DESIGN AND CONSTRUCTION OF MICROCONTROLLER BASED VEHICLE TRACKING AND DEMOBILIZING SYSTEM USING GPS AND GPRS

BY

YUSUF MUSTAPHA

(EEE/15D/5367)

JANUARY, 2020

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A PROJECT REPORT SUBMITTED TO THE DEPATMENT OF ELECTRICAL ELECTRONICS ENGINEERING, SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY, MODIBBO ADAMA UNIVERSITY OF TECHNOLOGY YOLA, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF BACHELOR OF ENGINEERING.

JANUARY, 2020

DECLARATION

I hereby declare that this project report was written by me and it is a record of my own research work. It has not been presented before in any previous application for a Bachelor's Degree. References made to published literature have been duly acknowledged.

………………………. Date: ………………….……

YUSUF MUSTAPHA
(Student)

The above declaration is confirmed

..……………………….. Date…………….................

ENGR. MATHEW K. LUKA
(Supervisor)

CERTIFICATON

This project entitled "DESIGN AND CONSTRUCTION OF MICROCONTROLLER BASED VEHICLE TRACKING AND DEMOBILIZING SYSTEM USING GPS AND GPRS" by YUSUF MUSTAPHA. (EEE/15D/5367) meets the regulations governing the award of the bachelor's degree of the Modibbo Adama University of Technology, Yola and is approved for its contribution to knowledge and literary presentation.

………………………… Date: …………………………

ENGR. MATHEW K. LUKA
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ENGR. I. M VISA

(Head of department)

....….. Date: …….……………...........

ENGR. Dr. JONATHAN A ENOKELA

(External Examiner)

DEDICATION

This project report is dedicated to my brother SULE OMIKA, my wife and my children.

ACKNOWLEDGEMENTS

All thanks and praises be to the Almighty Allah Who provided me with those things which are suitable for the completion of this project, overlook my mistakes, pardoned my sins, and took lenient look to my disorderly conduct. May the peace and blessings be upon the last prophet (S.A.W) and his house-hold. There are many people who have helped me directly or indirectly in the successful completion of my project. I would like to take this opportunity to thank one and all.

First of all, I would like to express my deep sense of gratitude towards my project supervisor Engr. MATHEW K. LUKA for always being available whenever I require his guidance as well as for motivating me throughout the project work, and to the Head of the department of Electrical and Electronics Engineering Engr. Dr .I.M. Visa and the entire lecturers in department for being not just a lecturer but more than a father.

ABSTRACT

The objective of this project is to design and construct a GSM and GPS based advanced vehicle tracking demobilizing system. In this project, a device was developed that would track and provide complete vehicle location and send the information to a control unit at the user side. This kind of device is able to provide complete location information to user over mobile phone by sending SMS through GSM modem. This SMS contains longitude and latitude of the location of vehicle. Microcontroller is the central processing unit CPU of this project. Microcontroller gets the coordinates from GPS modem and then it sends this information to the user in Text SMS. GSM modem is used to send this information via SMS. The incorporation of GPS and some modules to monitor some parameters of vehicle like overheat or PMS leakage, and also help to detect accident with the help of high sensitivity vibration sensors are recommended for future works.

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LIST OF ABBREVIATION AND SYMBOLS

List		Definitions
1.	GSM	Global System for Mobile Communication
2.	GPS	Global Positioning System
3.	GNSS	Global Navigation Satellite System
4.	SIM	Subscriber Identity Module
5.	LED	Light Emitting Diode
6.	SMS	Short Message Service
7.	IDE	Integrated Development Environment
8.	DC	Direct Current
9.	AVL	Advance Vehicle Locator
10.	I/P	Input/output
11.	PIC	Programmable integrated Circuit
12.	GPRS	General Packet Radio Service
13.	ROM	Read Only Memory
14.	RAM	Random Access Memory
15.	EEPROM	Electrical Erasable Programmable Read Only Memory
16.	AVR	Advanced Virtual RICS or Alf and Vegard RISC
17.	USART	Universal Synchronous and Asynchronous Receiver and Transmitter
18.	GMSK	Gaussian minimum-shift keying
19.	ISP	In-System Self-Programmable Flash program
20.	TXD	Transmitter
21.	CMOS	Complementary Metal Oxide Semiconductor
22.	ADC	Analogue to Digital Converter
23.	RISC	Reduced Instruction-set- Computer
24.	CISC	Complex Instruction Set Computer
25.	CPU	Central Processing Unit
26.	RST	Reset
27.	GND	Ground
28.	RXD	Receiver
29.	VCC	Collector-voltage supply

CHAPTER ONE: INTRODUCTION

This chapter will be covering the general background of this project, problem statement, aims and objectives, significant of the project scope/limitations.

1.1 Background

The “Vehicle Tracking System using Global Positioning system (GPS) and General Packet Radio Service (GPRS) Technology” project is designed and developed to accommodate the needs of today’s vehicle fleet company to keep track on their fleets. It is a very useful and versatile device, and in fact it can be used by anybody with the need to keep track on their valuable goods and not just by the vehicle fleets company. The desired output from the system will be the data such as position, speed, and time obtained from the GPS receiver and will display on the owners mobile phone [1].

For the implementation of this system, use navigational technologies such as GPS, GPRS and database technologies. The system will be installed in a vehicle to allow the owner to track the vehicle’s location, this system will use GPS and GPRS module. Global Positioning System can determine the precise location of a vehicle. The GPS antenna present in the GPS receiver module receives the information from the GPS satellite in NMEA (National Marine Electronics Association) format and this information transmits to a server using GPRS module. GPRS provide TCP/IP Transmission Control Protocol/Internet Protocol) connection with tracking server. Tracking server has receiver vehicle location information via network and stores this information in database [2]. This information will be available to authorized users of the system over the internet on map. GPS is a satellite based navigation system, it is made up of 24 satellites, placed into the space. These satellites transmit coded information towards GPS receiver, the transiting is to identify vehicle locations on earth by measuring the distance from the satellites. GPRS network is a packet oriented data service, it uses the existing GSM network to transmit and receive TCP/IP based data to and from GPRS device/module. It supports packet switched data services such as email and web browser. It provides an always on functionality, without continuous consumption of resources. GPRS allows network operators to implement IP-based core architecture for data applications. The GPRS can transfer data at the maximum rate of 115.2 kbps. It is most suitable for a real-time tracking management system [3].

A vehicle tracking system consists of an electronic device installed on a vehicle so that it could be track by its owner or a third-party for its position. Most of today's vehicle tracking system uses Global Positioning System (GPS) to get an accurate reading of the vehicle position. Communication components such as cellular (GPRS) and satellite transmitter will be combined to transmit the vehicle's position to remote user. Vehicle's information can be viewed by using software on a computer. Vehicle tracking systems are commonly used by fleet operators for fleet management functions such as routing, dispatch, on-board information and security. Other applications include monitoring driving behaviour, such as an employer of an employee, or a parent with a teen driver. Vehicle tracking systems are also popular in consumer vehicles as a theft prevention and retrieval device. Police can simply follow the signal emitted by the tracking system and locate a stolen vehicle. When used as a security system, a Vehicle Tracking System may serve as either an addition to or replacement for a traditional Car alarm. The existence of vehicle tracking device then can be used to reduce the insurance cost, because the loss-risk of the vehicle drops significantly.

Vehicle tracking is also useful in many other applications like Asset Tracking scenarios where companies needing to track valuable assets for insurance or other monitoring purposes can now plot the real-time asset location on a map and closely monitor movement and operating status. Meanwhile, in field sales mobile where the situation of sales professionals can easily access real-time locations. For example, in unfamiliar areas, they can locate themselves as well as customers and prospects, get driving directions and add nearby last-minute appointments to itineraries. Benefits include increased productivity, reduced driving time and increased time spent with customers and prospects. It has been reported that, with this system, the users have been able to get many benefits by auditing employee hours to insure better utilization of vehicles. This system has also proof its ability to reduce mileage hence, reduce the fuel costs through monitoring private use of vehicles. Reducing the average speed of the vehicles also improve the fuel efficiency. Productivity also will be increased through better budgeting of time and resources [4].

The tracking hardware is installed inside the vehicle in such a manner that it is not visible from outside the vehicle. Hence, it works as an undisclosed unit which continuously sends the coordinates to the monitoring centre.

1.2 Problem Statement

In this fast moving and insecure world, it becomes a basic necessity to be aware of one's expenses and safety. With the rapid increase in pump price, spare part of vehicles and car theft, there is an increase need of tracking a vehicle due to increase in fuel consumption, maintenance cost and car theft incidence that are unsolved by the Police.

The project will help to reduce fuel, maintenance cost and car theft incidence. It will also help to recovered stolen motor vehicles. The tracking system will give all the specification about location of a vehicle. The system utilizes geographic position and real time information from the GPS.

1.3 Aim and Objectives

The aim of this project is to design a cost effective GPS and GPRS vehicle tracking system and the objectives are:

Help owners to view the present location of the target vehicle on Google map.

1. To help reduce fuel,
2. To reduce maintenance cost of the vehicle,
3. To reduce car theft.

1.4 Significance of Vehicle Tracking System

The in-vehicle tracking device or unit working along with a central server and a software, which let the user or owner of a car to know the whereabouts of his own vehicle, surely comes with several benefits. The GPS and GPRS installed inside the vehicle fetches its location information and send it to owner on regular intervals according to user's preferences, in order to remain up to-date all the time. As all the relevant information is displayed on the screen, it is very convenient for the user to monitor and take any actions in case of an emergency and monitoring also discourages dangerous and inefficient driving practices of drivers which lead to increased vehicle security and driver safety [5] .

The vehicle tracking system plays a vital role if it is used in any companies or organization for any kind of delivery purposes. Since the driver is being aware of the fact that the car is constantly being monitored so one would be careful while driving and take shortest possible route to reach destination right on time. This system can also be named as an anti-theft tracking system as this advanced yet affordable system ensures the recovery of stolen vehicles too. If the car does not get to designated location or being used by unauthorized user, the location can be traced and then notified to police to reach the unauthorized location where the vehicle is residing and thus this vehicle tracking system ensures car safety as well.

1.5 Scope and Limitation

The scope of this project is to study and design the GPS and GPRS Vehicle Tracking system that can give an output of information such as time, and position, from the GPS receiver. The users will also be able to send command to GPS receiver using GPRS technology.

The limitation is that GPS takes time to connect with the network due to poor weather conditions. For GPS to work properly, it needs to have a clear view of the sky. Therefore, due to obstacles like tall buildings which block views of the sky, often cause multipath error to GPS receiving signal.

CHAPTER TWO: LITERATURE REVIEW

In this chapter, the overview of vehicle tracking and demobilizing, the articles of the GPS history and GPRS communication technology, brief on the components theory, a couple of similar projects are covered.

