Sudan University of Science and Technology

Graduate Studies

Design and Implementation of Anti-Theft Vehicle Tracking System with Android App

تصميم وتنفيذ نظام مضاد للسرقه لتعقب المركبات بتطبيق اندرويد

A Research Submitted in Partial Fulfillment for The Requirement of The Degree of M.Sc. in Electronic Engineering Department of Computer and Network Engineering.

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الاستهلال

قال تعالي:

{وَلَا تَقْفُ مَا لَيْسَ لَكَ بِهِ عِلْمٌ ۚ إِنَّ السَّمْعَ وَالْبَصَرَ وَالْفُؤَادَ كُلُّ أُولَـٰئِكَ كَانَ عَنْهُ مَسْئُولًا}

[الإسراء:36]

Dedication

Every challenge work needs self-efforts as well as guidance of elders especially those who were very close to our heart

My humble effort I dedicate to my sweet and loving

Father & mother

Whose affection love encouragement and pays of day and night make me able to get such success and honor,

Along with all hard working and respected

Teachers

Acknowledgement

I am using this opportunity to express my gratitude to everyone who support me throughout my capstone project, for this occasion, I would like to thanks:

Dr.Alaa ALdeen Awooda, who is my supervisor within university. He helped me and coached me during my capstone project by giving me feedback and tips. And by guide me with valuable advice through my capstone. I want to thank him for his professional spirt and valuable guidance.

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My final thought go to my family and friends, and without them this project would not have been possible.

Abstract

The number of car theft increasing each year. If not recovered soon, stolen vehicles are generally sold, revamped or even burned if the resale price is considered to be too low. Once a vehicle is stolen, it becomes hard to locate it and track it, which considerably decreases the chances of recovering it. Nowadays, insurance companies suggest to their clients to equip their vehicles with a Global Positioning System (GPS) that can locate in real time their cars all over the country. In this work, design and implementation of Anti-theft vehicle and tracking system is presented that protects and secures vehicles. This project consists of building two main components: 1. Hardware component; this implements system running on Arduino UNO. 2. Software component; this deploys an Android application whereby end users and/or car owners control and locate their cars in an interactive map anytime and anywhere. Using this system will facilitate control the engine of the vehicle and keep tracking it this will increase the chance of recovering the car intact.

المستخلص

يزداد عدد سرقة السيارات كل عام. إذا لم يتم استردادها قريبًا ، يتم بيع السيارات المسروقة أو تجديدها أو حرقها بشكل عام إذا كان سعر إعادة البيع منخفضًا جدًا. بمجرد سرقة السيارة ، يصبح من الصعب تحديد موقعها وتعقبها ، مما يقلل بشكل كبير من فرص استعادتها. في الوقت الحاضر ، تقترح شركات التأمين على عملائها تزويد سياراتهم بنظام تحديد المواقع العالمي (GPS) الذي يمكنه تحديد موقع سياراتهم في الوقت الفعلي في جميع أنحاء البلاد. في هذا العمل ، تم تصميم وتنفيذ نظام مضاد للسرقة ونظام التتبع الذي يحمي ويؤمن المركبات. يتكون هذا المشروع من بناء مكونين رئيسيين: 1. مكونات الأجهزة ؛ هذا ينفذ نظام يعمل على اردوينو UNO 2.مكون البرنامج ؛ هذا ينشر تطبيق Android حيث يتحكم المستخدمون و / أو مالكو السيارات في سياراتهم و يتم كشف موقع السيارة في خريطة تفاعلية في أي وقت وفي أي مكان. سيؤدي استخدام هذا النظام إلى تسهيل التحكم في محرك السيارة ومواصلة تتبعه ، مما يزيد من فرصة استعادة السيارة كما هي.

