DESIGN AND CONSTRUCTION OF MICRO-CONTROLLER BASED VEHICLE TRACKING SYSTEM

BY

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(EE/07/0018)

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

DECEMBER, 2012

APPROVAL

This project report submitted to the department of electrical and electronics engineering, Modibbo Adama University of Technology, Yola has been assessed and approved to meet the requirement and regulations governing the award of Bachelor of engineering (B. Eng) Degree in Electrical and Electronics Engineering.

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DECLARATION

I hereby declare that this project was written by me and 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....................................

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The above declaration is confirmed

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CERTIFICATION

This project entitled **Design and Construction of Micro Controller Based Car Tracking Device Using GPS Receiver** by **Banire, Adebola Sulaiman (EE/07/0018)** meets the regulations governing the award of bachelor's degree of the federal university of technology, Yola, and is approved for its contribution to knowledge and literary presentation.

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Engr. (Mr.) I. A. USMAN

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Engr. I. M. VISA

(HOD)

.... Date...

Prof. E. E. OMIZEGBA

(External supervisor)

DEDICATION

I sincerely dedicate this project to the Almighty Allah for His grace and for enabling me sail through my undergraduate career. I also dedicate this report to my parents Mr. and Mrs. Banire and every member of my family for their immense support, encouragement and prayers.

ACKNOWLEDGEMENTS

‘BISMILLAHIRRAHMANIRRAHIM’

In the name of Allah, the most gracious and the most merciful.

‘Alhamdulillah’, first of all, I would like to express my gratitude to the Almighty for blessing me with strength and courage to complete this project. From the beginning till the end of this project, I have so many people who stand by me; giving me guidance for every obstacle that stands in my way. Therefore, I would like to express my deepest appreciation to those involved in this project.

First and foremost, I would like to express my gratitude and millions of thanks to my project supervisor, Engr. (Mr.) I. A. Usman, and all the staff of the department of Electrical and Electronics engineering Modibbo Adama University of Technology Yola, Adamawa State.

Who had contributed with ideas and guidance from the very beginning till the last second. I will never forget all their sacrifices and only God could ever repay what they have done for me.

My special appreciation also goes to my parent to Mr. and Mrs. Banire for their immense support and encouragement throughout my university education. I also want to appreciate all members of my family especially, my sisters Mrs. Aishat Akinshola, Miss Zainab Banire, Miss Amina Banire, my love Halima Abubakar. My in-law Mr. Abdulrazak Akinshola for their support and encouragement both financially and otherwise during the course of my studies as an undergraduate.

Thank you again.

ABSTRACT

Considering the rampant cases of car stealing in our society today, it is paramount to devise a system which would be incorporated to cars, such that when a car is stolen the current location of the car could be determined, it will provide a way of tracking the stolen vehicle, hence helping security agents in the recovery of the vehicle.

In this work, a robust and low cost micro-controller based car tracking device will be designed and constructed. The device will be made in such a way that it is small, and can be hidden in the car, so that only the car owner is aware of its existence and not the burglar.

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ABBREVIATIONS

AVR advanced virtual risc

GPS global positioning system

DOD Department of Defense

LCD liquid crystal display

GSM global system for mobile communication

LPC linear predictive coding

EFR Enhanced Full Rate

GMSK Gaussian minimum-shift keying

SIM Subscriber Identity Module

D.C direct current

A.C alternating current

CHAPTER ONE

INTRODUCTION

The “Vehicle Tracking System using GPS and GSM Technology” accommodates the needs of today’s vehicle fleet company to keep track of their fleets. It is a very useful and versatile device, and in fact can be used by anybody with the need to keep track of their valuable goods. 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 liquid crystal display (LCD). This chapter will cover the general background of this project, its concept, objectives, scope and the problem statement.

1.0 BACKGROUND

A vehicle tracking system consists of an electronic device installed on a vehicle so that it could be tracked by its owner or a third-party for its position. Most of today’s vehicle tracking systems uses Global Positioning System (GPS) to get an accurate reading of the vehicle position. Communication components such as cellular (GSM) 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 behavior, 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 the 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 such as 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.

1.1 STATEMENT OF THE PROBLEM

Car theft is a rampant crime that is very common in our society; hence the need for an intelligent control system that would be capable of locating a stolen car, as well as stopping the car from moving becomes helpful in recovery of the stolen car. It is against this background that this research work was conceived.

1.2 OBJECTIVES

The objective of this research work is to design and construct a micro-controller based car tracking device using GPS receiver. A tracking system that will enable easy tracking of a stolen car, by receiving SMS on the current coordinate position of the car.

1.3 SIGNIFICANCE

The significance of this research work cannot be over-emphasized. Proper utilization of the designed car tracking system will translate into the under-listed benefits:

1. Elimination or mitigation of car-loss risk.

2. Enhancement of recovery process for any loss vehicle.

3. Not only the car, but the thieves could also be tracked.

4. The low cost feature of the design implies the affordability of the device to all car owners.

1.4 SCOPE OF STUDY

The car tracking system will be designed using ATMEL89C52 micro-controller. The micro-controller programming will be in C language. The entire system is purely network dependent. Thus, the system will fail to track in areas where there is no network coverage.

CHAPTER TWO

LITERATURE REVIEW

2.1 AN OVERVIEW OF GLOBAL POSITIONING SYSTEM (GPS)

The GPS System was created and realized by the American Department of Defense (DOD) and was originally based on and run with 24 satellites (21 satellites being required and 3 satellites as replacement). Nowadays, about 30 active satellites orbit the earth in a distance of 20200 km. GPS satellites transmit signals which enable the exact location of a GPS receiver, if it is positioned on the surface of the earth, in the earth atmosphere or in a low orbit. GPS is being used in aviation, nautical navigation and for the orientation ashore. Further it is used in land surveying and other applications where the determination of the exact position is required. The GPS signal can be used without a fee by any person in possession of a GPS receiver.

In 1957, the very first satellite which was sent to space was the Russian Sputnik 1. The purpose of this mock satellite was to test on its functionality. Sputnik 1would be transmitting radio signal (Doppler or frequency) which was monitored by researchers from Applied Physics Laboratory (APL) of the John Hopkins University. Based on the Doppler shifted of satellite motion, Dr. Frank T. McClure (of APL) discovered that the user's location can be defined from the Doppler Shift measurement [1]. In April 1960, trial satellite (known as Transit) built based on the Doppler Shift measurement was launched via rockets into space. Similarly, another satellite known as Cicada was built based on the same Doppler system by the *Union of Soviet Socialist Republics (USSR)* after a short period of time [2]. In 1988, the Transit launch program ended. Eventually, the Transit system was inactive in 1996 [3].

In the early 1970s, the Transit system was being replaced by Global Positioning System (GPS) which was conceived by the U.S. Department of Defense (DoD). Global Positioning System (GPS) was originally designated for military use. The original purpose for development of the system is the need for Submarines to accurately locate their position before launching missiles [4].

In 1973, Decision has been made to develop a satellite navigation system based on the systems TRANSIT, TIMATION und 621B of the U.S. Air Force and the U.S. Navy. Four years later, First receiver tests are performed even before the first satellites are stationed in the orbit. Transmitters are installed on the earth's surface called Pseudolites (Pseudo satellites). By 1985, a total of 11 Block I satellites are launched into the orbit. Decision has been made to expand the GPS system.