2.1 Overview of Vehicle Tracking and Demobilizing

A vehicle tracking system consists of an electronic device installed on a vehicle so that it could be tracked by the owner or a third party for its position. Since the concept of security has become a major concern for our world and to most vehicle users, auto mobile manufacturers employed the idea of vehicle security system which do not just help the human agent but could on their own completely provide all the necessary security requirement without human supervision.

An automobile security system (ASS) as a form of vehicle security system combines with the installation of electronic device on in a vehicle with purpose designed computer software to enable the owner to track the location while collecting data in the process. In this kind of security system a telecommunication system and method is used for instructing a device interfaced with a vehicle electrical system to activate or deactivate specific electric device such as ignition, car lock system and the electronic fuel injector using a cellular network. This can be accomplished by utilizing a unit containing the GPRS module which is interconnected to ‘‘power interface unit’’ (PIU). The (PIU) is directly interconnected to the vehicles electrical system and ignition. The GPRS when triggered will send notification via SMS or receive instruction to activate or deactivate electrical devices depending on the nature of instruction given by the user.

2.2 Review of Related Works

There have been many other projects on the internet that uses the same concepts applied on this project. But most of the projects use a combined GPS and GSM module, as it is easier to operate.

GPS/GSM tracking system using Telit GM862 module can be put in the car and it could trigger an alarm, if the car got stolen. It actually could tell a where it is [6].

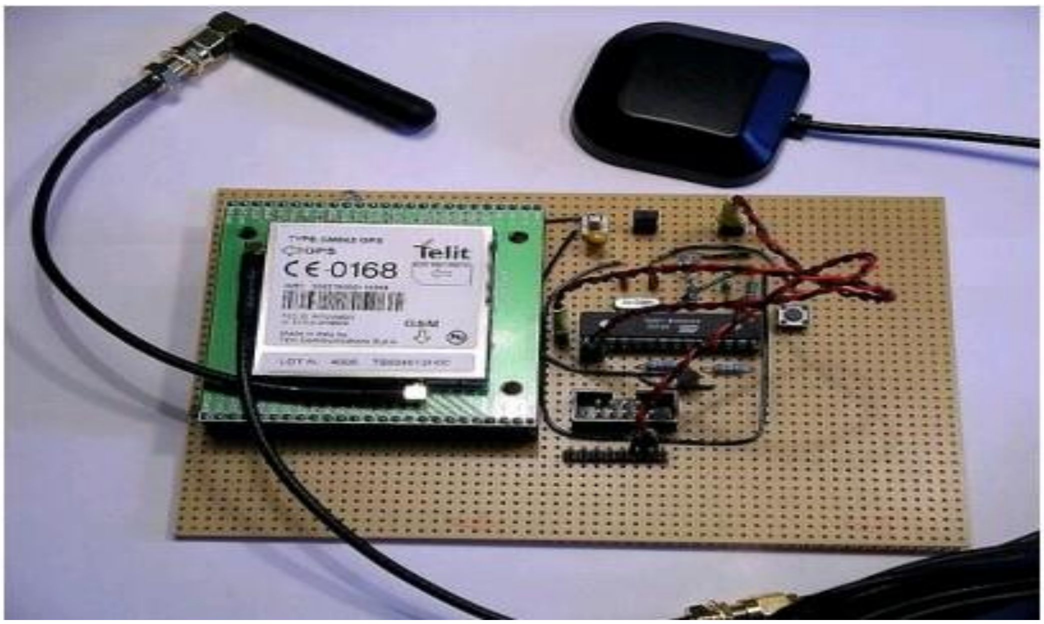

Figure 2.0 Telit GM862 module used for tracking system **[7]**

GPS tracking unit is a device that uses the Global Positioning System to determine the precise location of a vehicle or other asset to which it is attached. A GPS receiver is operated by a user on Earth, it measures the time taken by radio signals to travel from four or more satellites to its location, it then calculates its distance from each satellite, and from this calculation it determines the longitude, latitude, and altitude of that position. By following triangulation or trilateration methods the tracking system determines the location of the vehicle easily and accurately. Trilateration is a method of determining the relative positions of objects using the geometry of triangles. To "triangulate," a GPS receiver accurately measures the time taken by the satellite to make its brief journey to Earth (less than a tenth of a second) and hence measures its distance from the satellite using the travel time of the radio signal. To determine the distance between it and the satellite, the measured time is multiplied by the speed of a radio wave that is 300,000 km (186,000 miles) per second. The coordinates of latitude and longitude can be sent to the user on request via SMS, or it may be transmitted and stored in the database, using a cellular or satellite modem that is the GPRS modem embedded in the unit. This enables the user to display \the asset's location on the Google map either in real time or later whenever the user wants the data for further analysis [8].

In [9]Kai-Tai Song and Chih-Chieh Yang have a designed and built on a real-time visual tracking system for vehicle safety applications. In their paper built a novel feature-based vehicle-tracking algorithm, automatically detect and track several moving objects, like cars and motorcycles, ahead of the tracking vehicle. Joint with the concept of focus of expansion (FOE) and view analysis, the built system can segment features of moving objects from moving background and offer a collision word of warning on real-time. The proposed algorithm using a CMOS image sensor and NMOS embedded processor architecture. The constructed stand-alone visual tracking system validated in real road tests. The results provided information of collision warning in urban artery with speed about 60 km/hour both at night and day times.

In this paper, the authors proposed a novel method of vehicle tracking and locking system used to track the theft vehicle by using GPS and GSM technology. This system puts into sleeping mode while the vehicle handled by the owner or authorized person otherwise goes to active mode, the mode of operation changed by in person or remotely. If any interruption occurred in any side of the door, then the IR sensor senses the signals and sends SMS to the microcontroller.

The controller issues the message about the place of the vehicle to the car owner or authorized person. When SMS was sent to the controller, it issues the control signals to the engine motor. Engine motor speeds are gradually decreases and come to the off place. After that all the doors will be locked. To open the door or restart the engine, authorized person needs to enter the passwords. In this method, tracking of vehicle place is easy and doors locked automatically, thereby thief cannot get away from the car[10].

Anil and S. Rajendra designed and developed an advanced vehicle tracking system in the real time environment. Whenever someone wants to steal vehicle by entering the wrong password then the system which is feed in vehicle sends a SMS to the owner of the vehicle. The other main aim of this project is to send the location of the vehicle if it meets any accident, if so it will immediately send the details of the locations like the latitude and the longitude using GPS module. So the user can get to know the exact location of the vehicle where it has met the accident. The user can use the latitude and the longitude which is obtained in the SMS to find the location of vehicle pointed out on the Google maps. And also if the driver of the vehicle has consumed the alcohol then the vehicle stops moving. The main aim is to get the information of the vehicle time to time. The system can be further improved by upgrading to stop at any point through the SMS. And also send the SMS to the nearest hospital and police station, so that further process can be easier. The project can be extended by adding an android application which can predict the nearest hospital according to the Latitude and Longitude obtained from the GPS device[11].

2.3 Review of Fundamental Concept

2.3.1 *History of Global Positioning System (GPS)*

The Global Positioning System (GPS) is the principal component and the only fully operational element of the Global Navigation Satellite System (GNSS). The history of the GPS program pre-dates the space age. In 1951, Dr. Ivan Getting designed a three-dimensional, position-finding system based on time difference of arrival of radio signals. Shortly after the launch of Sputnik scientists confirmed that Doppler distortion could be used to calculate ephemerides, and, conversely, if a satellites position were known, the position of a receiver on earth could be determined. Within two years of the launch of Sputnik the first of five low-altitude “Transit” satellites for global navigation was launched. In 1967, the first of three “Timation” satellites demonstrated that highly accurate clocks could be carried in space. In parallel with these efforts, the 621B program was developing many of the characteristics of today’s GPS system [12]. The figure below shows the Timation 1satellite.

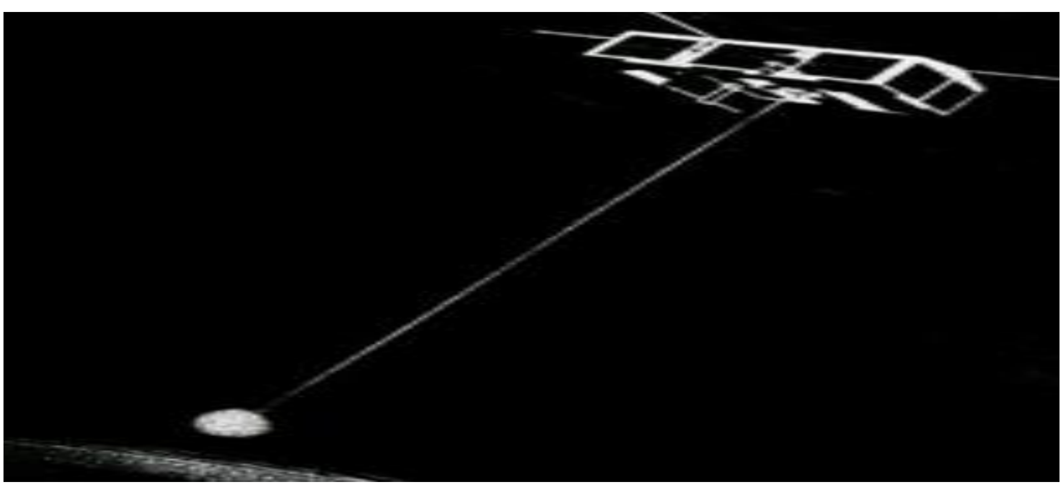

Figure 2.1 Timation 1 satellites [12]

In 1973 these parallel efforts were brought together into the NAVSTAR-Global Positioning System, managed by a joint program office headed by then-colonel Dr. Brad Parkinson at the United States Air Force Space and Missile Systems Organization. This office developed the GPS architecture and initiated the development of the first satellites, the worldwide control segment and ten types of user equipment. Today, it continues to sustain the system as the Global Positioning System Directorate of the Space and Missile Systems Center. All performance parameters for the system were verified during ground testing by 1978. Ten development satellites were launched successfully between 1978 and 1985 and the initial ground segment that would provide the critical uploads to the satellites was also developed. The initial constellation of 24 operational satellites was deployed between 1989 and 1994 and the system was declared “fully operational” in 1995. It has been sustained at that level or higher ever since.

The initial operational satellites transmitted authorized signals on two frequencies, designated L1 and L2, and a signal intended for open (civilian) use on the L1 frequency. GPS is currently engaged in a modernization program that will bring new and improves services to the global user community through new generations of satellites, referred to as Blocks. With the first Block IIR-M satellite (in 2005), a second civil signal was added (to L2) improving the quality of the system for civil users. Seven of these satellites were on orbit. With the first Block IIF satellite (in 2010), a third signal (L5) was added to help ensure the availability of GPS to civil aeronautical and search-and-rescue users (called the safety of life signal). The next generation of GPS satellites, GPS Block III, is in production. They will transmit another new civil signal on L1 that will provide more power and enable greater civil interoperability with other global and regional elements of the GNSS, such as Europe’s Galileo system, Japan’s Quazi-Zenith Satellite System and other [12].

