile telephone systems were analog rather than digital, but one challenge facing analog systems was the inability to handle the growing capacity needs in a cost-efficient manner. As a result, digital technology was welcomed. The advantages of digital systems over analog systems include ease of signaling, lower levels of interference, integration of transmission and switching, and increased ability to meet capacity demands. This prompted the formation of Groupé Special Mobile (GSM) in 1982, by the European Conference of Postal and Telecommunications Administrations (CEPT) with the objective of developing a standard for a mobile telephone system that could be used across Europe, a field test was done in 1986 so as to check the access method that would be chosen and Time Division Multiple Access (TDMA) was chosen. In 1991, the first GSM commercial start-up was launched and by the end of 1995 it has gotten the coverage of cities, main roads and even rural villages [8] and even in Nigeria as at 2004 has total subscriber of over 3.8 million and have generated a revenue of over 1.1 billion USD[6].

THE ELECTROMAGNETIC SPECTRUM

The electromagnetic spectrum (EM) is the range of all possible radiation. The electromagnetic spectrum of an object is the frequency range of electromagnetic radiation with wavelengths from thousand kilometres down to fractions of the size of an atom. It is commonly said that Electromagnetic Waves beyond these limits are very rare, although this is not actually true. The short wavelength limit is likely to be Planck length, and the long wavelength limit is likely is the size of the universe itself, though in principle the spectrum is infinite.[9]

Electromagnetic energy at a particular wavelength λ (in vacuum) has an associated frequency, f and photon energy E. Thus the electromagnetic spectrum may be expressed equally well in terms of any of these three quantities. They are related according to the equations:

Speed (c) = Frequency (f) x wavelength (λ) (1)

So high- frequency electromagnetic waves have a short wavelength and high energy, low frequency waves have high wavelength and low energy.

When light waves (and other electromagnetic waves) enter a medium, their wavelength is reduced. Wavelength of electromagnetic radiation, no matter what medium they are travelling through are usually quoted in terms of the vacuum wavelength, although this is not always explicitly stated.

RADIO INTERFACE

GSM is a cellular network, meaning that mobile phones connect to it by searching for cells in the immediate vicinity. Its networks operate in four different frequency ranges. Most GSM networks operate in the 900MHz or 1800MHz frequency bands were already allocated [10].

The rarer 400 and 450 MHz frequency bands are assigned in some countries. In the 900 MHz band the uplink frequency band is 890-915 MHz, and the downlink frequency band is 935-960

Mhz. This 25 MHz bandwidth is subdivided into 124 carrier frequency channels, each placed at 200kHz apart. Time Division Multiplexing is used to allow eight full-rate or sixteen half-rate speech channels per radio frequency channel. There are eight radio timeslots grouped into what is called TDMA frame. Half rate channels use alternative frames in the same timeslot. The channel data rate is 270.833 kbit/s, and the frame duration is 4.615 ms. The transmission power in the handset is limited to a maximum of 2 watts in GM850/900 and 1 watt in GSM1800/1900[9].

There are four different cell sizes in a GSM network – macro, micro, pico and umbrella cells. The coverage of each cell varies according to the implementation environment. Macro cells can be regarded as cells where the base station antenna is installed on a mast or building above average roof top level. Micro cells are the cells whose antenna height is under average roof top level; they are typically used in urban areas. Piocells are small cells whose diameter is a few dozen metre; they are mainly used indoors. Umbrella cells are used to cover shadowed regions of smaller cells and fill in gaps in coverage between those cells.

Cell horizontal radius varies depending on antenna height, antenna gain and propagation conditions from a couple hundred metres to several tens of kilometres. The longest distance the GSM specification supports in the practical use is 35km or 22 miles. There are also several implementations of the concept of an extended cell, where the cell radius could double or even more depending on the antenna system, the type of terrain and the timing advantage[10].

Indoor coverage is also supported by GSM and may be achieved by using an indoor piocell station, or an indoor repeater with distributed indoor antennas fed through power splitters, to deliver the radio signals from an antenna outdoors to the separate indoor distributed antenna system. These are typically deployed when a lot of call capacity is needed indoors, for example

in shopping centres or airports. However, this is not a prerequisite, sinc indoor coverage is also provided by in-building penetration of the radio signals from nearby cells.

The modulation used in GSM is Gussian minimum shift keying (GMSK), a kind of continuous-phase frequency shift keying. In GMSK, the signal to be modulated onto the first carrier is first smoothed with a Gaussian low-pass filter prior to being fed to a frequency modulator, which greatly reduces the interference to neighbouring channels (adjacent channel interference)[10].