Thereupon the resources are considerably shortened and the program is restructured. At first only 18 satellites should be operated. 1988 the number of satellites is again raised to 24, as the functionality is not satisfying with only 18 satellites. Launching of the first Block I satellite carrying sensors to detect atomic explosions. This satellite is meant to control the abidance of the agreement of 1963 between the USA and the Soviet Union to refrain from any nuclear tests on the earth, submarine or in space. When a civilian airplane of the Korean Airline (Flight 007) was shot down after it had gone lost over Soviet territory, it was decided to allow the civilian use of the GPS system. In 1986, the accident of the space shuttle "Challenger" means a drawback for the GPS program, as the space shuttles were supposed to transport Block II GPS satellites to their orbit. Finally the operators of the program revert to the Delta rockets intended for the transportation in the first place.

In 1989, the first Block II satellite was installed and activated. Temporal deactivation of the selective availability (SA) during the Gulf war. In this period civil receivers should be used as not enough military receivers were available. On July 01, 1991 SA is activated again. The Initial Operational Capability (IOC) is announced in 1993. In the same year it is also definitely decided to authorize the world wide civilian use free of charge.

The last Block II satellite completes the satellite constellation in 1994. Full Operational Capability (FOC) is announced the following year. In 2000, final deactivation of the selective availability and therefore improvement of the accuracy for civilian users from about 100 m to 20m.

2.2 GSM TECHNOLOGY

GSM is a cellular network, which means that mobile phones connect to it by searching for cells in the immediate vicinity. GSM networks operate in four different frequency ranges. Most GSM networks operate in the 900 MHz or 1800 MHz bands.

Some countries in the Americas (including Canada and the United States) use the 850 MHz and 1900 MHz bands because the 900 and 1800 MHz frequency bands were already allocated.

GSM has used a variety of voice codecs to squeeze 3.1 kHz audio into between 5.6 and 13 Kbit/s. Originally, two codecs, named after the types of data channel they were allocated, were used, called Half Rate (5.6 Kbit/s) and Full Rate (13 Kbit/s). These used a system based upon linear predictive coding (LPC). In addition to being efficient with bitrates, these codecs also made it easier to identify more important parts of the audio, allowing the air interface layer to prioritize and better protect these parts of the signal. GSM was further enhanced in 1997 with the Enhanced Full Rate (EFR) codec, a 12.2 Kbit/s codec that uses a full rate channel. Finally, with the development of UMTS, EFR was refactored into a variable-rate codec called AMRNarrowband, which is high quality and robust against interference when used on full rate channels, and less robust but still relatively high quality when used in good radio conditions on half-rate channels.

There are five different cell sizes in a GSM network—macro, micro, pico, femto and umbrella cells. The coverage area 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 a building above average roof top level. Micro cells are cells whose antenna height is under average roof top level; they are typically used in urban areas. Pico cells are small cells whose coverage diameter is a few dozen meters; they are mainly used indoors. Femtocells are cells designed for use in residential or small business environments and connect to the service provider’s network via a broadband internet connection. Umbrella cells are used to cover shadowed regions of smaller cells and fill in gaps in coverage between those cells.

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

2.3.1 GSM MODEM

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves.

A GSM modem can be an external device or a PC Card / PCMCIA Card. Typically, an external GSM modem is connected to a computer through a serial cable or a USB cable. A GSM modem in the form of a PC Card / PCMCIA Card is designed for use with a laptop computer. It should be inserted into one of the PC Card / PCMCIA Card slots of a laptop computer. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate.

2.3.2 SUBSCRIBER IDENTITY MODULE (SIM)

One of the key features of 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 phone book. This allows the user to retain his or her information after switching handsets. Alternatively, the user can also change operators while retaining the handset simply by changing the SIM. Some operators will block this by allowing the phone to use only a single SIM, or only a SIM issued by them; this practice is known as SIM locking, and is illegal in some countries.

2.4 SIMILAR PROJECTS

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

1. GPS/GSM tracking system using Telit GM862 module.

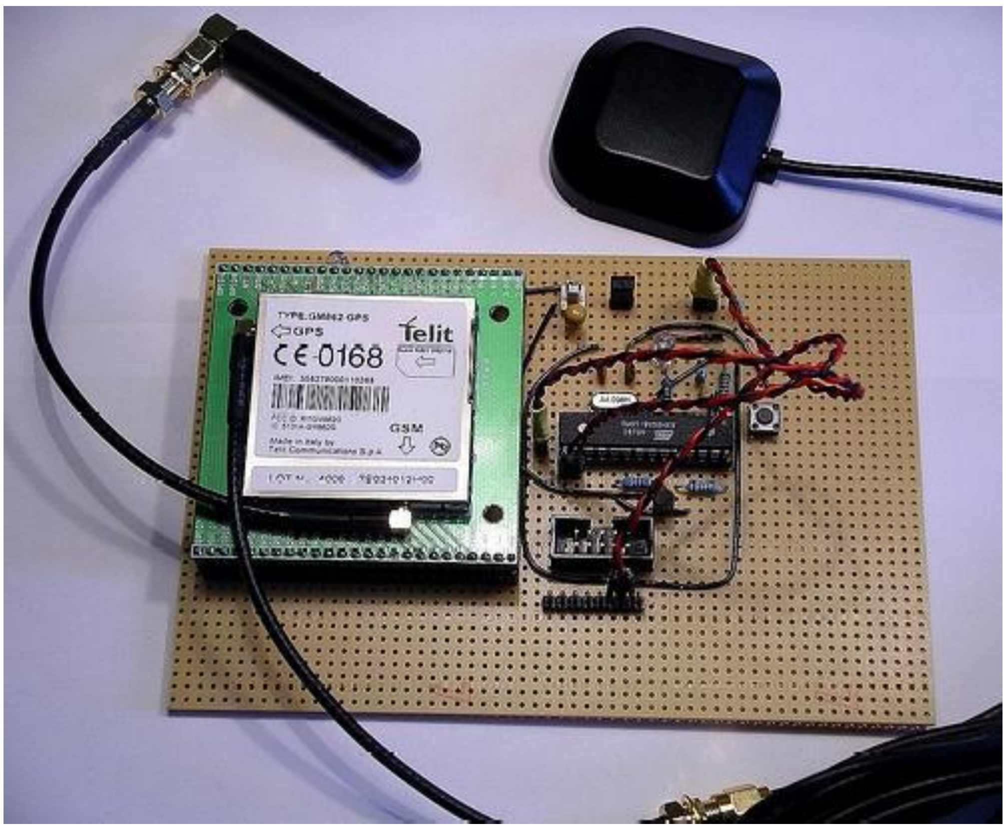

Fig 1: Telit GM862 module used for a tracking system.

The inventor is unknown but his goal is to build a kind of a mobile tracker. There are many different use cases we can think of but one of the obvious is a device that is able to report where it is. This device can be put in the car and it could trigger an alarm, if the car got stolen. It actually could tell you where it is. There are already mobile tracking devices out there, but they seemed to be too expensive and too closed for our needs. Another option is one of this new Nokia N95 which has built-in GPS. They are really nice, but about 600€, which is not a bargain.

The idea was to combine a microcontroller with a GSM and a GPS module. The Telit GM862 is used in this project, which is a GSM module with a built in GPS receiver. This module offers quad band GSM, has SiRF III GPS built in. This project also able to become a mobile phone if equip with a speaker and a microphone because it also offers data, voice, SMS and fax communication

CHAPTER THREE

DESIGN AND CONSTRUCTION

3.0 INTRODUCTION

This Chapter considers the Design methodology employed in the overall system design. Calculations of all component values used are also presented in this chapter.

3.1 THE POWER SUPPLY

The complete electronic device or system requires a D.C voltage source for its operation. In this case, the battery of the vehicle is used. Therefore for the purpose of this design, an alternating (A.C) voltage source of 230V is used where the A.C voltage is converted to D.C voltage by rectification. Thus the process of converting the A.C voltage to the D.C voltage was accomplished with the help of a rectifier, filter and voltage regulators using voltage divider theorems. The main function of the voltage divider is to provide the various D.C voltages needed by the different electronic components in the system.