In 1983, following the shoot-down of KAL-007 after straying off-course into prohibited airspace, the President of the United States directed that GPS would be made available for civilian use as a common good. The GPS civil signal was initially slightly degraded due to its potential military implications. However, in 2000, the President directed that the quality of the signal available to civilian users would no longer be degraded. In 2004, the President released a new U.S. National Space-based Positioning, Navigation, and Timing Policy. The 2004 policy placed the GPS system under the oversight of a National Space-based Positioning, Navigation and Timing Executive Committee that is co-chaired by the US Deputy Secretaries of Transportation and Defense, and made up of nine Departments and Agencies across the United States Government [13].

Although GPS was originally viewed as a unique capability, other nations have recognized the importance of this technology to their critical infrastructures and economies and are now in various stages of implementing GPS-like systems of their own. The GPS program has worked hard to ensure these multiple satellite-based navigation and timing systems can operate with compatibility, interoperability and transparency for all open signals. GPS made major technical contributions to analysis techniques that predict compatibility, so systems can share spectrum for interoperability while ensuring radio frequency compatibility is attained. In bilateral working groups and multinational fora, the U.S. Government and representatives from Japan, Europe, India, Russia, and China and other nations have moved toward common signal designs on L1 and L5 frequencies that will be used by civil signals in almost every system of the GNSS.

GPS has become a ubiquitous utility, required to be available to civil users around the world, at no cost, providing unprecedented timing, position and navigation accuracies with almost incalculable human benefits, it was developed initially as a military system. It is now the underpinning of incredibly broad civil applications and also, in keeping with its origins, amazingly accurate precision strike systems. This also has significant human benefit; since when conflict cannot be avoided, the history of the last two decades has shown that collateral damage and civilian casualties resulting from military actions are significantly less than was seen in pre-GPS conflicts [13].

2.3.2 Global Positioning System

The GPS is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to three or more GPS satellites. GPS technology can be described in terms of three segments:

Space Segment: Consists of twenty-four satellites orbiting 11,000 nautical miles above the earth.

Control Segment: Consists of 5 ground stations around the globe that manage the operational health of the satellites by transmitting orbital corrections and clock updates.

User Segment: Consists of various types of GPS receivers that can vary in complexity and sophistication [14].

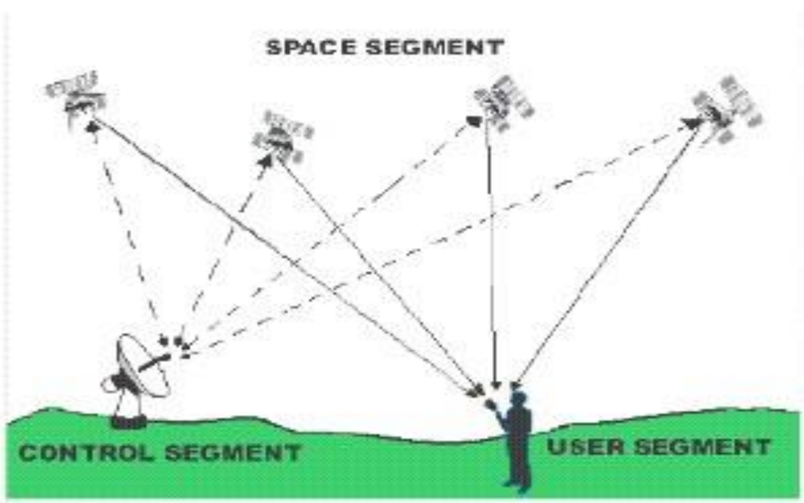

Figure 2.2 Schematic representations of GPS components. [14]

GPS receivers are able to identify their location when three GPS satellites triangulate and measure the distance to the receiver and compare the measurements. A fourth satellite measures the time to the receiver. The information from all four satellites is compiled to determine the location. The sophistication of a GPS receiver impacts the reliability and accuracy of the GPS data received [15].

2.3.3 General Packet Radio Services (GPRS)

General Packet Radio Service GPRS is a packet switched service based on Global System Mobile Communications GSM, an extensively deployed voice technology. GPRS is a 2.5G cellular network. It provides affordable and fast internet connections to service users. Billing is based on the amount of data transferred rather than on the connection time. This is achieved by allocating resources radio channels to users only when they need to send data. GPRS may offer data rates up to 171.2 kbps. GPRS utilizes most nodes in an existing GSM network; two additional nodes are introduced in the GSM network to support GPRS Serving GPRS Support node SGSN and Gateway GPRS Support Node GGSN, these two nodes constitute the core network of a GPRS sub-network and they are connected through an IP based GPRS backbone [15].

2.3.4 GPRS Module

The GPRS module is an easy add plug-in module that enables the system to communicate over the GPRS networks for reporting, control and programming. It can be used as primary communication or as a backup for the IP or PSTN communications in case of communication failure.

Reporting events to monitoring stations can be done over voice, SMS or GPRS using the RISCO IP Receiver. Event can be reported in SIA/IP, SIA and Contact ID monitoring protocols. Using the GPRS module, end users can obtain system control using DTMF or SMS in addition, user can enjoy peace of mind by receiving real time SMS, voice messages and email alert. The GPRS module can supports two-way communication [15].

CHAPTER THREE: DESIGN AND CONSTRUCTION PROCEDURE

This chapter deals with details and orderly presentation of the design and construction procedures of this system (GSM and GPS based advanced vehicle tracking system). In this project microcontroller is interfaced serially to a GSM Modem and a GPS Modem. A GSM modem is used to send the position (Latitude and Longitude) of the vehicle from a remote place to the monitoring Centre. The GPS modem will continuously give the data i.e. the latitude and longitude indicating the position of the vehicle. This vehicle tracking system takes input from GPS and send it through the GSM module to desired mobile/laptop using mobile communication, the transmitting side performs tracking functionality. It tracks the vehicle through GPS and transmits its current location, at the monitoring center, various software's are used to plot the Vehicle on a map.

3.1. System Description

The building block diagram of the GSM and GPS based advanced vehicle tracking system is as shown in figure 3.1 below. It consists of the power supply unit, the control unit (which is the microcontroller Atmega328p), the GPS modem with its antenna and the GSM modem with its own antenna.

The power supply unit powers the entire circuit, it has in it an LM 7805 voltage regulator and some capacitors which regulate 12V to 5V, the microcontroller Atmega328p is the control unit, it is a programmable chip and it controls the activities of the entire system, the GPS modem help us calculate accurately the geographical location, the GPS antenna help us receive the information from the GPS satellites, The GSM modem now help us to send the location information through GSM network, the GSM modem has a valid SIM card with a sufficient recharge amount to make outgoing SMS. The circuits are powered by +5v DC

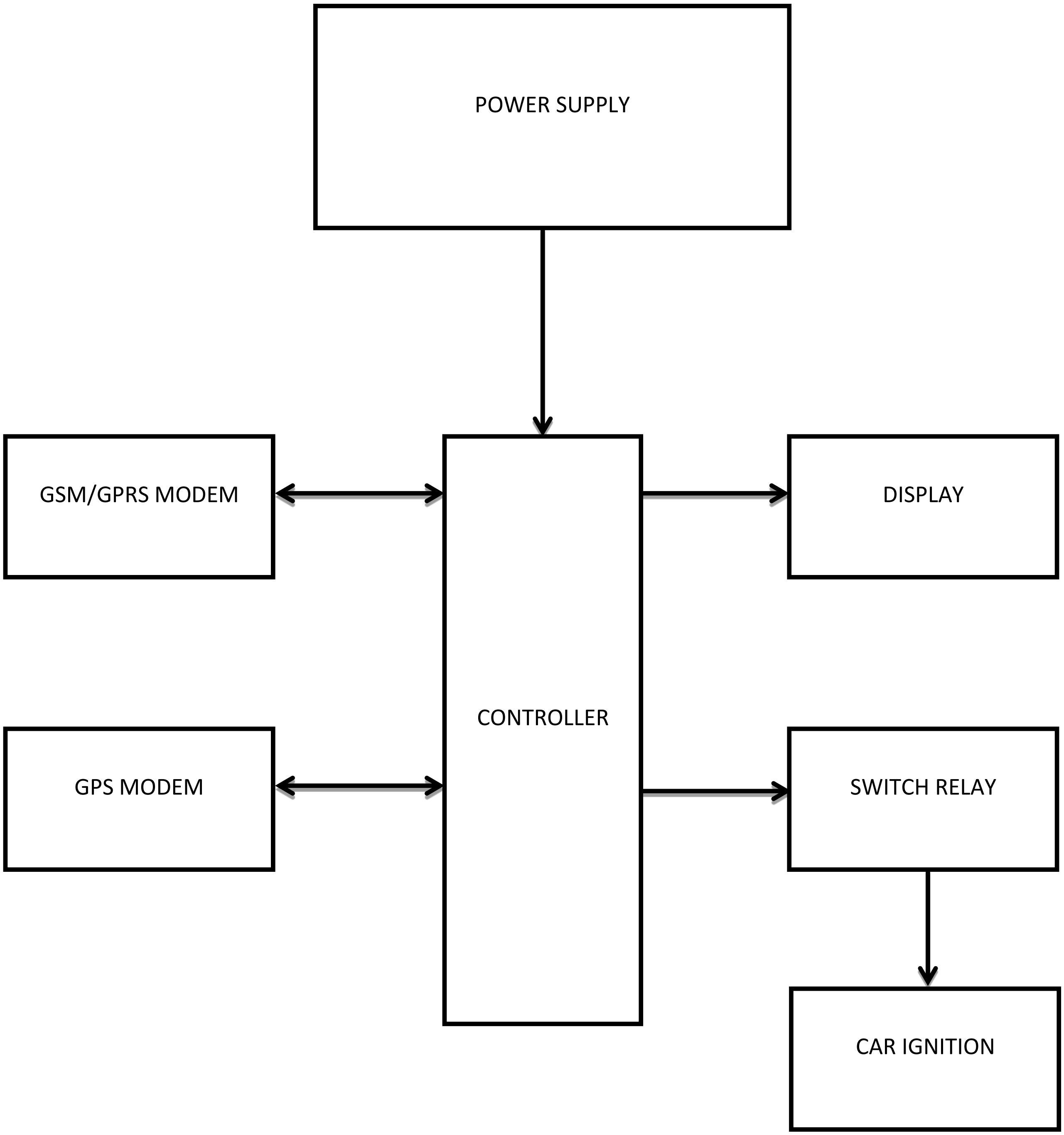

Fig. 3.1: Block diagram of the system

3.2 Component Description and Hardware Design

This aspect deals with the detailed design and selection of the hardware components required for each functional block of the system. All components are purchased from different manufacturers. These components are soldered on a soldering board. The following list of hardware are required for this system.