A nearby GSM handset is usually the source of the ''dit dit'' signal that can be heard from time to time on home stereo systems, televisions, computers and personal music devices. When this audio devices are in the near field of the GSM handset, the radio signal is strong enough that the solid state amplifiers in the audio chain function as a detector. The clicking noise itself represents the power burst that carry the TDMA signal. These signals have been known to interfere with other electrical devices, such as car stereos and portable audio players. This is a form of RFI. And could be mitigated or eliminated by use of additional shielding and/or bypass capacitors in these audio devices; however, the increased cost of doing so is difficult for a designer to justify.[10]

NETWORK STRUCTURE

The network behind the GSM system seen by the customer is large and complicated in order to provide all of the services which are required. It is divided into a number of sections among which are the following:-

The Base Station Subsystem(the base stations and their controllers)

The Network and Switching Subsystem

The GPRS Core Network

All of the elements in the system combine to produce many GSM services such as voice calls and SMS.

SUBSCRIBER IDENTITY MODULE

One of the key features of the GSM is the Subscriber Identity Module (SIM), commonly known as a SIM card. The SIM is a detachable smart card containing the user's subscription, information and phonebook. This allows the user to retain his or her information after switching handsets, alternatively, the user can also changer operators while retaining the handset simply by changing the SIM [11].

The use of the SIM card is mandatory in the GSM world. Without it, a mobile phone cannot communicate with another and vice-versa.

FREQUENCY GENERATION AND RECEPTION

The frequency is generated and received by means of any mobile phone, which has an inbuilt transmitter and receiver.

MOBILE PHONE HISTORY[12]

Cells for mobile phone base stations were introduced by Bell Labs engineers at AT&T in 1947 and further developments were carried out at the labs during the 1960s. Radiophones have a history that goes back to the Second World War with the military use of telephony links and civil services in the 1950s, while hand-held cellular radio devices have been available since 1983. Due to their low establishment cost and rapid deployment, mobile phone networks have since spread rapidly throughout the world, outstripping the growth of the fixed telephony.

In 1945, the zero generation(0G) of mobile telephones was introduced.0G mobile telephones, such as Mobile Telephone Service, were not officially categorized as mobile phones, since they

did not support the automatic change of channel frequency during calls, which allows the user to move from one cell (the base station coverage area) to another cell, a feature called ''handover''. In 1970, Bell labs invented such a ''call handoff'' feature, which allowed mobile phone users to travel through several cells during the same conversation. The invention of the first practical mobile phone for handheld use in non-vehicle setting has been widely attributed to Motorola. Using a modern and slightly heavy portable handset, they made the first call on a handheld mobile phone in April, 1973.

Fully automatic cellular networks were first in traduced in the early to mid 1980s (the 1G generation) with the Nordic mobile Telephone (NMT) system in 1981. Until the early 1990s, most mobile phones were too large to be carried in a jacket pocket, so they were typically installed in vehicles as car phones. With the miniaturization of digital components, mobile phones have become increasingly handy over the years.

CULTURE, CUSTOMS AND ETIQUETTE

In less than twenty years, mobile phones have spread out from the few business elites to being useful for anybody. They have been transformed from being rare and expensive pieces of equipment to low-cost handy items. A survey has it that there are more handsets in the UK today than there are people.[13] IT has given poor people in isolated communities access to services that are considered elementary human rights, such as medical and legal advice. The mobile phone itself has also become a fashion object of enormous value, with users decorating, customizing and adding accessories to their mobile phones to reflect their personality. This has emerged as its own industry. The sale of commercial ringtones exceeded $2.5billion in 2004[11]. The use of mobile phones is strongly discouraged in certain regions. Mobile phone etiquette has become an important issue with handsets ringing in lecture rooms, public gatherings and

functions. Users often speak at increased volume which has lead to places like bookshops, libraries, movie theatres, doctor's offices and house of worships posting signs prohibiting the use of mobile phones, and in some places installing signal-jamming equipment to prevent usage (although in many countries including Nigeria, the use of such equipment is not encouraged). Some new buildings such as auditoriums have installed wire mesh in walls (turning the building into a Faraday cage) which prevents any signal getting through, but does not contravene the jamming laws. Presently in Nigeria, the rules regulating mobile services are administered by the Nigerian Communications Commission (NCC).

While few jurisdictions have banned motorist from using mobile phones while driving outright, some have banned or restricted drivers from using hand-held mobile phones while exempting phones operating in hands-free fashion. Obviously, a driver will be distracted while operating a mobile phone which could result in dire consequences.

Some countries have mobile news services from the operators which expands the applications of these devices.