AC INPUT

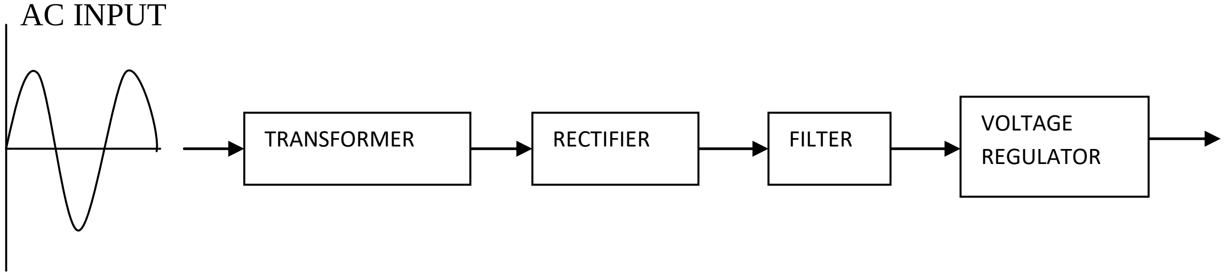

Fig 2: Conversion and stepping down of the voltage to the required voltage

The power supply requires has two outputs

- A 5V output required to supply the micro controller, LCD, GSM modem, GWG 16103-X
- A 12V output required by the relay

TRANSFORMER SELECTION

A 240/15V transformer with 500mA rated current was selected

Primary voltage of the transformer = 240

Secondary voltage of the transformer= 15V

From the transformer ratio equation k= $\frac{N1}{N2} = \frac{240}{15} = 16:1$

$V_{dc} == \frac{2v_{max}}{\pi}$

I_{dc}(d.c current)=$\frac{2I_{rms}\sqrt{2}}{\pi}$=$\frac{2\times 500\times 10^{-3}\times\sqrt{2}}{3.142}$=450mA

$V_{max\ dc}$=$\frac{Vdc\times\pi}{2} = \frac{2\times\sqrt{2}\times 3.142}{2} = 33.32v$

RECTIFIER

A full wave rectifier (IN4001) is selected for this purpose.

SELECTION OF FILTERING CAPACITOR

The choice of smoothing capacitor can be obtained from the supply frequency of 50 Hz, the capacitor used was calculated based on the following approximation.

The ripple voltage is given by;

V_R=V_{pp}-V_{rms}

Where V_{pp}=is the peak to peak voltage which is v_{rms}x$\sqrt{2} = 21.213v$

$V_{rms=}$15v (the voltage of the secondary

Where

V_R=$\frac{I_{dc}}{2FC}$

C=$\frac{I_{dc}}{2V_RF}$

V_R=V_{pp}-Vrms=21.21-15=6.213

C=$\frac{450\times 10^{-3}}{2\times 6.213\times 50} = 724\mu F$

Hence an electrolytic capacitor of capacitance greater than 724 microfarads (i.e. 2200microfarads) was selected for better filtration bearing that the higher the value of capacitor the lesser the ripples.

In this design the transformer was used to step down the A.C supply voltage to a low voltage output in order to suit the requirement of the circuit components fed by the D.C power supply.

The device is powered from a voltage of 230V AC mains electricity supply to the suitable low voltages required. LM7812 and LM7805 voltage regulators were used in this design to step down the voltages in order to obtain the desirable D.C output voltages needed by the electronic components used in the system. The LM7812 provides a 12V D.C voltage output which is used as the operating voltage of the relay in the demobilization unit while the LM7805 provides an output 5V D.C which is used as the operating voltage for GSM modem, GPS module, LCD display and the microcontroller. The power supply circuit diagram is shown below.

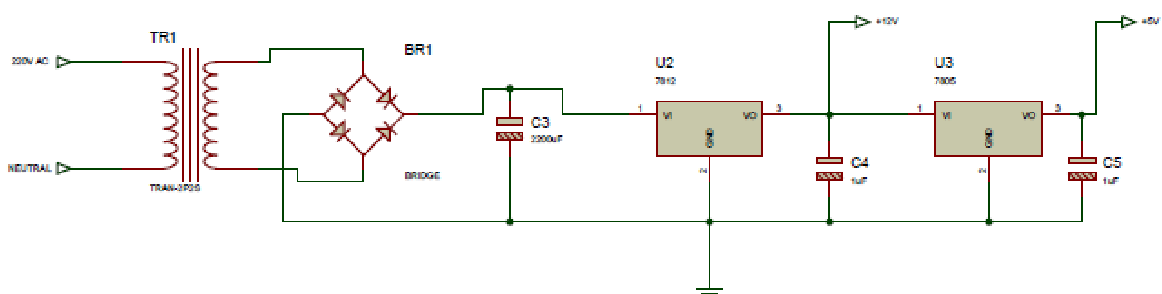

Fig 3: Power supply circuit

3.2 THE MICROCONTROLLER

The microcontroller serve as the heart of the circuit, it acts as an interface between GSM modem, GPS receiver and LCD display. In this design AT89C52 microcontroller is used. The ATMEL AT89C52 is a low power high performance CMOS 8-bit microcontroller.

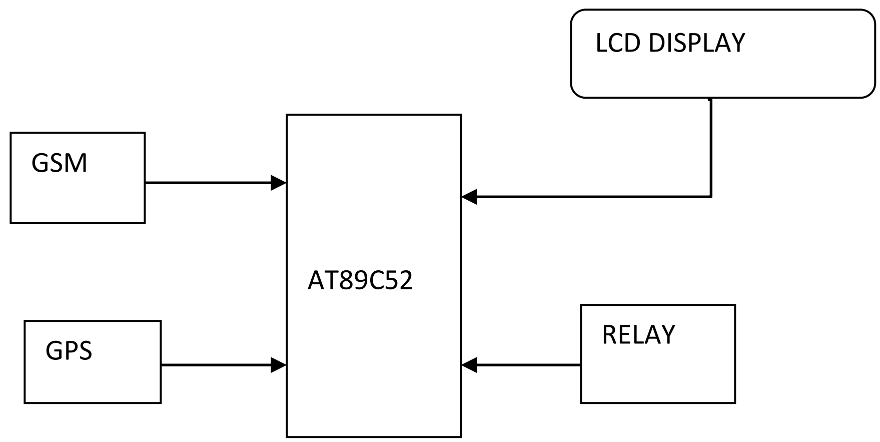

Fig 4: Block diagram for Vehicle Tracking system

3.2.1 DESCRIPTION OF BLOCK DIAGRAM

An AVR Microcontroller is interfaced to the GSM module, GPS Receiver, LCD display and also to the Relay. The microcontroller will always be expecting to receive a new SMS arrival. If the microcontroller senses that a new SMS is received, it will check the SMS for authentication and after authentication is verified it will read the GPS location from the GPS receiver and then send it to the user’s mobile phone in the form of SMS.

The device is been programmed in such a way that, when a vehicle is been lost or stolen, it can easily be located by simply sending an SMS “DATA” to the SIM card number inserted into the GSM modem. The GSM forwards the message to the microcontroller. At the same time the GPS receiver continuously calculates its location where it is on earth with the help of satellite signals from space and also sends this information to the microcontroller in this form, for example when the car is at a stationary position: “CAR STATUS:-PARKED. SPEED: 00Km/Hr. LATITUDE: and LONGITUDE: (depending on the location on earth). After retrieving all this information, the microcontroller forwards this information to the user’s mobile phone via SMS. However, the Vehicle can also be ACTIVATED or DEACTIVATED by the user’s mobile phone by simply sending an SMS “ENABLE” or “DISABLE” to the device.