Major components are;

1. Microcontroller ATMEGA328P
2. GSM module
3. GPS module
4. Voltage regulator
5. Relay

Auxiliaries are;

6. Crystal Oscillator
7. Diode
8. Resistors
9. Capacitors
10. LED

3.2.1. Power Supply Unit

The circuit requires +5v DC supply. A 12v battery was used and regulated to the required voltage using LM7805 regulator. The features of LM 7805 regulator as seen from the datasheet [19] are as follows:

Maximum output current of regulator = 1.0A

Maximum output voltage of regulator = 5.2V

A 1.0A output current is sufficient for this project as the current requirement for the components are summarized in the table below.

Table 3.1 current requirement for components

COMPONENTS	TYPICAL CURRENT	MAXIMUM CURRENT
Atmega328p	250Ma	-
GPS Module	200mA	250mA
GSM Module	250mA	500mA
LED	5Ma	10mA

3.2.1.1 IC LM7805:

7805 is a **voltage regulator** integrated circuit. It is a member of 78xx series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The **voltage regulator IC** maintains the output voltage at a constant value. The xx in 78xx indicates the fixed output voltage it is designed to provide. 7805 provides +5V regulated power supply. Capacitors of suitable values can be connected at input and output pins depending upon the respective voltage levels.

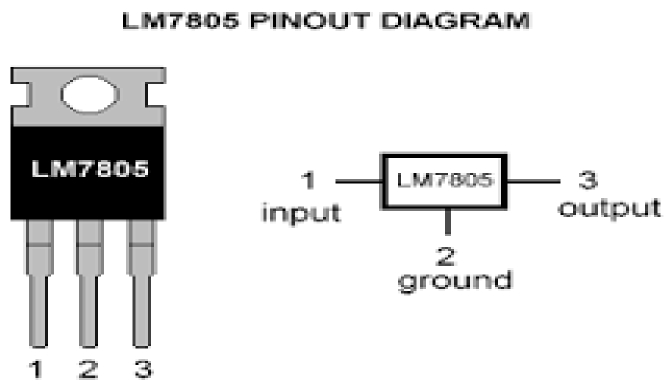

Fig. 3.2a: LM7805 Pin Diagram

The circuit diagram of a regulator is shown in figure 3.2 below

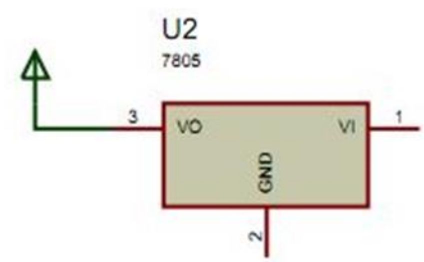

Fig. 3.2b: Voltage Regulator Circuit

3.2.2 Control Unit (microcontroller ATmega328p)

The microcontroller is the heart of the project; it controls all the activities of the entire System.

The criteria for choosing the microcontroller are: -

1. Meet the computation needs of task at hand efficiently and cost effectively.
2. Availability of software development tools such as compiler, assemblers and debuggers and widely availability and reliable source of the microcontroller.

   For this reason, the microcontroller ATmega328p is chosen.

The control unit is made up of a microcontroller of Atmel or AVR microcontrollers called ATmega328p. The ATmega328p is a high performance, low-power CMOS 8-bit microcontroller based on the AVR enhanced reduced- instruction- set computer (RISC) architecture. It combines 32KBytes of ISP (In-System Self-Programmable Flash program) Memory with read-while-write capabilities, 1KBytes EEPROM, 2KBytes Internal SRAM, 23 general purpose I/O lines, 32 x 8 General Purpose Working Registers, three flexible timers/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, 6-channel 10-bit A/D converter, programmable watchdog timer, and five software selectable power saving modes. It operates between 1.8-5.5 volts and a temperature range of -40°C to 105°C. It achieves throughputs approaching 1 MIPS. The chip is a programmable device [20]. It controls the activity of the entire system. The microcontroller circuit is as shown below.

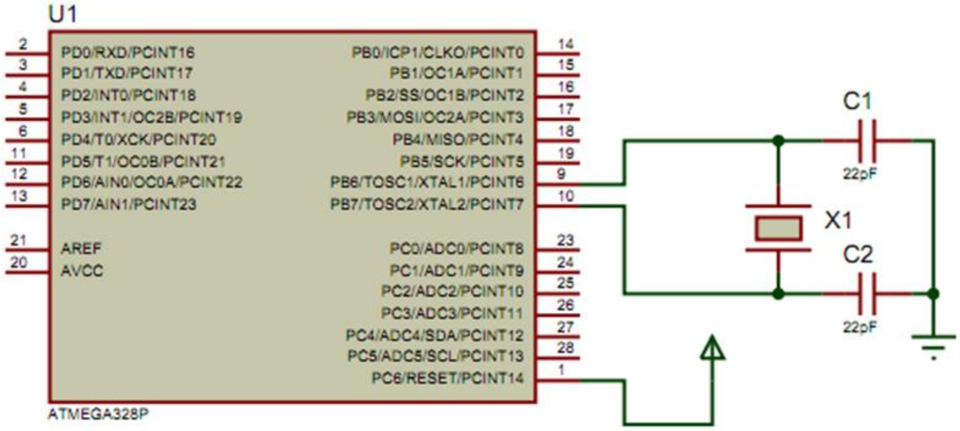

Fig. 3.3a Microcontroller circuit

Fig. 3.3b Microcontroller Atmega328p

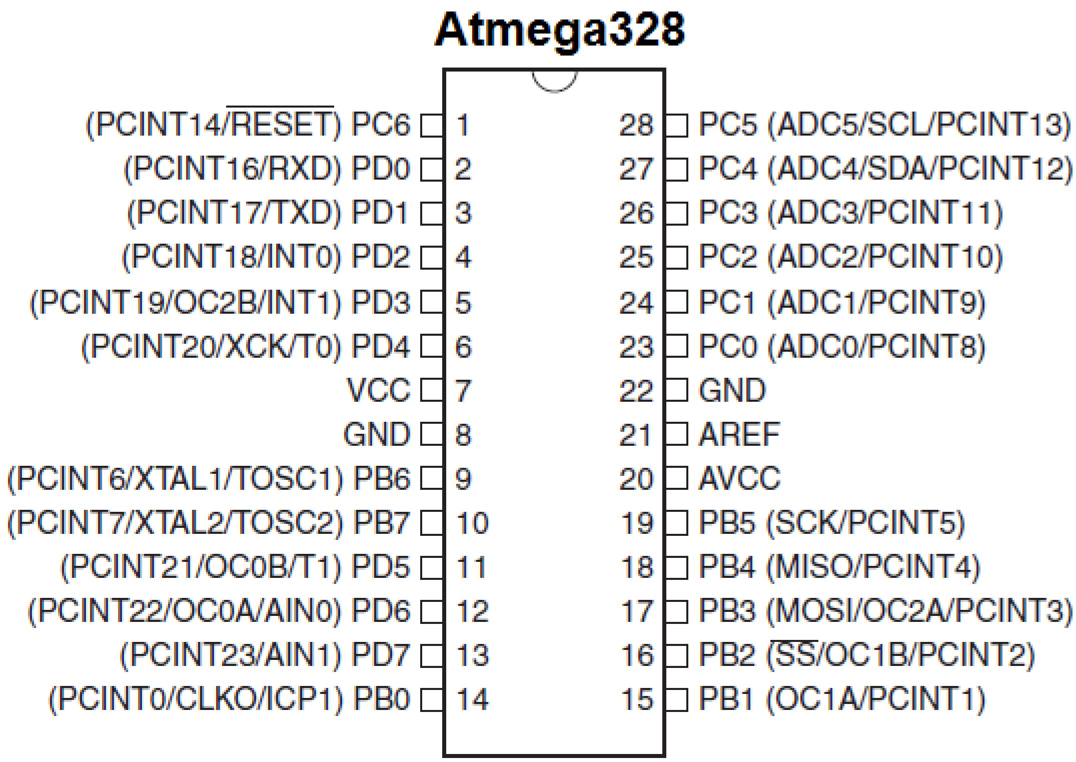

Fig. 3.3c Pin Diagram of Microcontroller Atmega328p

3.2.3 Oscillator Unit (clock)

An oscillator is an electronic circuit that generates repeated waveforms. The exact waveform generated depends on the type of circuit that is used in generating them. For the high speed performance required for this project the crystal oscillator is used.

The crystal oscillator is responsible for producing the clock signal required by the circuit (microcontroller). Two capacitors values are normally chosen from the range of values from the datasheet of the microcontroller (ATmega328p) and the standard table below to increase the stability of the oscillator and increase the startup time.

Table 3.2: Capacitor selection for crystal oscillator (from ATmega328p datasheet)

Mode	**Frequency**	**C1**	**C2**
LP	32 kHz	33Pf	33Pf
	200 kHz	15Pf	15Pf
	200 kHz	26 -68pF	26 -68pF
	1.0 MHz	15pF	15Pf
XT	4.0 MHz	20 -30pF	20 -30Pf
	4.0 MHz	15pF	15Pf
	8.0 MHz	15-33Pf	15-33Pf
	20 MHz	15-33Pf	15-33Pf
	25 MHz	15-33Pf	15-33Pf

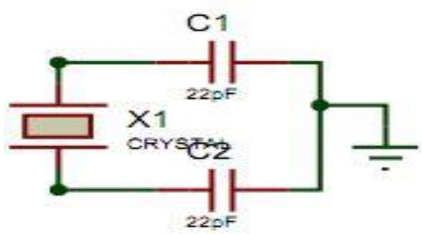

Figure 3.4 Oscillator circuit

The internal frequency of operation required for an instruction to be executed is given by:

$$f_{INT} = \frac{f_{QUARTZ}}{8} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

Where:

f_{QUARTZ} is the crystal frequency

f_{INT} is the internal clock frequency of the microcontroller

$$T = \frac{1}{f_{INT}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Assume a crystal oscillator Cx1 of 16MHz for this project. The required capacitor values C1 and C2 should be between 15-33pf (from table 3.2). Hence, a 22pf capacitor is chosen for this project.

From equation (1)

$$F_{int} = \frac{F_{quartz}}{8} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where:

F_{quartz} is the crystal frequency

And F_{int} is the internal clock frequency of the microcontroller

$$F_{int} = \frac{16MHz}{8} = 2\text{MHz}$$

From equation (2)

$$\text{T} = \frac{1}{F_{int}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$= \frac{1}{2MHz} = 0.5\mu\text{s}$$

Which is the period for executing an instruction.

3.2.4 GSM Modem SIM 800l

The GSM modem is wireless modem that works with a GSM wireless network. The GSM module can help in make/receive voice call, send/receive SMS message and allow to connect with the internet through GPRS wireless network, The GSM modem is a specialized type of modem which accepts a SIM card operates on a subscriber's mobile number over a network, just like a cellular phone. It is a cell phone without display. SIM800L is a quad-band GSM/GPRS module, that works on frequencies GSM850MHz, EGSM900MHz, DCS1800MHz and PCS1900MHz. SIM800L features GPRS multi-slot class 12/ class 10 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4. SIM800L is designed with power saving technique so that the current consumption is as low as 0.7mA in sleep mode.