CHAPTER THREE

3.1 DESIGN AND IMPLEMENTATION

The block diagram of the security system is shown below

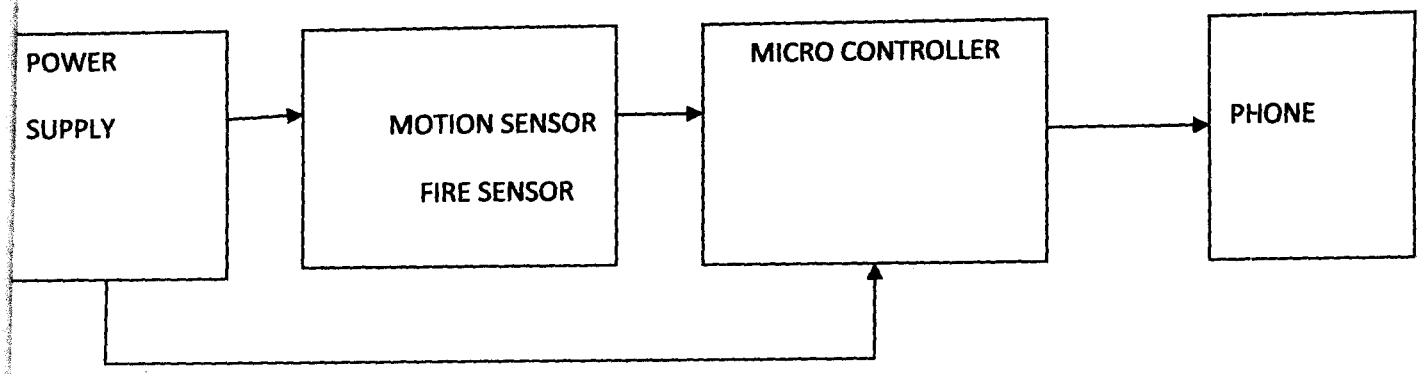

Fig 3.1 Block Diagram of the Home Security System

3.2 POWER SUPPLY UNIT

3.2.1 DESIGN OF POWER SUPPLY UNIT

Most electronic devices and circuits require a DC source for their proper operation, and a typical regulation and load. The complete circuit diagram of the power supply unit is as shown below:

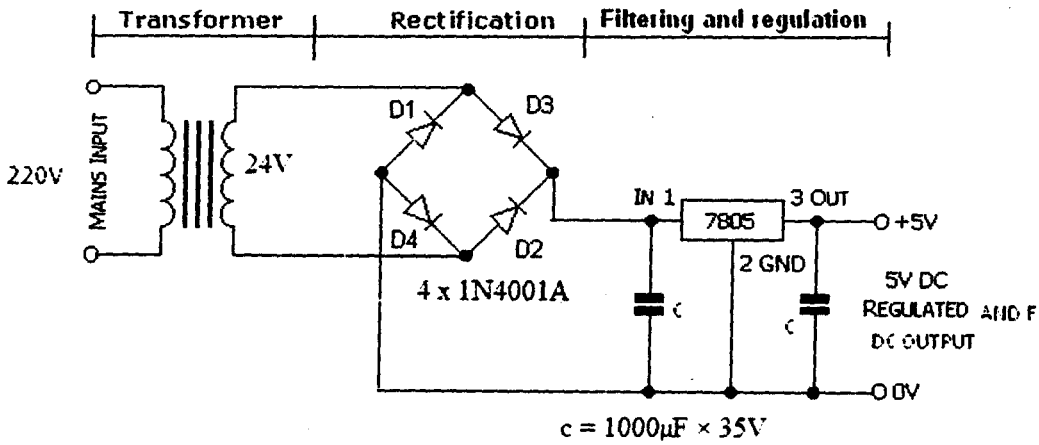

Fig. 3.2 Circuit Diagram Of Power Supply Unit

The main voltage of 220V is stepped down by a 220V/24V transformer and rectified by the use of a full – wave bridge diode rectifier using four 1N4001A diodes. It is then filtered by the use of an electrolytic capacitor of value 1000μF × 35V. The AC ripple free DC voltage is regulated using a 7805 regulator, to give a steady DC output voltage of 5V.

$C = I^{dt}/_{dv}$ (1)

Generally, dv which is the ripple voltage is chosen to be 30% of V_p, where V_p is the peak voltage.

Therefore, $V_p = V_{rms}\sqrt{2}$ (2)

Where $V_{rms} = 24V$, since a transformer of 220V/24V is being used.

$V_p = 24 \times \sqrt{2}$

$= 33.94V$

For bridge rectifier,

$V_{p(out)} = V_{p(in)} - 1.4V$ (3)

Since 0.7V drops across a diode whenever it conducts, only two diodes will conduct at a time.

Therefore,

$V_{p(out)} = 33.94V - 1.4V$

$= 32.54V$

$dv = ({}^{30}/_{100}) \times 32.54V$

$= 10.84V$

Therefore,

$$C = \frac{1 \times 0.01}{10.84}$$

$= 0.000922F$

$= 922\mu F$

So, the commercial values of 1000μF, 35V will be used in or

$$dv = \frac{1 \times 0.01}{1000 \times 10^{-6}} = 10\text{V}$$

This means that the output waveform goes from a peak value of 32.54V to

(32.54 – 10)V = 22.54V

It may be noted that the input voltage to the IC regulator must be at least 2V above the output voltage in order to maintain regulation. Therefore, the peak value of 32.54V to 22.54V is acceptable, since the output voltage is 5V. The ripple is regulated by the 7805 regulator, to a negligible value.