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List of Abbreviations

ANDROID	Automated Numeration Of Data Realized By Optimized Image Detection
AT command	Attention Command
BS	Base Station
CAD	Computer Aided Drafting
CAN	Control Area Network
CMOS	Complementary Metal Oxide-Semiconductor
CPU	Central Processing Unit
CSD	Circuit Switched Data
DC	Direct Current
DOD	Department Of Defense
ECM	Engine Control Module
EGNOS	European Geostationary Navigation Overlay Service
FCC	Federal Communication Commission
GAGAN	GPS Aided Geo Augmented Navigation System
GPS	Global Positioning System
GSM	Global System Mobile Communication
HSCSD	High Speed Circuit Switched Data
I2C	Integrated Circuit
ID	Identity
IDE	Integrated Development Environment
IEEE	Institute of Electrical And Electronic Engineers
I/O	Input/output
ISDN	Integrated Services Digital Network
ISM	Industrial Scientific And Medical
ISP	Internet Services Provider
LAN	Local Area Network
LEO	Low-Earth Orbit Satellite
LMDS	Local Multipoint Distribution System
M2M	Machine To Machine
MIT	Mobile Learning Lap
MMDS	Multichannel Multipoint Distribution Service
MMS	Multimedia Message Services
MSAS	MTSAT Satellite-Based Augmentation System
MSG	Massage
PND	Portable Navigation System
PSTN	Public Switched Telephone Network

RX	Receiver
SIM	Subscriber Identity Module
SMS	Short Message Services
TTL	Transistor- Transistor Logic
TX	Transmitter
UART	Universal Asynchronous Receiver/Transmitter
U-NII	Unlicensed National Information Infrastruction
USB	Universal Serial Bus
UWB	Ultra-Wide Band
VGPS	Virtual GPS
WAAS	Wide Area Augmentation System
WIMAX	Worldwide Interoperability for Microwave Access
WWW	World Wide Web
3G	Third Generation

Chapter One

Introduction

1.1 Overview Work

Now a day the cases of vehicle theft increases very much and the existing methods have various shortcomings like the logics used cannot be implied in all situations. Also the available security systems in the market contain either a locking system or a GPS based tracking system. The problem with this normal locking system is that an expert can easily unlock the vehicle if he has the necessary tools. There are so many recent technologies evolving and new methods are being upgraded in overcoming this issue.

A car with Electronic control unit security system helps the user to lock and unlock doors at the press of a button. Mainly two types of Electronic control unit are used in Auto industry -Automatic Electronic control unit and Manual Electronic control unit that ensures smoother and secured operation. Again this system could not prove to provide complete security and accessibility of the vehicle in case of theft. So a more developed system makes use of an embedded system based on GSM technology. The designed & developed system is installed in the vehicle.

Anti-vehicle theft system guarantees the best ensure to secure your vehicle from various types of burglary cases. A mobile app can act as an interaction between the user and the vehicle. Location updates are sent periodically to the registered user through mobile app. The anti-theft vehicle

and tracking system is a total security and fleet management solution. It is the technology used to detection robber, lock engine and determine the location. Determine the location of a vehicle using different methods like GPS and other navigation system operating via satellite and ground based stations. Modern vehicle tracking system use GPS technology to monitor and locate our vehicle anywhere on earth, but sometimes different types of automatic vehicle location technology are also used.

The system has very important two part, the first one is Ignition locking system is to design an embedded system for implementing an efficient ignition locking system that will be useful to find the car and catch the thief. Location of the car is to design an embedded system for implementing an efficient tracking of the car. It consists of GSM and GPS modem. This will extract the SMS information from GSM modem, and it will plot the latitudes and longitudes on the Google map.

1.2 Problem Statement

Cars are expensive items and probably one of the most stolen possessions around the world. In the last decade stolen cars increased with urban cars increase, an efficient security mechanism is needed for cars in order to protect it from robbery.

1.3 Proposed Solution

This project provides solution to protect vehicle from robbery. It provides real-time information such as location from anywhere through the

mobile phone app. Also when the vehicle has been stolen the owner can lock or unlock the engine from his mobile phone application.

1.4 Aims and Objectives

The main aim is to propose anti-vehicle theft system which will protect cars from robbery.

To achieve this aim:-

- To design and construct a remotely controlled vehicle anti-theft system via android app.
- To initiate some control actions on the vehicle from a mobile phone.
- To monitor the state or condition of the vehicle after it has been stolen.
- To simulate the proposed system.

1.5 Methodology

Before start implementing the project, problem statement need to be analyze. And why the project is conducted. Problems that need to be identified would not only be the one which might occur during conducting the project but also with the system that is to be design. That includes the type of microcontroller that is going to be used.