The power supply range of SIM800L is from 3.4V to 4.4V. Recommended voltage is 4.0V. The transmitting burst will cause voltage drop and the power supply must be able to provide sufficient current up to 2Amp.

Table 3.3: SIM800L key features

Feature	Implementation
Power supply	3.4V ~ 4.4V
Power saving	Typical power consumption in sleep mode is 0.7mA (AT+CFUN=0)
Frequency bands	• Quad-band: GSM 850, EGSM 900, DCS 1800, PCS 1900. SIM800L can search the 4 frequency bands automatically. The frequency bands can also be set by AT command

	"AT+CBAND". • Compliant to GSM Phase 2/2+
Transmitting power	Class 4 (2W) at GSM 850 and EGS Class 1 (1W) at DCS 1800 and PCS
GPRS connectivity	GPRS multi-slot class 12（default） GPRS multi-slot class 1~12 (option)
Temperature range	Normal operation: -40°C ~ +85°C

The GSM modem operates from 3.4V to 4.4V DC supply at 2A. The module and its antenna which changes the electrical signal into electromagnetic waves that can be transmitted over a free space. The module was interface with the microcontroller via Pin 2 and Pin 3 which is PORTD0 and PORTD1 of the microcontroller respectively. The modem consists of six terminals which include the VCC, TXD (transmitter), RXD (receiver), RST (reset) NET (antenna) and GND (ground). The modem is powered through VCC with 4.3V and GND is grounded, the antenna is connected through the NET terminal, The TXD and RXD terminals are connected to the microcontroller as shown in figure 3.5 below.

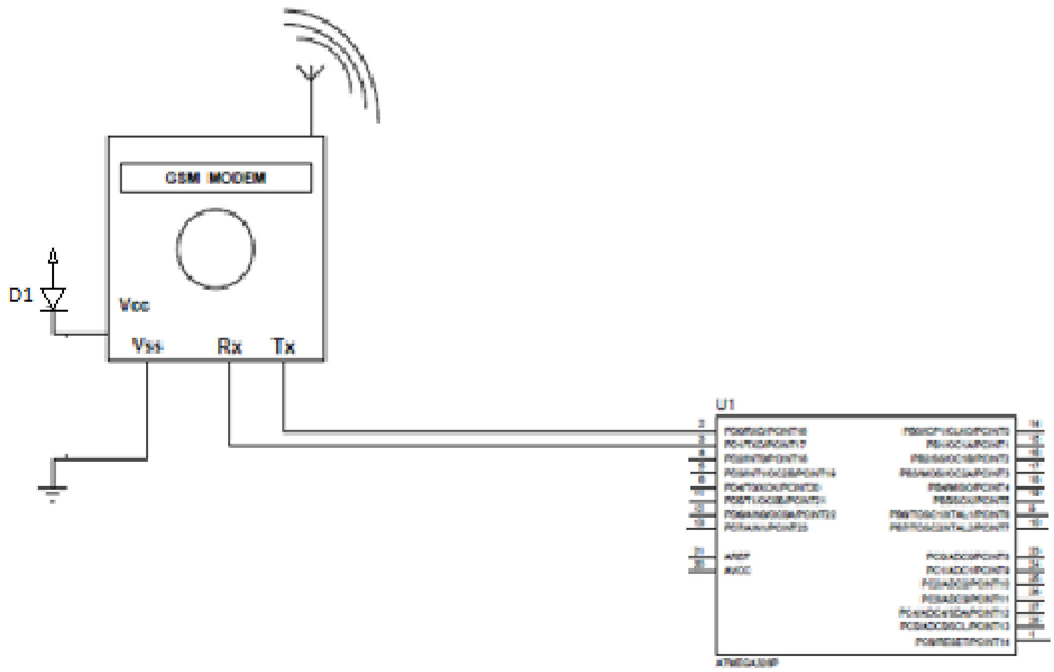

Fig. 3.5: GSM modem interfaced to the microcontroller

The voltage supplied from the power supply unit was reduced from 5V to 4.3V by using silicon diode, 4.3V is an acceptable voltage required by the GSM modem as the voltage range is between 3.4V ~ 4.4V. Silicon diode was used because when it is forward biased and the applied voltage is increased from zero, hardly any current flows through the device in the beginning, it is so because the external applied voltage is being opposed by the internal barrier voltage $V_{B,}$ whose value is 0.7V for silicon diode. As soon as V_B neutralized, current through the device increases rapidly with increasing battery voltage.

The voltage required is gotten from;

$V = VA - VB$ ……………………………………….. (5)

Where,

V_A is the applied voltage = 5V

V_B is the internal barrier voltage of the silicon diode = 0.7V

V = 5V – 0.7V

V = 4.3V

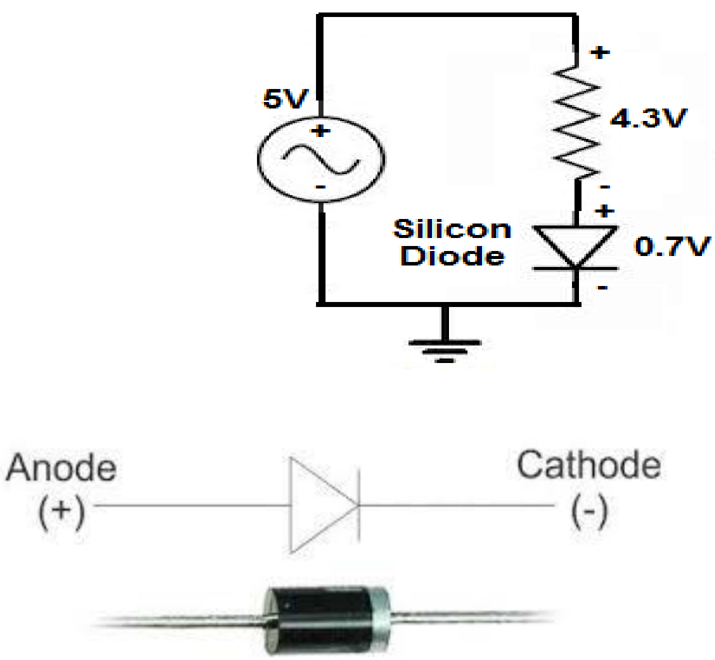

Fig. 3.6: Silicon Diode.

3.2.5 GPS Modem

As earlier discussed in chapter two, The Global Positioning System (GPS) is a space-based global navigation satellite system (GNSS) that provides reliable location and time information in all weather and at all times and anywhere on or near the Earth when and where there is an unobstructed line of sight to four or more GPS satellites.

GPS modules are popularly used for navigation, positioning, time and other purposes. GPS antenna receives the location values from the satellites. The GPS modem operate from 3.3V to 5V system. The module and its antenna help us to accurately calculate the geographical location by receiving information from the GPS satellites. The module was interface with the microcontroller via Pin 4 and Pin 5 which is PORTD2 and PORTD3 of the microcontroller respectively. The modem consists of four terminals which include the VCC, TXD (transmitter), RXD (receiver) and GND (ground). The modem is powered through VCC with 5V and GND is grounded, the antenna is connected through its antenna terminal, The TXD and RXD terminals are connected to the microcontroller as shown in figure 3.7 below.