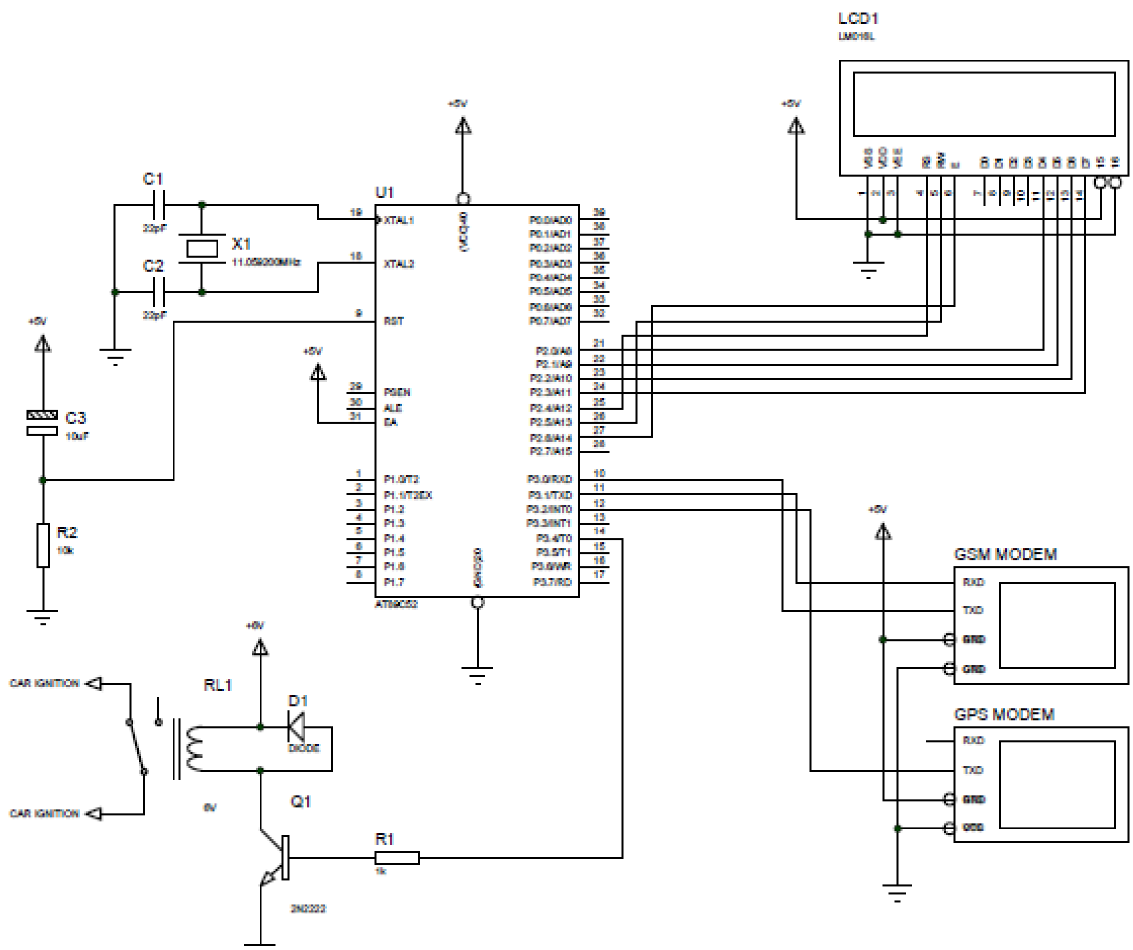

Fig 5: Circuit diagram of the vehicle tracking system

3.2.2 DESCRIPTON OF THE CIRCUIT DIAGRAM

In this design PROTEUS ISIS was used to create the circuit and then simulated with the help of AVR Studio which controls the execution of C programs for different resources on AVR microcontroller.

The LCD display device (LM016L) is interfaced with the microcontroller unit (AT89C52). The data pins (D0-D7) of LM016L are connected to PORT 2 of AT89C52 microcontroller. The GSM AND GPS modules are connected to the pins in PORT 3 of the AT89C52 microcontroller.

The relay is used for the activation and deactivation of the Vehicle ignition and is interfaced to pin 14 in PORT 3 of the AT89C52 microcontroller. The relay connection is in such a way that it is connected in series to the load (car ignition), when a high signal (1) is sent to the relay from the microcontroller, the electromagnet acts upon the single pole double throw (SPDT) switch so that the normally open and common terminals are connected to the load and when a low signal (0) is sent, the normally closed and common terminals are connected (it acts just like a switch to the ignition of the vehicle).

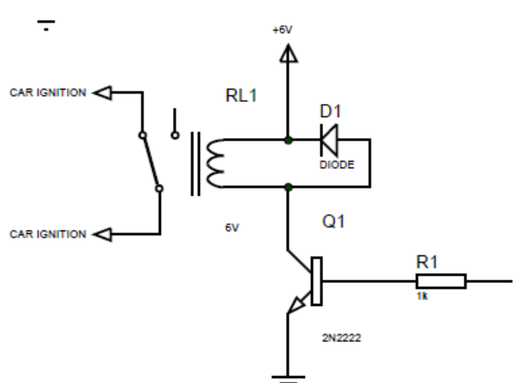

Fig 6: Schematic of a relay

3.3 SOFTWARE USED

3.3.1 PROTEUS ISIS

In this design PROTEUS ISIS was used to create the circuit of the vehicle tracking system and was further used to simulate the circuit to make sure the purpose of the design is achieved. Below is the schematic of the simulation for the circuit design using PROTEUS ISIS design suit.