The average voltage going to 7805 is calculated by

$V_p - 0.5dv$ (4)

$= 32.54 - (0.5 \times 10)$ V

$= 32.54 - 5$

$= 27.54$V

3.3 DESIGN OF INPUT TRANSDUCERS

Two transducers were utilized, one for detecting fire outbreak and the other for bridge of security by intruders. A temperature sensor was used in detecting fire and it works with the fact that any fire accident will immediately increase the temperature of the surrounding environment while a LASER-LDR sensor was used for motion, both of which are further described below

3.3.1 DESIGN OF TEMPERATURE SENSOR

The sensing unit for the fire outbreak detection was effectively designed by the use of a thermistor. It works on the principle of variance of resistance of some materials with

temperature. There are two basic types available the PTC (Positive-temperature-Coefficient) and the NTC (Negative-Temperature-Coeffiecient). For PTC the resistance will rise with increase in temperature and with NTC the will reduce with decrease in temperature. A PTC thermistor was used. To further increase or make its sensitivity flexible an LM358 operational amplifier was used together with it which serves as a voltage comparator. The circuit arrangement is shown below.

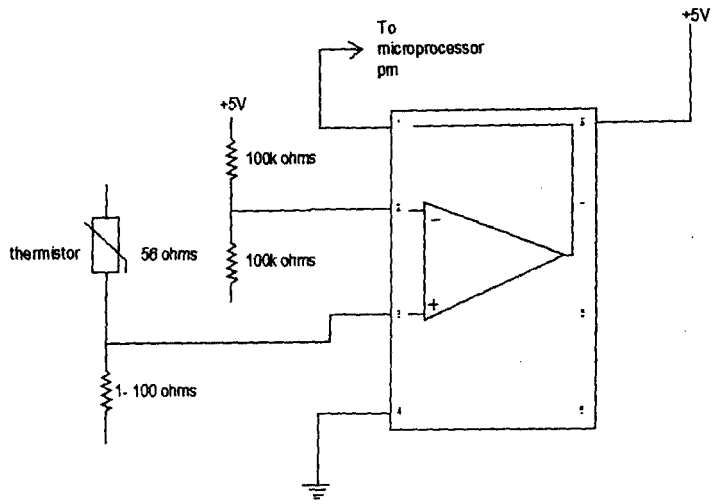

Fig 3.3 Circuit Diagram Of The Temperature Sensor

The output pin 1 of the LM358 operational amplifier gives a voltage value of 3.8V when the voltage at pin 3 is at a lower level than that of pin 2 and gives a value of 0V when the voltage of pin 3 is at a higher level than pin 2. A fixed voltage value of 2.5V is applied across pin 2 through the voltage divider between the two 10kΩ resistors. The value of voltage at pin 3 however lies on which of the two resistance (that of the thermistor or that of the variable resistor) is higher. Under normal condition, the resistance of the thermistor is 56Ω and as the value of the variable resistor is set to 60Ω, the voltage applied across pin 3 and ground is

$$\frac{60}{56+60} \times 5 = 2.6\Omega \quad (5)$$

Which is higher than that of pin 2 to give a logic level of 1 at output pin 3 (that is 3.8).

As soon as the temperature increases above normal the resistance rises to about 72Ω and the voltage across pin 3 becomes

$$\frac{60}{72+60} \times 5 = 2.273V \quad (6)$$

Which is lower than 2.5V for pin2 and in turn changes the output (pin1) to a logic level of 0V. The microcontroller has been set to respond to this logic level by sending the fire alert message.

3.3.2 DESIGN OF LASER BASED MOTION SENSOR

The LDR (Light Dependent Resistor) is an electronic component whose resistance reduces with the intensity of light falling or its surface. A very low resistance of 150Ω it's resistance at full intensity and a relatively high value of 400kΩ where there is total darkness. The microcontroller has a pull up resistor value of 100kΩ (internal) and all the three factors were considered in building the sensor shown in the figure below.