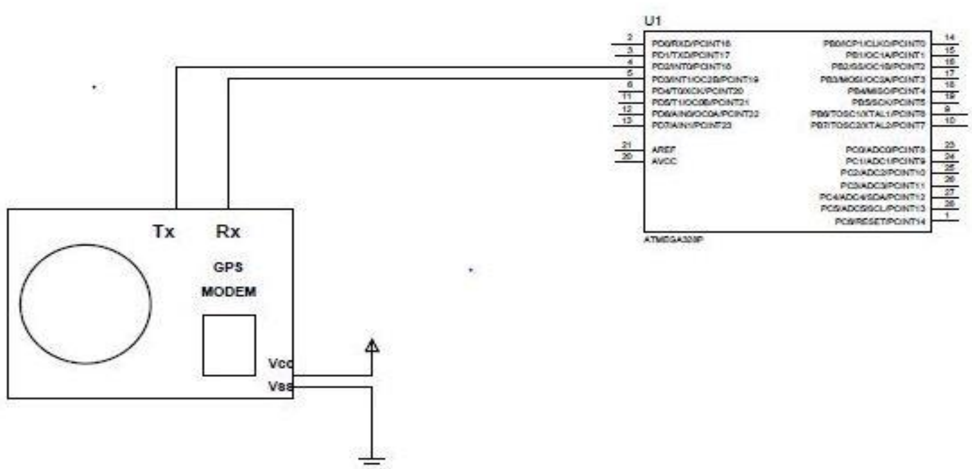

Fig. 3.7: GPS modem interfaced to the microcontroller

The overall circuit diagram of the entire project is shown below

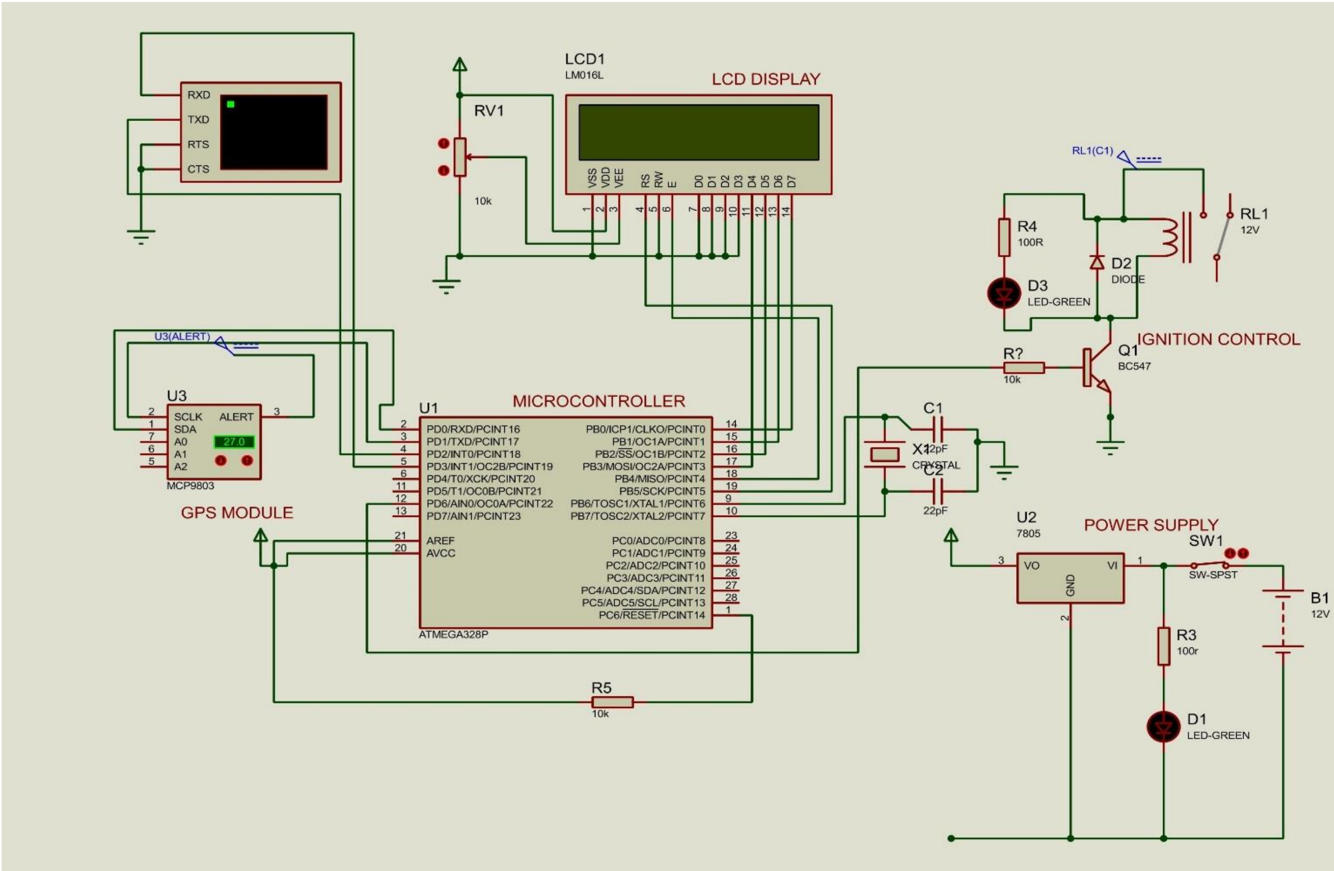

Fig. 3.8: Circuit diagram of the system

3.3 Software Design

This section deals with the program that was written to serve user's purpose. The control program was written in C language and compiled using Arduino integrated development environment which is an integrated applications software development system.

3.3.1 Arduino Compiler:

The Arduino IDE is a cross-platform application written in Java, and is derived from the IDE for the Processing programming language and the Wiring project. It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and is also capable of compiling and uploading programs to the board with a single click. There is typically no need to edit make files or run programs on a command-line interface. Although building on command-line is possible if required with some third-party tools.

The Arduino IDE comes with a C/C++ library called "Wiring" (from the project of the same name), which makes many common input/output operations much easier. Arduino programs are written in C/C++.

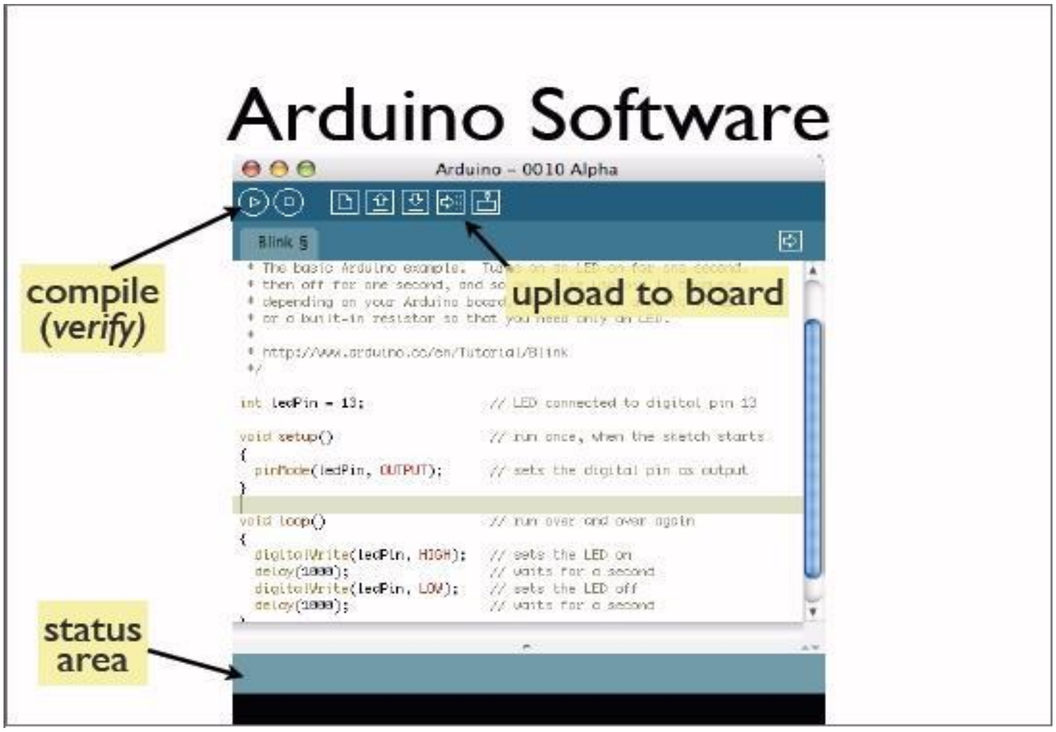

Fig. 3.9a: screen shot of the programmed IDE

3.3.1.1 FLOW CHART

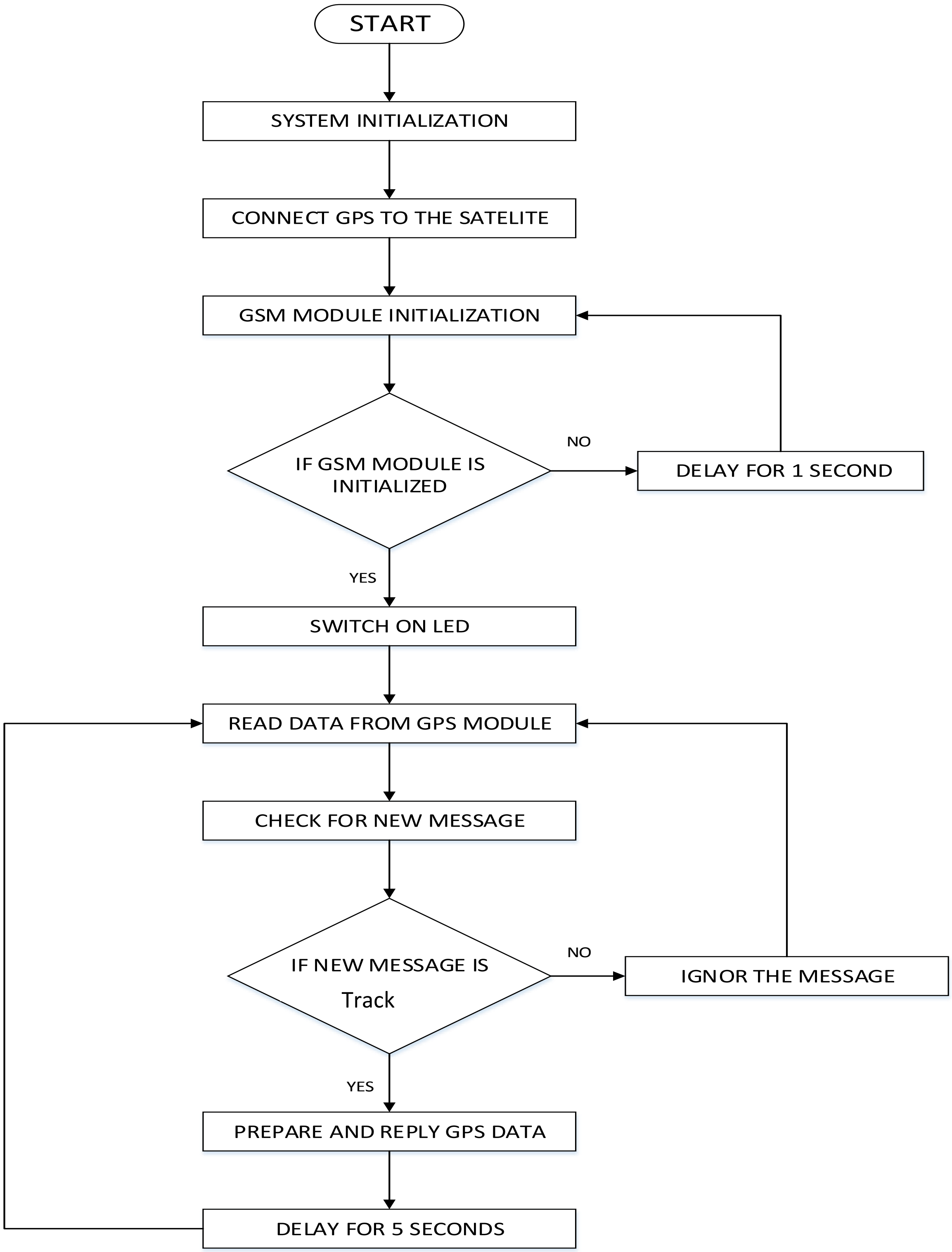

Fig. 3.9b: System software flowchart

3.4 Construction Procedure and packaging

This section details the stages involved in the construction, project assembling and packaging. The various components on the system circuit diagram was implemented and soldered on Vero board

3.4.1 Construction Procedure

In order to ensure reliability of the project work, A PCB board was first produced. The construction started with the production of the circuit PCB layout. This was achieved using proteus ARES software. The layout was printed on a glossy paper and was transferred to plane copper board. This was achieved by placing the printed layout on the copper board. An electric iron was used to transfer the layout by heating. After transfer, the board was soaked in water to remove the glossy paper leaving the track of the layout on the board. The board was placed inside the solution of ferric chloride with warm water to remove copper or etch the part of the board that was uncovered with the track layout . After print, holes were drilled to allow components terminals to pass through using hand drilling machine in the laboratory. Figure below shows the complete work assembled on the constructed PCB board