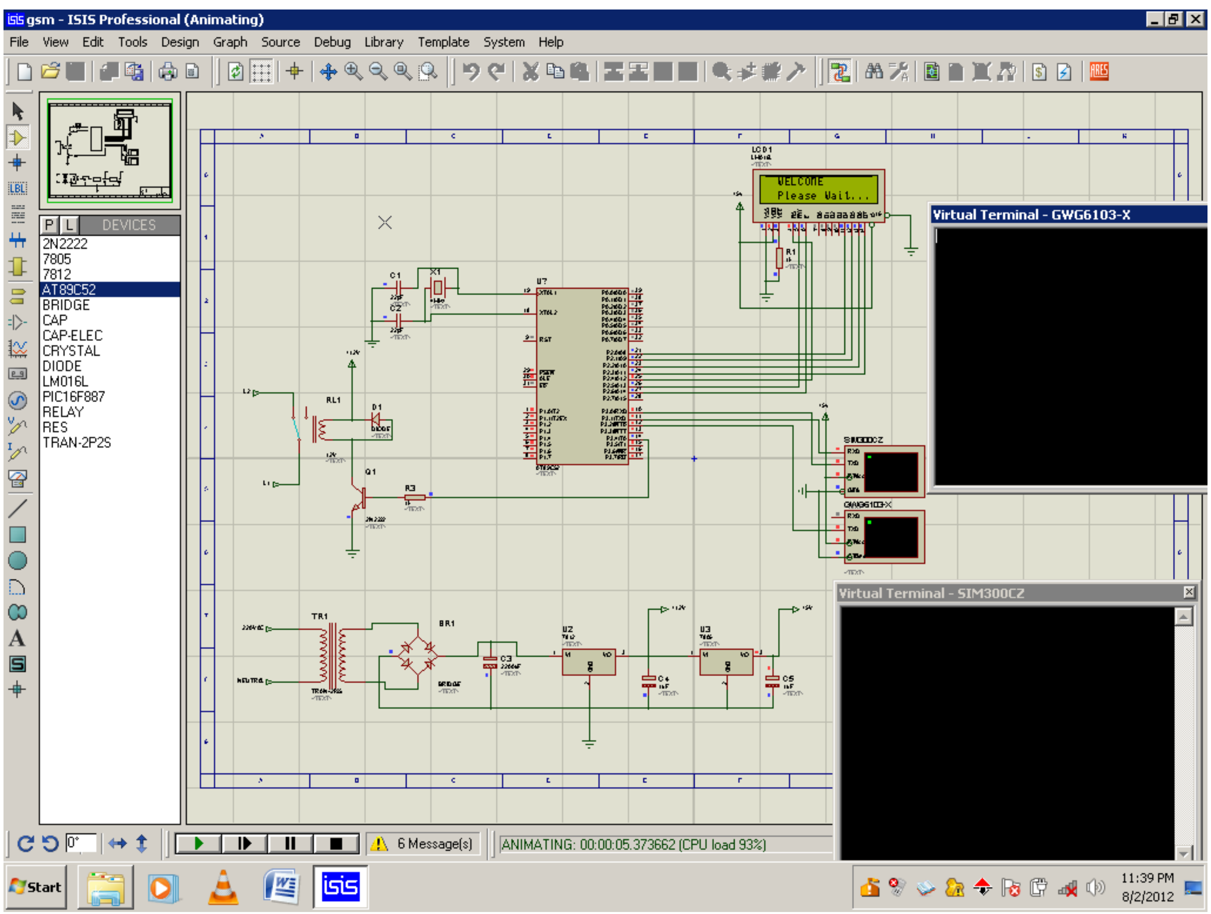

Plate 1: Simulation for vehicle tracking system using Proteus

3.3.2 AVR STUDIO

The AVR studio is an integrated development environment for writing and debugging AVR applications. It also provides a project management tool, source files editor and chip simulator. However, the program used in this project was written in C language and compiled in this environment. The preview of the program is shown in Appendix D.

The program was converted to the hexadecimal equivalent and loaded to the AT89C52 microcontroller with the aid of the USB interface between the microntroller and computer.

3.4 CONSTRUCTION

All the required components used for the project were tested to make sure they operate effectively. After the component analysis has been completed, the components were tested to ensure that they are in good working condition. The circuit was then mounted on a breadboard according to the specification in order to ascertain its performance. The components were mounted with respect to the continuity of the breadboard and care was taking in mounting each component to ensure that the correct configuration and connections were made.

Afterwards, the circuit was transferred and assembled on a single compact vero-board in which all the components were soldered accordingly.

3.5 CONSTRUCTION ON BREADBOARD

The circuit was initially assembled on the breadboard where each units of the system was tested stage by stage and it was found to be working satisfactory according to the design specifications.

3.6 CONSTRUCTION ON A VERO-BOARD

The circuit was mounted on a vero-board. This is done in order to ease construction work and also to minimize error during the soldering process. It also allowed tests to be carried out at different stages when tracing a fault on the system. When assembling the components on the vero-board, the polarities of the components were carefully observed. So also all soldering were checked for dry joints or for drops of solder that may cause short circuit across the tracks before it was powered.

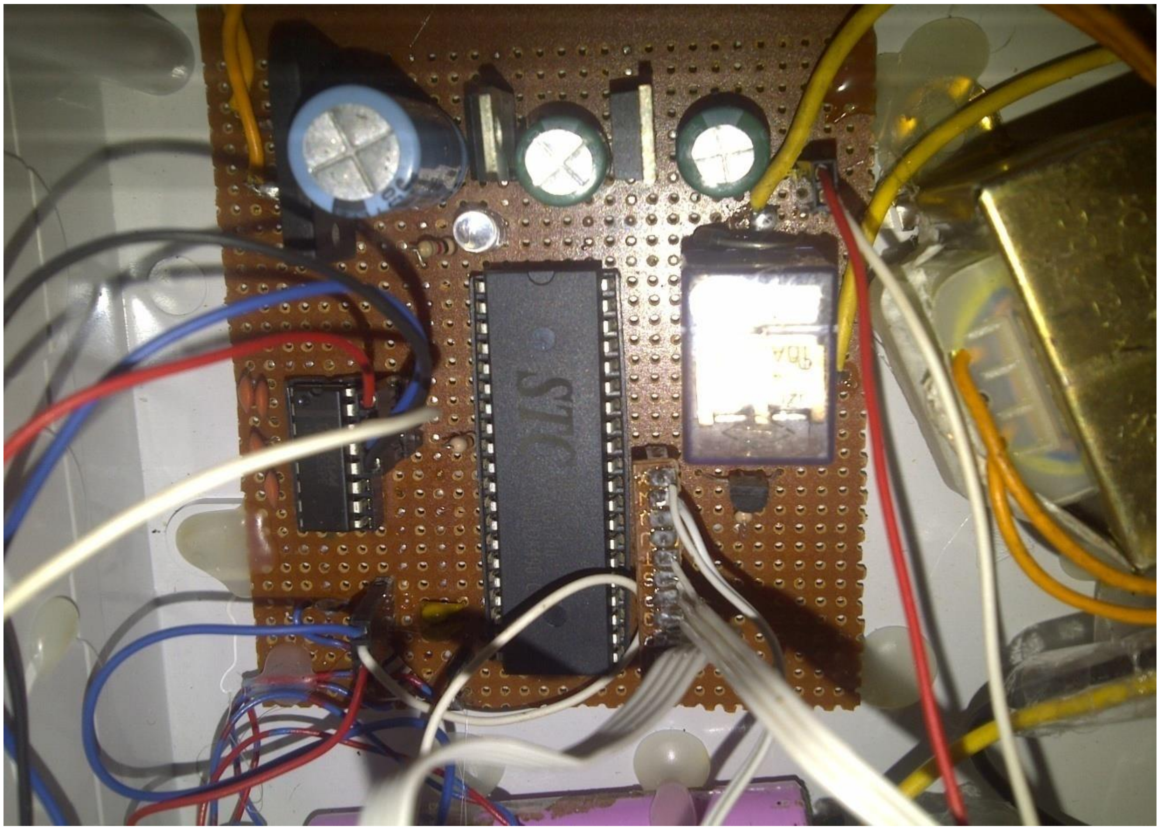

Plate 1: Vero board construction process

3.7 METHODOLOGY IN THE CONSTRUCTION PROCESS

The methodology in the construction process depends on the type of board to be used which could be vero-board, strip board or printed circuit board (PCB). It also depends on the size and the type of circuit to be constructed. As far as this project is concerned at this level, the vero-board is the most appropriate board to be used. The methodology in construction using the vero-board is as follows:

1. The surface of the vero-board should be checked and cleaned in order to ensure that it has no damage, breakage and lifted track before transferring the components to the vero-board. This was done in order to avoid poor soldering.
2. All the components were soldered on the vero-board carefully using a soldering iron of 60 watts.
3. Small capacitors and resistors were mounted flush with the board and components mounted vertically were seated squarely on the board.

When mounting the components, the following were considered

- Component identification is visible
- Rows of components form neat lines
- The identification of components read from left to right in relation to diagram.

3.8 CASING

The casing of Vehicle tracking system is made from a well finished plastic material in which the complete circuit constructed was packaged inside. The main switch is mounted on the front cover of the case so also a hole was provided via which the main power supply wires ran into the case.