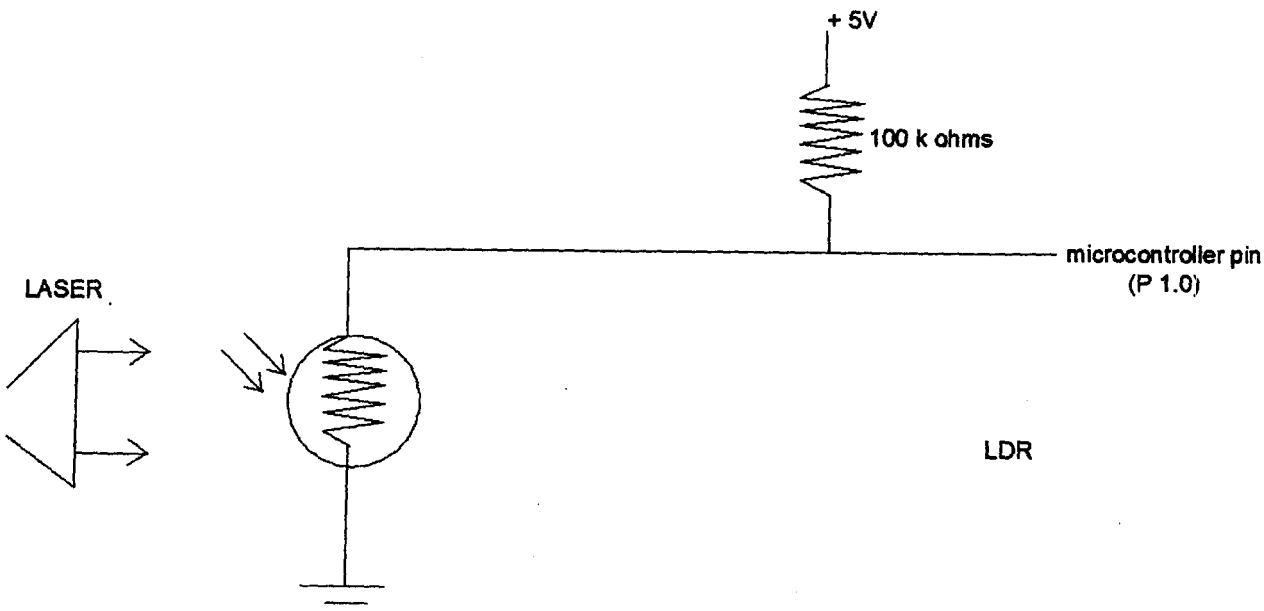

Fig 3.4 Circuit Diagram Of The Motion Sensor

When the Laser beam is focused on the LDR, the resistance is 150Ω and the microcontroller pin is at a voltage level of

$$\frac{150}{150\times100000} \times 5 = 0.00749 \cong 0V \quad (7)$$

Thus the pin is at a logic level 0. However when an intruder cuts the path of light the resistance of the LDR rises to 400kΩ and the applied voltage is

$$\frac{400}{400+100} \times 5 = 4V \quad (8)$$

Thus a logic level of 1 is applied at the pin 1.0 of the microcontroller and effectively triggering the SMS unit by program response.

3.4 DESIGN OF OUTPUT DRIVERS

Three output electronic switches are used to control the phone (NOKIA) as there are three basic switches of the phone used these are the power button, select button and scroll down button. PNP transistors (BC638) are used.

The select and scroll down buttons configurations differ from the power button configuration and the figure below shows both connections

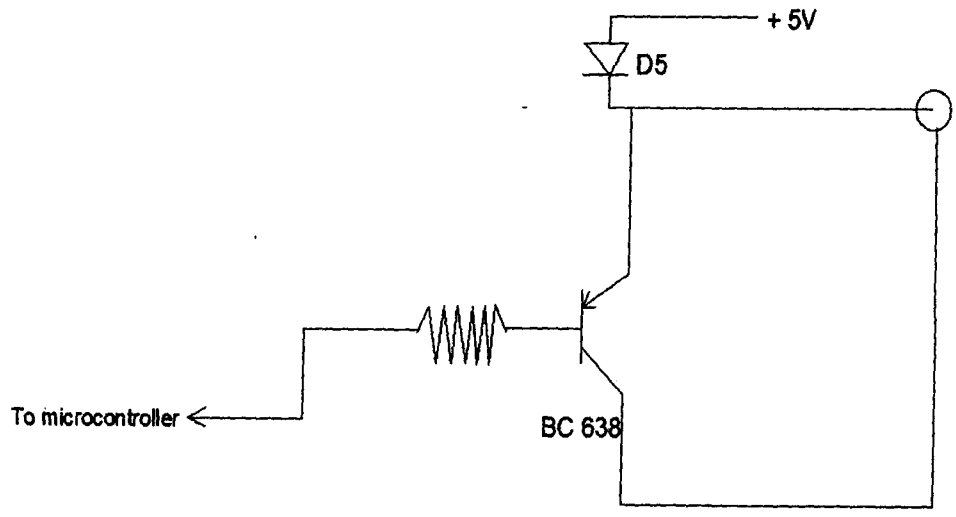

Fig 3.5 Transistor Switching Circuit For The Power Button

The resistor 10kΩ limits the base current of the transistor to avoid damaging it and the diode D5 prevents backflow of current to other buttons of the phone when the power button is switched ON.

To switch the power button the BC638 transistor's base needs a low logic level from the microcontroller.