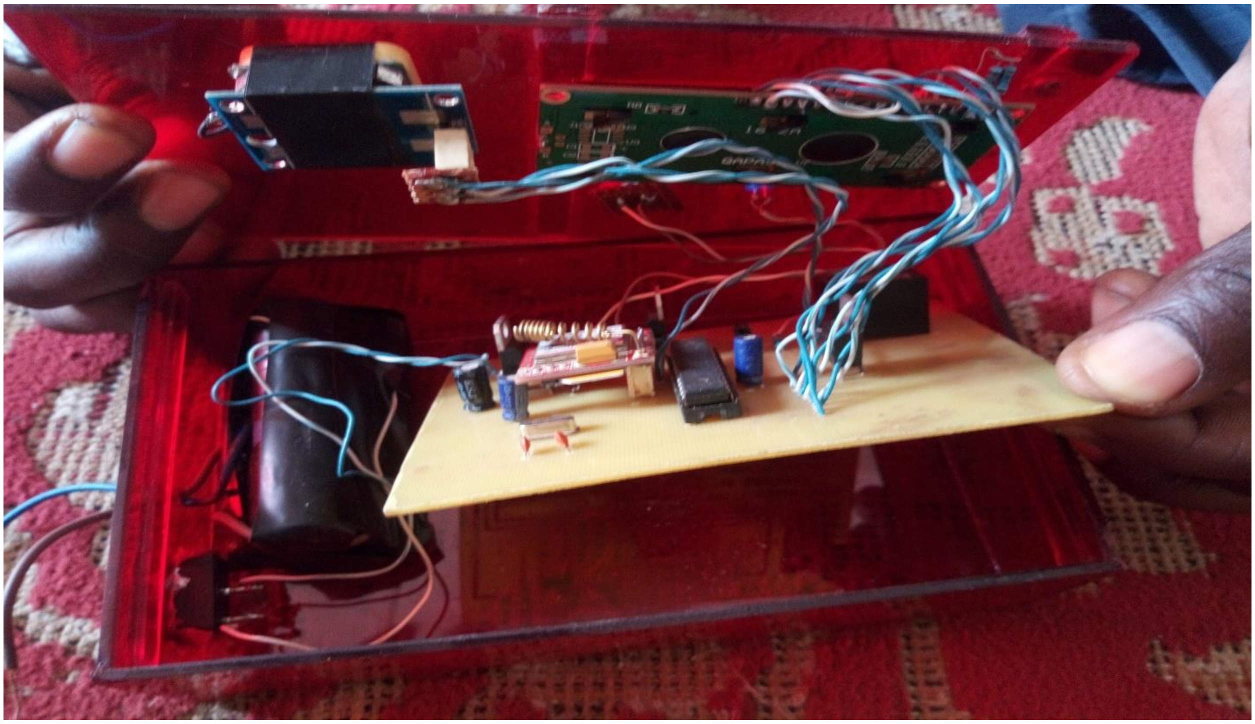

Fig. 3.9c: Constructed circuit

3.4.2 Casing Construction

The packaging material was practically made from a sheet of thin Plastic casing. Using a meter rule and pencil, the required shape and size for the casing was marked. The parts were then joined together. Using a hand drill with tiny drilling bit, screw holes and other relevant ventilation holes were performed.

Factors that were considered before choosing a specific shape and size include, a large enough space inside the enclosure to prevent over compression of the circuit board.

3.4.3 Packaging

Having constructed the circuit board and the casing, the circuitry was placed in the casing to provide support and avoid damage, due to the nature of components used in the construction, the project was assembled. Assembling was simply fixing the circuit board firmly in the casing and ensuring that there was no conducting object inside the casing and also that casing was not too small for the circuit board since this might cause compression which might result to breakage or the Vero board crack. Proper connections were made between the units. This was a bit complicated and demand great care and attention since the use of a lot of connecting wires were involved.

3.4.4 List of Tools Used in Construction

1. Soldering iron
2. Pair of pliers
3. Side cutter
4. Lead solder
5. Tweezers

CHAPTER FOUR: PERFORMANCE AND COST EVALUATION

This chapter deals with the experiment carried out in order to test the workability of this project, as well as the cost evaluation of all the components used in the construction of this project.

4.1 Design Simulation

Prior to the construction of the project, the circuit was first designed using Proteus. The control program was written in C language and compiled using Arduino integrated development environment which is an integrated applications software development system, and then embedded on the microcontroller. This was done in order to see how the circuit would work under real conditions. The GPS modem was connected to the microcontroller and the GSM modem was also connected so as to send commands to the circuit and see real time simulation of the VEHICLE TRACKER. With the whole setup, a simulation was established and the circuit was seen to perform the required tasks and then real construction of the project began.

4.2 Testing

Testing is the process of evaluating a system or its component(s) with the intent to find whether it satisfies the specified requirements or not. In simple words, testing is executing a system in order to identify any gaps, errors, or missing requirements in contrary to the actual requirements. It is an assessment intended to measure the respondents' knowledge or other abilities of a system. Technically, it is a technique used to evaluate the functionality of a system. Different types of test were carried out before, during and after the construction work. These include the primary and secondary test. The primary test was carried out before and during the construction work while the secondary test was carried out towards the end of the construction and after the construction work.

4.2.1 Primary Test

Under the primary test, two tests were carried out which are; continuity test and insolation test.

4.2.1.1 Continuity Test

A continuity test is the checking of an electric circuit to see if current flows (that it is, in fact, a complete circuit). A continuity test is performed by placing a small voltage (wired in series with an LED or noise producing component such as a piezoelectric speaker) across the chosen path. If electron flow is inhibited by broken conductors, damaged components, or excessive resistance, the circuit is "open". Devices that can be used to perform continuity tests include multimeter which measure current and specialized continuity testers which are cheaper, more basic devices, generally with a simple light bulb that lights up when current flows.

On this project, a continuity test was carried out on the Vero board strips to ensure the continuity line from one end to the other (no breakage where continuity is required and no bridges needed). This is also referred to as open circuit or short circuit test.

4.2.1.2 Insulation/Isolation Test

An electrical isolation test is a resistance test that is performed between one or more electrical circuits of the same subsystem. The test often reveals problems that occurred during assemblies, such as defective/wrong component, improper component placement/orientation, and wire insulation or insulator defects that may cause inadvertent shorting or grounding to chassis, in turn, compromising electrical circuit quality and product safety. This test was carried out on the project to ensure no leakage current between the insulation of conductors.

4.2.2 Secondary Test

This is the type of test that is performed during and towards the end of the construction. Two tests were carried out under this test; power supply test and software test.

4.2.2.1 Power supply Test

This was carried out basically to ascertain the voltage rating and of course the maximum current required to power the entire circuitry.

4.2.2.2 Software Test

Software testing is a process, to evaluate the functionality of a software application or program with the intention of finding whether the developed software meet the specified requirements and to identify the defects to ensure that the product is defect-free in order to produce the quality product. Software testing is needed in order to detect the bugs in the software and to test if the software meets the intended requirements.

4.3 Performance Test

The procedures of the experiment and the analysis of result obtained from the experiment will be discussed as follows:

After all the components were soldered on the plain copper board, various tests were carried out. The set up was found to be properly working. The circuitry was further placed in the casing and packaged. A registered MTN SIM card with sufficient recharge amount to make outgoing SMS was inserted into the GSM modem. The device was connected to a car battery which serve as the power source and then the SMS command '#TRACK?.' was sent to the device. A report was replied back from the device with details of the location i.e. the coordinates (Latitude and Longitude) values. This experiment was repeated fifteen times with the device placed at fifteen different locations.

Table 4.1 Experimental Result Table

S/N	TESTS	SMS COMMAND SENT	ACTUAL GEOGRAPHICAL LOCATION OF THE TRACKING DEVICE	RESPONSE RECEIVED
1	Test 1	#TRACK?.	Sangere, Near Al-jazeera Bakery	Latitude:934997 Longitude:1251649
2	Test 2	#TRACK?.	Near Adamawa hospital Yola	Latitude:921209 Longitude:1247203
3	Test 3	#TRACK?.	Kabir Umar Hall MAUTECH Yola	Latitude:935060 Longitude:1249962
4	Test 4	#TRACK?.	AMA Midala Fuel Station Vinikilang, Mubi Road	Latitude:930257 Longitude:1247643
5	Test 5	#TRACK?.	Near Target Junction, Jimeta	Latitude:927160 Longitude:1245262
6	Test 6	#TRACK?.	Near Babz Lounge, Police	Latitude:925879

			Roundabout, Jimeta	Longitude:1245717
7	Test 7	#TRACK?.	Near Duragi Hotels, Barracks Road	Latitude:923843 Longitude:1245355
8	Test 8	#TRACK?.	Near Sare Kosam, Yola	Latitude:921096 Longitude:1246779
9	Test 9	#TRACK?.	Yola International Airport	Latitude:926649 Longitude:1242551
10	Test 10	#TRACK?.	Total Filling Station, Near Jimeta Modern Market	Latitude:927526 Longitude:1243396
11	Test 11	#TRACK?.	San Hussain Mall, Near Jimeta Modern Market	Latitude:927645 Longitude:1243883
12	Test 12	#TRACK?.	Near Mubi Roundabout	Latitude:927882 Longitude:1245152
13	Test 13	#TRACK?.	Opposite Jimeta Shopping Complex	Latitude:927497 Longitude:1245216
14	Test14	#TRACK?.	Near Adamawa State Board of Internal Revenue	Latitude:927398 Longitude:1246255
15	Test 15	#TRACK?.	Opposite Ribadu Square, Jimeta	Latitude:926929 Longitude:1246373
		#OFFCAR?..		OFF CAR

4.4 Discussion of Result

The objective of this project using GSM and GPS modules in order to track vehicle location was achieved as illustrated by the result above. When the SMS command TRACK was sent to the device. A report was replied back from the device with details of the location i.e. the coordinates (Latitude and Longitude) values.

4.5 How to Track the Location on Actual Map

It would be time consuming to track location on Printed maps. But nowadays various websites are available on internet which shows online map. Google maps is one of the main and useful websites. We use any one of these websites to track or find the location of vehicle. We can track the location using the Longitude and Latitude values received in the SMS. Using these maps, you can get the exact location as well as directions and the time to go to those places from your current/desired location.

The following figure shows the Screen shot of the location on actual Google map.

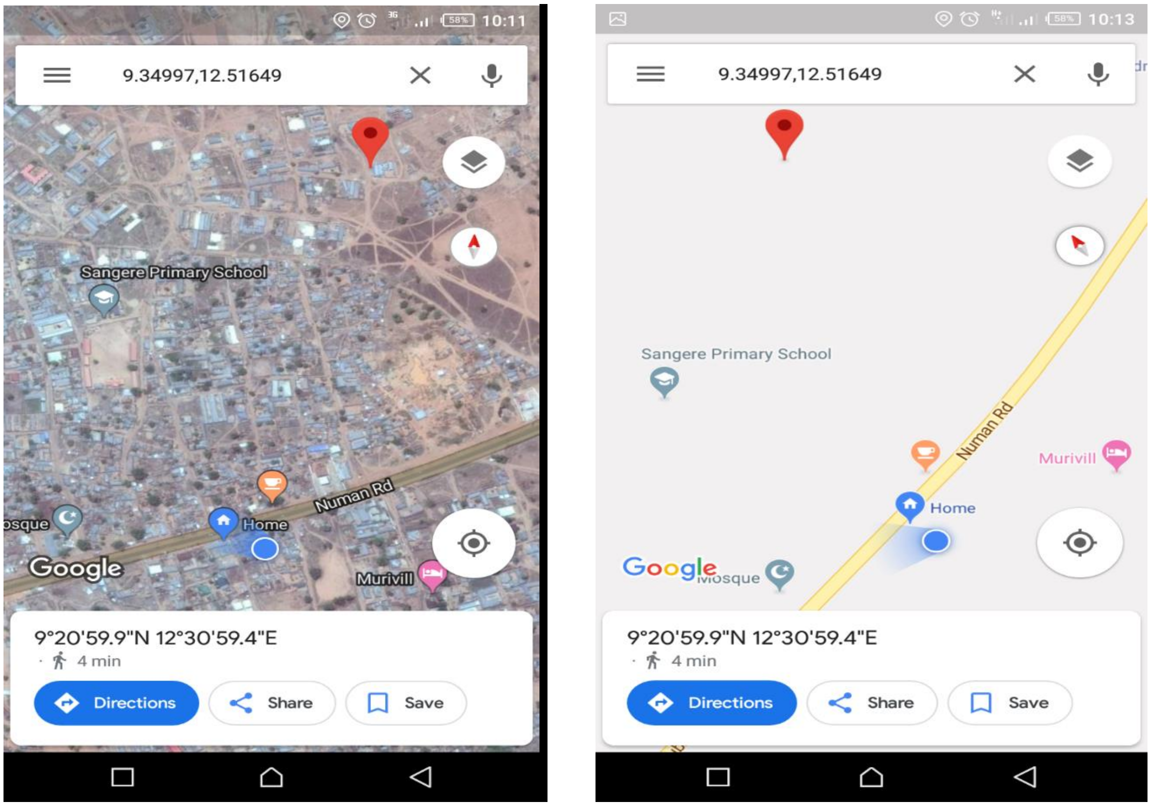

Fig. 4.1 *screen shot of the location on actual map*

4.6 Cost Evaluation

Before any project can be considered to be reasonable, it has to be cost effective i.e. economical in design and construction. This cost determines how prosperous that particular project is going to be used. In view of this, the project is seen to be cost effective as most components are readily available locally. The packaging as seen is a plastic casing. From the cost evaluation table below it can be deduced that the cost of producing a unit is quite expensive due to the procedures and methods of carrying out the project in a local setting. It should therefore be noted that for a mass production on a commercial scale the cost will reduce as much as 50% of the cost of producing a unit as components will be purchased in bulk. The cost of the components used in the construction of this project is shown in table 4.2 below:

Table 4.2: List of Components and cost evaluation.