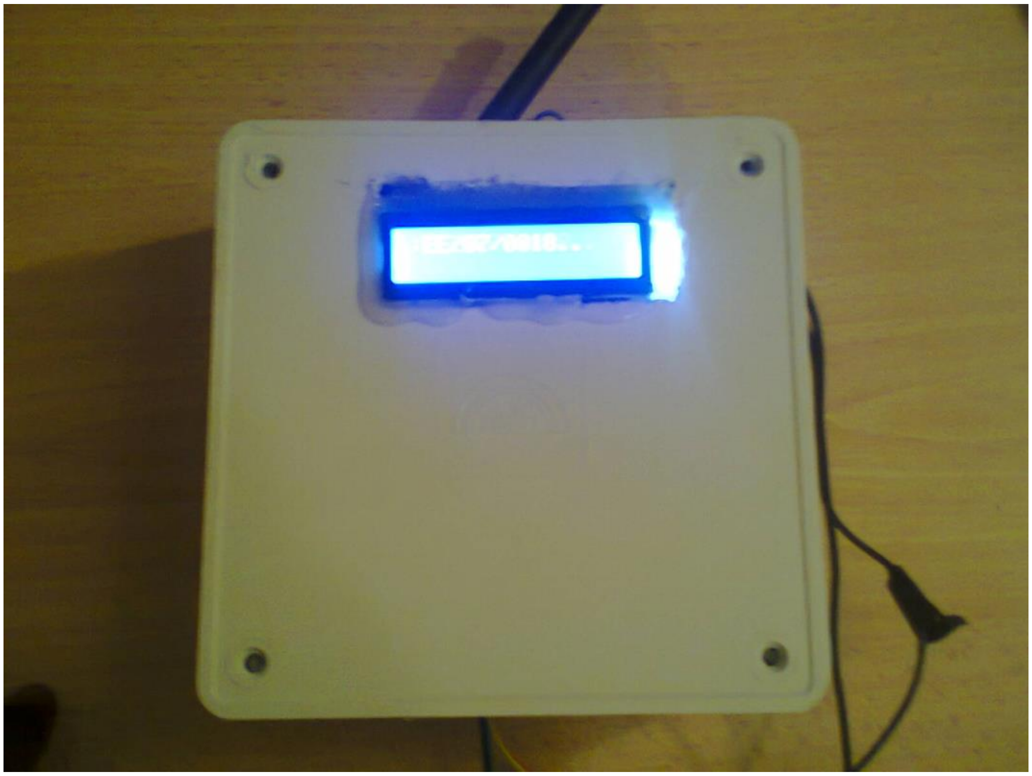

Plate 3: A view of the completed vehicle tracking system

3.9 INSTALLATION

Instructions provided in this section describe the hardware installation of the Vehicle tracking system.

• Choose a convenient location in the vehicle either in the trunk or interior of a vehicle. Avoid locations that might expose the device to excessive heat or moisture.

• Hold the Vehicle tracking system in place and mark the location for mounting screw holes

• Using the markings as a guide, drill mounting holes in those positions

• Align the Vehicle tracking system in the drilled holes and secure it with mounting screws

The Vehicle tracking system is **NOT** a waterproof or sealed device. Care must be taken to ensure the device is kept away from water or any other liquids.

CHAPTER FOUR

PERFORMANCE AND COST EVALUATION

4.0 INTRODUCTION

This chapter reveals the tests carried out on the project work and the performance /results obtained. It also provides a list of the components used and the cost.

4.1 TESTING/PERFORMANCE

The software, PROTEUS ISIS was used to create the circuit design and then simulated as shown in plate 3.1 in chapter 3. The software code which was written in C language was compiled, debugged and tested with the help of AVR Studio which controls the execution of C programs for different resources on 8051 microcontroller as shown below:

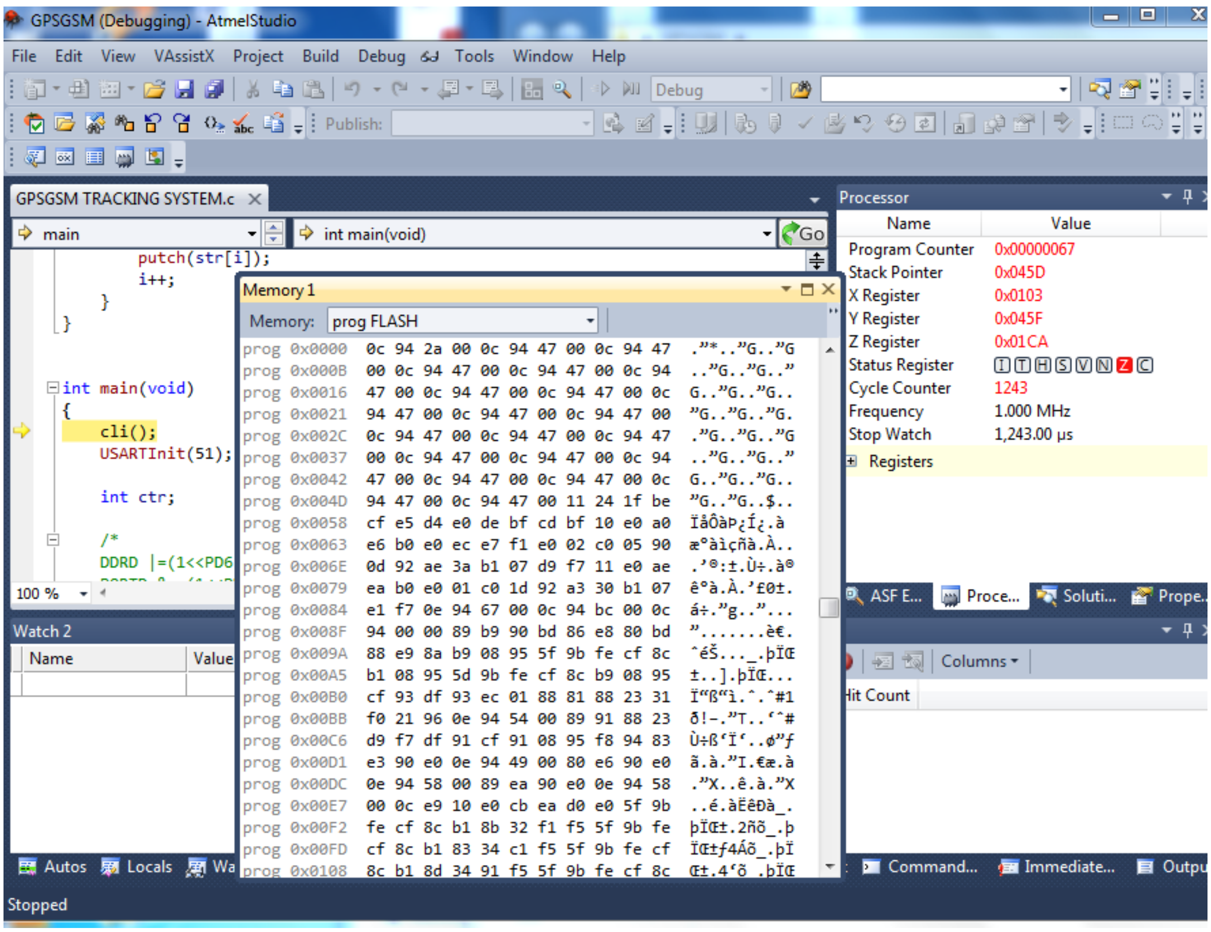

Plate 4: Execution and debugging of the program using AVR Studio

After successful completion of this project construction, it was ensured that all connections of the various stages were made correctly without any mistake. A test was carried out using a digital multi meter to ascertain the output voltage.