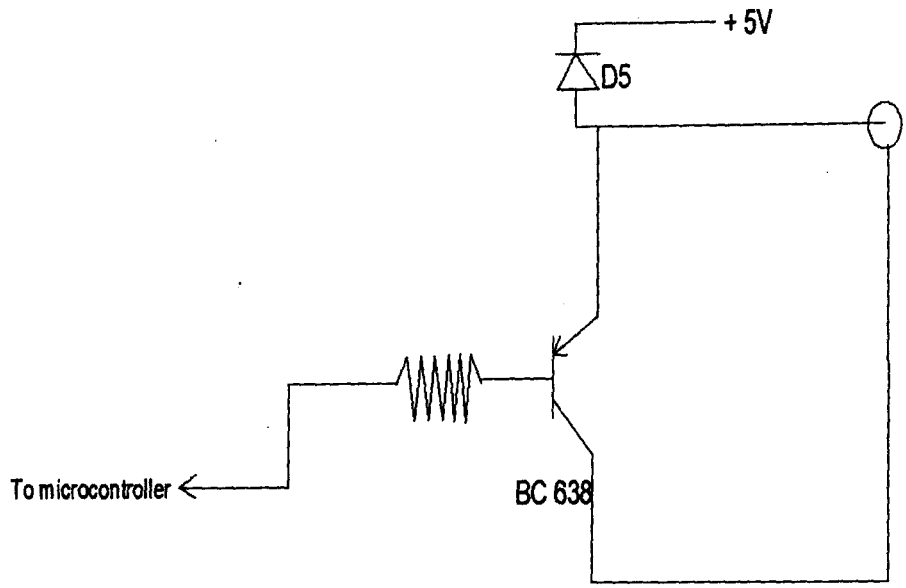

Fig 3.6 Transistor Switching Circuit For Select And Scroll Button

3.5 MICROCONTROLLER UNIT

3.5.1 MICROCONTROLLER

A microcontroller is a single chip that contains the processor (the CPU), non-volatile memory for the program (ROM or flash), volatile memory for input and output (RAM), a clock and an I/O control unit. Also called a "computer on a chip," billions of microcontroller units (MCUs) are embedded each year in a myriad of products from toys to appliances to automobiles. For example, a single vehicle can use 70 or more microcontrollers.

The pin diagram of the 8051 shows all of the input/output pins unique to microcontrollers:

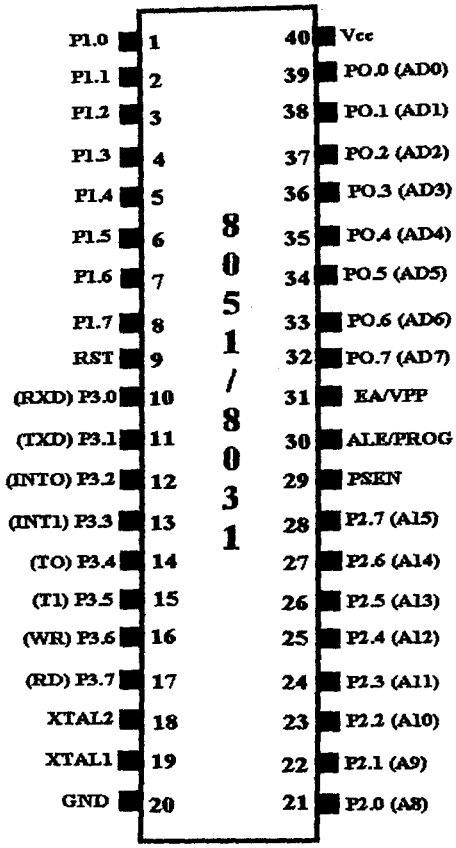

Fig 3.7 Pin diagram of the 8051 Microcontroller

The following are some of the capabilities of 8051 microcontroller.

Internal ROM and RAM

I/O ports with programmable pins

Timers and counters

Serial data communication

The 8051 architecture consists of these specific features:

16 bit PC &data pointer (DPTR)

8 bit program status word (PSW)

8 bit stack pointer (SP)

Internal ROM 4k

Internal RAM of 128 bytes.

4 register banks, each containing 8 registers

80 bits of general purpose data memory

32 input/output pins arranged as four 8 bit ports: P0-P3

Two 16 bit timer/counters: T0-T1

Two external and three internal interrupt sources Oscillator and clock circuits.[15]

89s52 MICROCONTROLLER

The AT89S52 used in this project is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller, which provides a highly flexible and cost-effective solution to many, embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt.[15]

For this project, the AT89S52 microcontroller was interfaced with Nokia GSM mobile phone to decode the received message and do the required action. The protocol used for the communication between the two is Assembly Language. The microcontroller pulls the SMS received by phone, decodes it, recognizes the Mobile no. and then Sends a message to the no.

3.5.2 PROGRAMMING THE AT89S52 MICROCONTROLLER

The Microcontroller was programmed with the use of assembly language and simulated by the use of edsim51 software before finally burning it on the chip.