S/N	**Components Description**	**Rating**	**Quantity Used**	**Cost per unit (Naira)**	**Total cost(Naira)**
1	LED		1	10.00	10.00
2	Electrolytic Capacitors	1000µF	1	50.00	50.00
3		10µF	1	30.00	30.00
4	Ceramics Capacitors	22Pf	2	30.00	60.00
5		104Pf	2	40.00	80.00
6	Resistors	10kΩ	1	20.00	20.00
7		220Ω	1	10.00	10.00
8	ATmega328p Microcontroller		1	1700.00	1700.00
9	GSM Module SIM800l		1	4500.00	4500.00
10	Silicon Diode		1	30.00	30.00
11	LM 7805 Regulator		1	50.00	50.00
12	GPS Module		1	5000.00	5000.00
13	Power Cable cord		1	50.00	50.00
14	Jumper wire		5yards	30.00	150.00

15	Lead		10yards	30.00	300.00
16	Plain Copper board		1	150.00	150.00
17	Switch button		1	50.00	50.00
18	16MHz Crystal oscillator		1	150.00	150.00
19	Adapter terminal		1	50.00	50.00
20	Plastic casing		1	500.00	500.00
21	SIM Card		1	200.00	200.00
22	Miscellaneous				2000.00
	TOTAL				**15,140.00**

CHAPTER FIVE: CONCLUSIONS

5.1 Summary

The project entitled "design and construction of a GSM and GPS based advanced vehicle tracking system" was successfully executed using GSM modules and GPS modules, LED, Microcontroller and a voltage regulator. In this project, a device was developed that would track vehicle location and send the information to a control unit at the user side. The entire system was cordinated and controlled by a microcontroller, which makes the system to be user friendly. The system was well packaged and its applications were also highlighted. The overall performance of the constructed system was evaluated by testing the system performance fifteen times with the device placed at fifteen different locations and the results obtained were as expected and it also confirmed the accuracy of the system. Finally, the cost evaluation of the system was also presented.

5.2 Conclusions

The main objective of this project work, which is design and construction of a GSM and GPS based advanced vehicle tracking system was achieved. From the results obtained, the system can be seen to effectively track vehicle location. In order to avoid theft, the system will provide the location coordinates of the vehicle. This system is becoming increasingly important in large cities and it is more secured than other systems. Nowadays vehicle theft is rapidly increasing and with this device we can have a good control in it. The vehicle can be recovered by only sending a simple SMS.

5.3 Recommendations

Based on the design and construction of a GSM and GPS based advanced vehicle tracking system, the following recommendations were suggested for Further research;

1. The size of the kit can be reduced by using GPS and GSM on the same module.
2. We can monitor some parameters of vehicle like overheat or PMS leakage.
3. The kit can be used for detection of bomb by connecting it to the bomb detector.
4. With the help of high sensitivity vibration sensors, we can detect the accident. Whenever vehicle unexpectedly had an accident on the road with help of vibration sensor, we can detect the accident and we can send the location to the owner, hospital and police.

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APPENDIX

```
#include<LiquidCrystal.h>
LiquidCrystal lcd(13,12,11,10,9,8);

#include <Sim800l.h>
#include <SoftwareSerial.h> //is necesary for the library!!
Sim800l Sim800l;  //to declare the library

String textSms,numberSms;
uint8_t index1;
bool error;
char* number = "+2348054120252";

int ENGINE = 19;    // PIN CONNECTED TO AN OUTPUT DEVICE i.e relay
int l = 0, x = 0, k = 0;

String  gpsString = "";
char  *test = "$GPGGA";
String latitude = "no";
String longitude = "no";
String text = "";
int times = 0, flag = 0, temp = 0, i;
char message[80];
char value_str[10];

float deg1;
float deg2;

boolean gps_status = 0;
void setup()
{
 Serial.begin(9600);//Serial baud
 pinMode(ENGINE, OUTPUT);
 digitalWrite(ENGINE, HIGH);

  lcd.begin(16, 2);//type of LCD
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Vehicle Tracking");
lcd.setCursor(0,1);
lcd.print("& Demobilising Sys");
delay(3000);

lcd.clear();
lcd.setCursor(0,0);
```

```
lcd.print("Yusuf Mustapha");
lcd.setCursor(0,1);
lcd.print("EEE/15D/5367");
delay(3000);

lcd.clear();
lcd.setCursor(0,0);
lcd.print("Supervised By:");
lcd.setCursor(0,1);
lcd.print("Engr Mathew Luka");
delay(3000);

lcd.clear();
lcd.setCursor(0,0);
lcd.print("Configuring GSM");
lcd.setCursor(0,1);
lcd.print("Please wait...");
delay(500);
Sim800l.begin(); // initializate the library.

  lcd.print("GPS Initializing");
  lcd.setCursor(0, 1);
  lcd.print("  No GPS Range  ");
  get_gps();
  delay(500);
  lcd.clear();
  lcd.print("GPS Range Found");
  lcd.setCursor(0, 1);
  lcd.print("GPS is Ready");
  delay(2000);
  lcd.clear();
  lcd.print("System Ready");

}
void loop() {
  check_sms();
  get_gps();
  lcd.clear();
  lcd.print("  System Ready  ");
  delay(2000);

}

void check_sms(){
    textSms=Sim800l.readSms(1); //read the first sms
```

```
  if (textSms.indexOf("OK")!=-1) //first we need to know if the messege is correct. NOT an
ERROR

      {
      if (textSms.length() > 7)  // optional you can avoid SMS empty
 lcd.clear();
 lcd.setCursor(0,0);
 lcd.print("New Message");
 lcd.setCursor(0,1);
 lcd.print(textSms);
 delay(3000);
         {
       textSms.toUpperCase();  // set all char to mayus ;)

       if (textSms.indexOf("ONCAR")!=-1){
            digitalWrite(ENGINE, HIGH);
           }
        if (textSms.indexOf("OFFCAR")!=-1){
            digitalWrite(ENGINE, LOW);
           }
         if (textSms.indexOf("TRACK")!=-1){
             tracking();
           }
         Sim800l.delAllSms(); //do only if the message is not empty,in other case is not necesary
          //delete all sms..so when receive a new sms always will be in first position
         }
      }
   }

void gpsEvent()
{
 gpsString = "";
 while (1)
 {
  while (Serial.available() > 0)         //checking serial data from GPS
  {
    char inChar = (char)Serial.read();
    gpsString += inChar;                 //store data from GPS into gpsString
    i++;
    if (i < 7)
    {
      if (gpsString[i - 1] != test[i - 1])    //checking for $GPGGA sentence
      {
        i = 0;
        gpsString = "";
      }
```

```
      }
      if (inChar == '\r')
      {
        if (i > 65)
        {
          gps_status = 1;
          break;
        }
        else
        {
          i = 0;
        }
      }
    }
    if (gps_status)
      break;
  }
}
void get_gps()
{
  gps_status = 0;
  int x = 0;
  while (gps_status == 0)
  {
    gpsEvent();
    int str_lenth = i;
    latitude = "";
    longitude = "";
    int comma = 0;
    while (x < str_lenth)
    {
      if (gpsString[x] == ',')
        comma++;
      if (comma == 2)     //extract latitude from string
        latitude += gpsString[x + 1];
      else if (comma == 4)     //extract longitude from string
        longitude += gpsString[x + 1];
      x++;
    }
    int l1 = latitude.length();
    latitude[l1 - 1] = ' ';
    l1 = longitude.length();
    longitude[l1 - 1] = ' ';
    lcd.clear();
    lcd.setCursor(0,0);
    lcd.print("Lat:");
```

```
    lcd.print(latitude);
    Serial.print(latitude);
    lcd.setCursor(0,1);
    lcd.print("Long:");
    lcd.print(longitude);
    Serial.print(longitude);
    i = 0; x = 0;
    str_lenth = 0;
    delay(10000);
  }
}
void tracking()
{
  float latstring;
  float longstring;
  latstring = latitude.toFloat();
  longstring = longitude.toFloat();

  float deg;
  float degWhole;
  float degDec;
  degWhole = float(int(latstring / 100));
  degDec = (latstring - degWhole * 100) / 60;
  deg = degWhole + degDec;
  deg1 = deg;

  degWhole = float(int(longstring / 100));
  degDec = (longstring - degWhole * 100) / 60;
  deg = degWhole + degDec;
  deg2 = deg;
  lcd.print(deg1, 5);
  lcd.print(deg2, 5);
 /*
  * char result[8]; // Buffer big enough for 7-character float
dtostrf(resistance, 6, 2, result); // Leave room for too large numbers!
*/
     message[0]='\0';
    strcat(message,"Lat:");
   dtostrf(deg1, 8, 5, value_str);
    strcat(message,value_str);
    //message[0]='\1';
    strcat(message,"  Long:");
   dtostrf(deg2, 8, 5, value_str);
    strcat(message,value_str);
    //message[0]='\2';
    strcat(message,"http://maps.google.com/maps?&z=15&mrt=yp&t=k&q=");
```

```
 dtostrf(deg1, 8, 5, value_str);
  strcat(message,value_str);
  //message[0]='\3';
  strcat(message,"+");
 dtostrf(deg2, 8, 5, value_str);
  strcat(message,value_str);
  delay(100);
 //strcat(text, message);
Sim800l.sendSms(number,message);
lcd.clear();
lcd.print("Message Sent");
delay(2000);
}
```