The essence of the test carried out was primarily done so as to verify the design and construction as well as its performance. The following tests were carried out:

i. Tests for continuity and discontinuity were often carried out to ensure open and short circuits were maintained.
ii. Lengths of the jumper wires were minimal to ensure effective transfer of voltage from one point to another.
iii. D.C output voltages were also tested.

4.2 LIST OF COMPONENTS AND COSTING

The various components selected for the assembling of the microcontroller based vehicle tracking system and their prices plus other expenses are displayed in the table below;

Table 1 Cost of Items

ITEM	NO	UNIT PRICE (₦)	AMOUNT (₦)
Transformer (12v/1000mA)	1	350	350
GSM modem	1	9500	9500
Bridge Rectifier	1	50	50
Voltage Regulators	2	50	100
Electrolytic Capacitor	4	50	200
Ceramic Capacitor	1	20	20
Vero and bread boards	1	400	400
Resistors	15	10	150
Microcontroller unit (include crystal)	1	800	800
Transistors(TIP41)	2	30	60

IC socket(base)	1	100	100
D.C Battery	2	70	140
Electromagnetic Relay (12A)	1	150	150
GPS receiver	1	9500	9500
Lead, Jumper wires, Copper wires		700	700
MAX232	1	600	600
Casing	1	600	600
Miscellaneous		3000	3000
TOTAL			**₦26,420**

Table 1: Component costing

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.0 SUMMARY

This project work attempts to proffer a lasting solution to the long lingered car theft in the country. It is achieved by using AT89C52 micro-controller which serves as the brain of the project, and thus helps to eliminate the use of unnecessarily large number of components.

The use of C language to program the microcontroller guarantees excellent performance and accuracy beyond average. Information surfed from the internet and relevant books form the sources of data used to achieve the desired goal.

5.0 CONCLUSION

In this work, a robust, low cost, and user friendly vehicle tracking system, based on embedded system which provides information against theft has been evolved. The GSM modem provides information to the user's phone whenever it is requested for and can get access to the position of the vehicle at any instance, thus SMS could be sent in order to stop the vehicle. The GPS Receiver on the device will locate the position (latitude and longitude) of the vehicle using the satellite service. This is an efficient and reliable system of providing information to vehicles through GPS and GSM Technology.

5.1 RECOMMENDATIONS

It is recommended that this project could be improved through the use of satellite modems instead of mobile phones service network as network dependent system may fail when there is no network coverage in a particular region. This device can be enhanced in future to support mobile phones, cameras and laptops. The device could also be made more secured with the aid of a security code which can only be accessed by the car owner.

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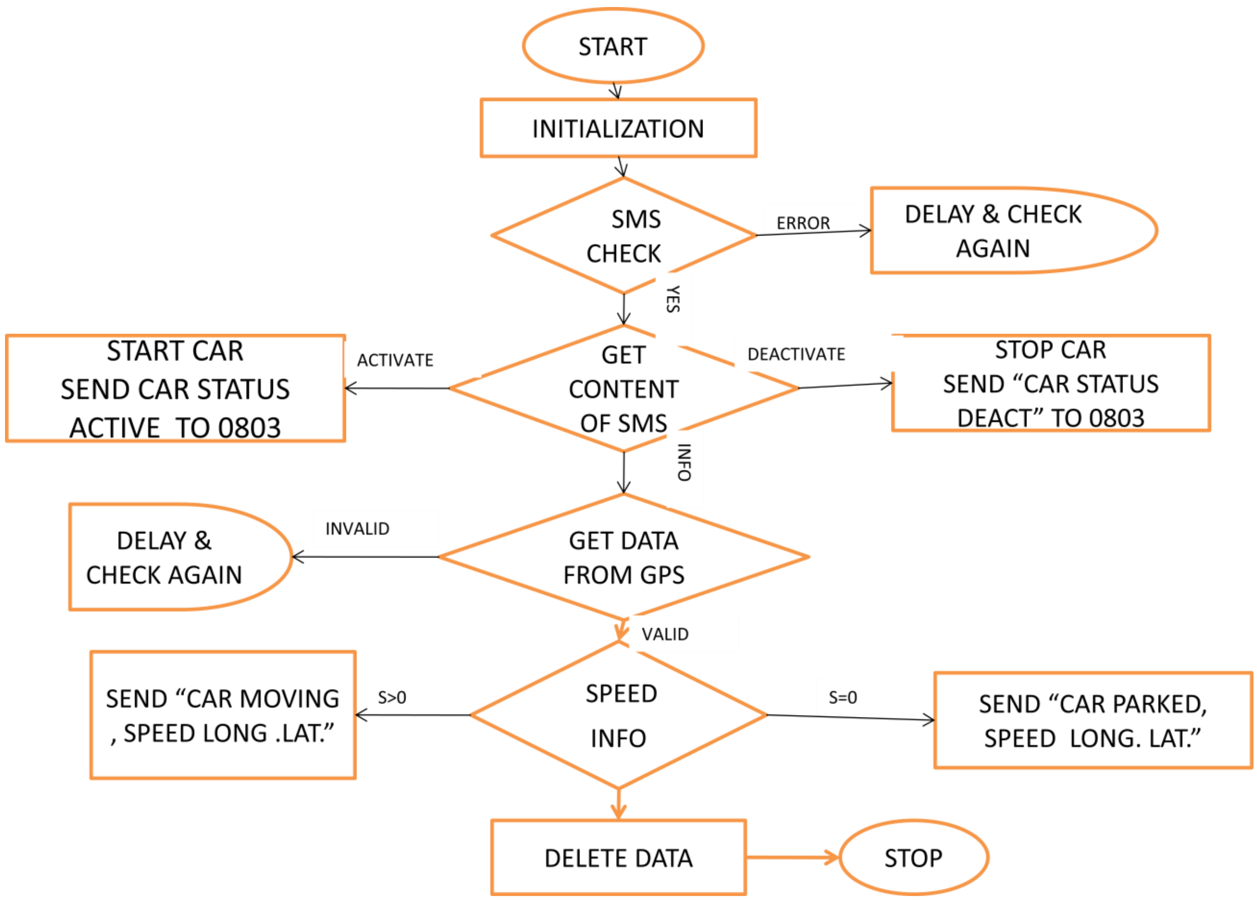
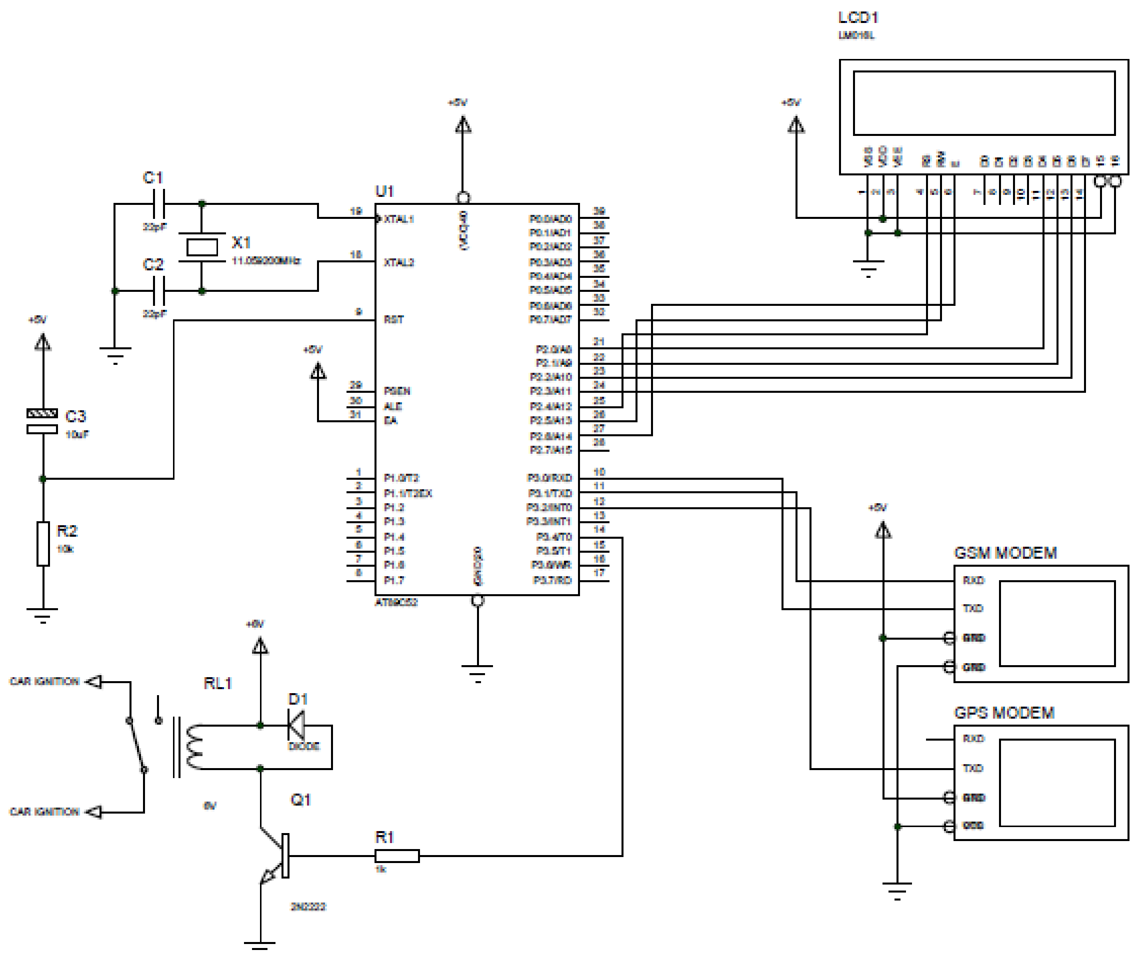
APPENDICES