The flow chart and program is shown below:

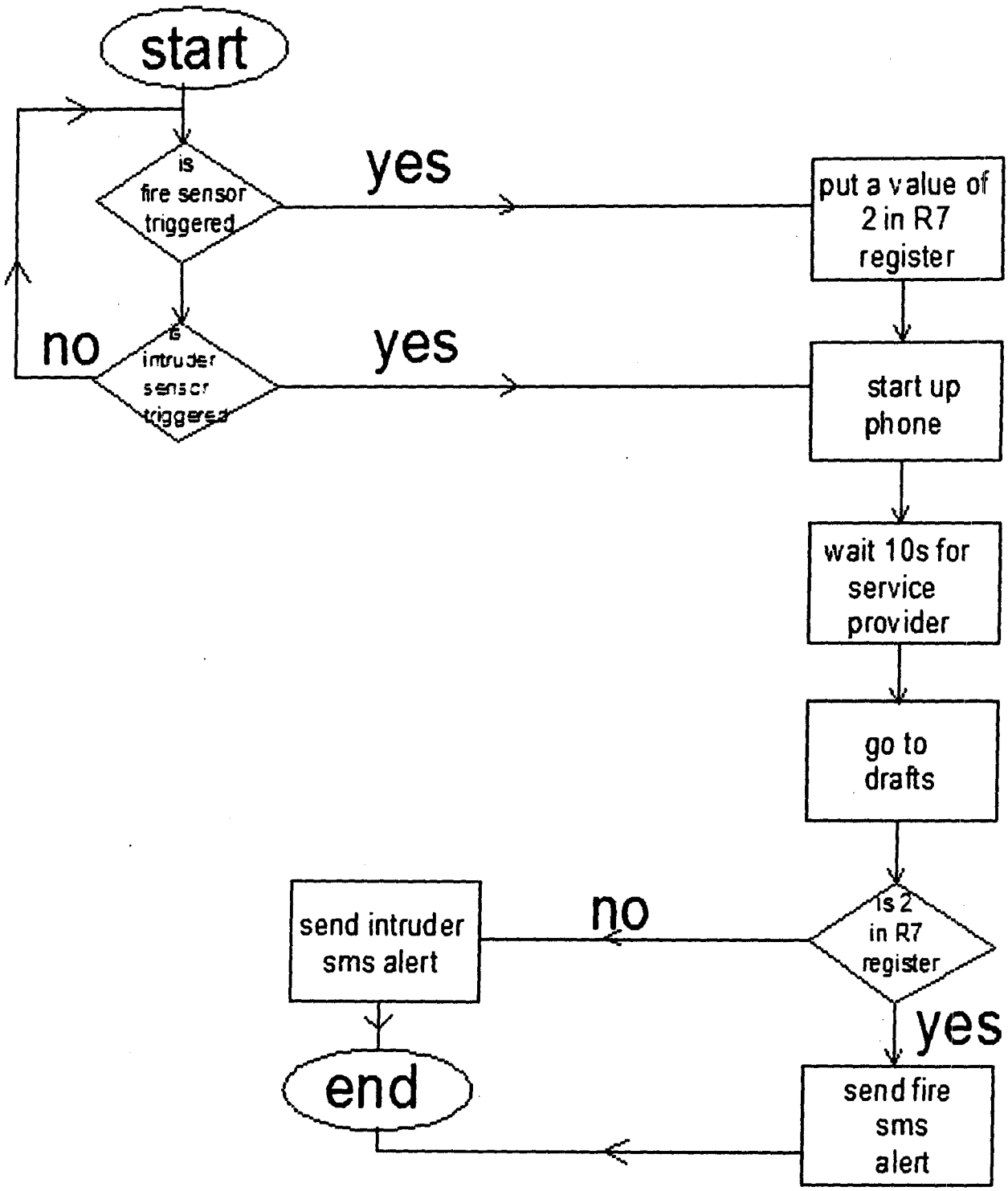

Fig 3.8 Microcontroller Flowchart

CIRCUIT DIAGRAM

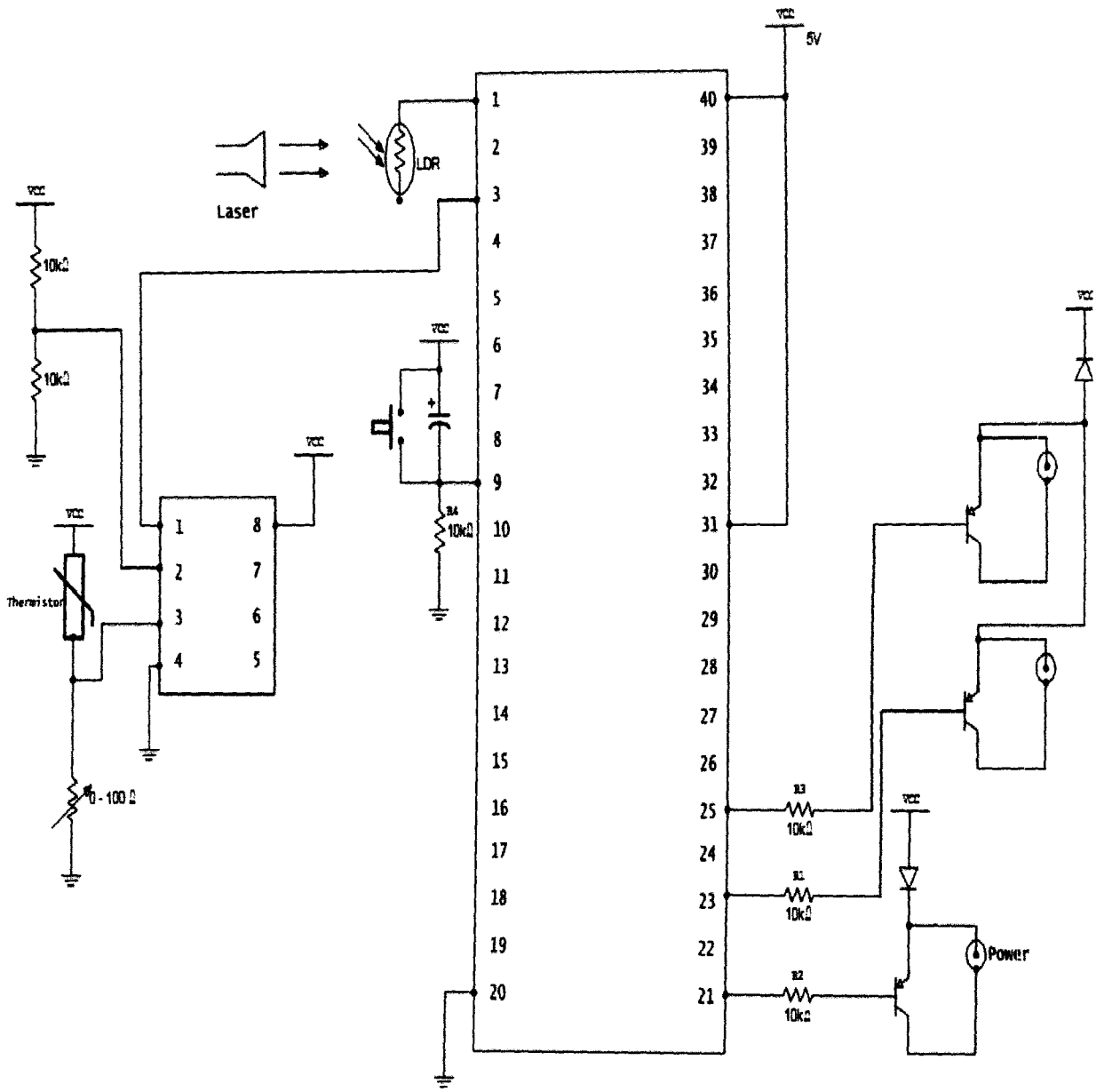

Fig 3.9 Circuit Diagram

CHAPTER FOUR

4.1 TESTING

At every stage of construction of the project, there was constant need for measurement of certain quantities to ensure that they conformed to the required/expected values.

For the testing of the project the most indispensable tool used was the multi-meter. A digital multi-meter (DMM) was used for measurement of voltages and resistances.

Communication test was performed after connecting the circuit appropriately to check if the circuit will be able to send a SMS message to its appropriate destination.

The power supply was tested to ensure accurate supply of 5V voltage. The output pin 3 of the voltage regulator was also tested and a value of 4.97V was read, after this the capacitor and a value of 4.98V was read.

4.2 DISCUSSION OF RESULT

From the results obtained, it was observed that the designed system is highly effective and has a wide range for security applications such as car security systems, bank security systems, home systems.

CHAPTER 5

5.1 CONCLUSION AND RECOMMENDATION

The aim of this project was to design a remote security system that would send an SMS when an intrusion has occurred and in terms of robustness, flexibility, simplicity, and reduction in size, the aim of the project was met.

The cost of components was reduced owing to the fact that the 8051 microcontroller was programmed to perform most of the required functions, hence fewer components were required.

5.2 PROBLEMS ENCOUNTERED

Some problems that were encountered at various stages and in general include:

- Unavailability of some components in the market.
- Failure of some components to function as in the ideal case.
- Improper alignment/isolation of wires causes unnecessary triggering of the device

  Power failure.

5.3 RECOMMENDATIONS

There exists substantial room for improvement on the project. To develop the design for further work or commercial use the following suggestions should be considered;

I. To improve the project, some changes could also be made to the code to make it more robust against potential sources of errors.

II. Software development would make it not only possible to send text messages but to receive text message, make calls and receive calls.

III. Another element to consider would be the possibility replicating the project based on IP in case of GSM network failure.

IV. In place of phone, GSM modems could be used; GSM modems are readily available, can be embedded into any design and are very portable.

V. A backup battery could also be incorporated should there be absence of power supply

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