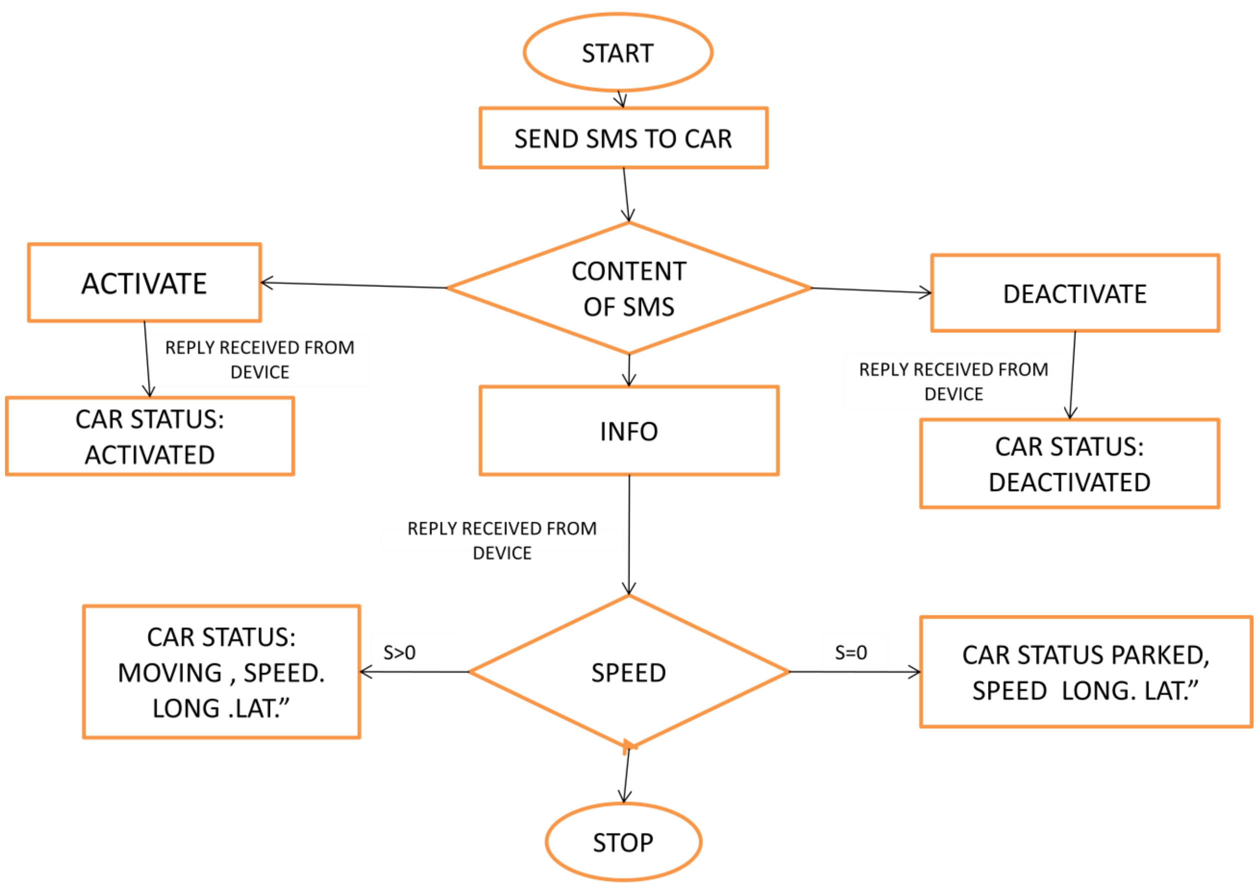
Appendix A: Program flowchart



Appendix B: Circuit diagram of vehicle Tracking Device



Appendix C: Operation Flowchart



APPENDIX D: program listing

C LANGUAGE PROGRAM OF THE PROJECT

```
/****************************************************************************************/
/*  ****************www.microscale-embedded.com***********************
*/
/* FILENAME   : GPS_CAR_TRACKER.C                                  */
/* PROJECT    : GPS CAR TRACKER
*/
/* CPU TYPE   : 8051 family                                */
/* COMPILER   : Keil Uvision4 for 8051 family of mcu
*/
/* AUTHOR     :          Microscale Embedded ltd.                    */
/*                                               */
/************************** CHANGE AND RELEASE LOG
************************/
/* Version | ACTION                              |  DATE  | SIG  */
/* --------|-----------------------------------------------|--------|----- */
```

```
/*        |                                   |       |      */
/*   0.00 | Created file                          | 150712 | ST   */
/*                                                       */
/***********************************************************************
*****/
#include"reg52.h"
#include"stdio.h"
#include <ctype.h>
#include <string.h>
#include <stdlib.h>

#include"Lcd_4.h"

sbit RX_PIN =P3^2;     //soft ware uart recieve pin
sbit TX_PIN =P3^3;     //soft ware uart transmit pin

sbit RELAY =P3^4;

#include"Soft_Uart.h"

/*some useful definitions  */
#define CR        0x0d
#define LF        0x0a
#define ESC       0x1b
#define BEEP      0x07
#define CZ 26
```

```
/* Some helpful defines */

#define SPACE  0x20

#define COMMA          0x2C

#define FULLSTOP  0x2E

#define SIZE    70

#define MAXSIZE    66            /* GPS at most, sends 80 or so chars per message string.  So
set maximum to 100 */


unsigned char idata latitudeString[13];            //array to hold the latitude string

unsigned char idata longitudeString[13];                 //array to hold the longitude string

unsigned char  *pChar;

short count;

bit network_flag

unsigned  int estHour;
```