Therefore, a suitable component to achieve the propose solution. After choosing the suitable microcontroller and component, then the next step is to

choose a programming language in order to program the microcontroller and to use it. Thus, research needed to be done in order to know which programming languages can provide the better solution with the programming by knowing each languages pros and con.

After the above steps have been done, now is the time to draw the block diagram of the system and the flow chart which describes how the system works. Test the circuit using simulation to verify whether the function as it was supposed to be or not.

Based on designed anti-vehicle theft system, a suitable program is being constructed using the programming language chosen to be written into the microcontroller used. The last stage is test and run. This is the stage where the anti-vehicle theft system was tested together with the programming to verify whether the anti-vehicle theft system function as it was supposed to be or not.

Design android app for remote control of the car. And build the hardware of the circuit and test it.

1.6 Thesis Outline

The thesis will be reported in five chapters

1. Chapter one includes introduction, problem statement, proposed solution, objectives and methodology.
2. Chapter two contains literature review and describe of component.
3. Chapter three includes methodology.
4. Chapter four simulations and discussion.
5. Chapter five includes conclusion and recommendation

Chapter Two

Literature Review

2.1 Overview

Thousands of vehicles are lost each year in the state and thousands of vehicles are also recovered by the police from when they catch the robbers or even when the robbers leave the vehicles they have stolen after they have used them. The usual problem with the recovered vehicles did not be found in the same jurisdiction as one in which the complaint was launched. So, when a vehicle is recovered, usually the Police try to trace out the actual owner of the vehicle from the RTO based on the license and chassis number. But this is a lengthy and time consuming process for the RTO to trace out the actual owners from the records and inform back to the Police stations. Because of these delays, vehicles that are recovered all long time to actually reach their owners. Despite the various technologies that have been introduced in recent years to detect car thefts and tracking it.

Vehicle security is always been an important priority in the automobile industry. Various techniques like central locking system with alarm were one of the security parameter, which could only protect against thefts only when the vehicle was stationery. However, to keep in touch with a remote vehicle and track its other aspects like speed and location are being developed and tested, Today's generation phones are not only capable of sending mails, making phone or video calls but also have the capability to control other smart

phones. Therefore an intelligent auto theft detection system is designed in such a way it can predict the event of theft accurately [4].

Tracking and controlling of theft car system ensures the best guarantee to protect your car from different kinds of theft cases. It is a car security device that offers excellent protection to your car. A car with central locking security system helps the user to lock and unlock engine at the press of a button. Vehicle tracking and locking system used to track the theft vehicle by using GPS and GSM technology. GSM and SMS technology is a common feature with all mobile network service providers. Utilization of SMS technology has become popular because it is an inexpensive, convenient and accessible way of transferring and receiving data with high reliability [7].

2.2: Related Work

In 2013**,** Kashyap [4] proposed Tracking and Controlling of Theft Car, vehicle tracking and locking systems used to track the theft vehicle by using GPS and GSM technology. This system puts into the sleeping mode vehicle handled by the owner or authorized persons; otherwise goes to active mode. The mode of operations changed by persons or remotely. When the theft identified, the responsible people send SMS to the micro controller, then microcontroller active the relay and issue the control signals to stop the engine motor. After that location of the car is send to the owner and nearby police station with the image of thief taken by spy camera. To start the motor again we have to send the SMS to the microcontroller again, and then it issues the signal to the relay to start the engine again [1].

In 2014**,** Prakash and K.Sirisha presented Design and Implementation of a Vehicle Theft Control Unit using GSM and CAN Technology. In this paper for avoiding vehicle theft uses a mobile phone that is embedded in the vehicle with an interfacing to Engine Control Module (ECM) through Control Area Network (CAN) Bus, which is in turn, communicated to the ECM. The vehicle being stolen can be stopped by using GPS feature of mobile phone and this information is used by the owner of the vehicle for future processing. The owner sends the message to the mobile which is embedded in the vehicle which has stolen which in turn controls the vehicles engine by locking the working of the engine immediately. The developed system accept the message and broadcasted to the Vehicle Network through CAN Bus. The engine can be unlocked only by the owner of the vehicle by sending the message again [2].

In 2015, Zacharia [2] proposed VTDS: Vehicle Theft Detection System. In this paper vehicle tracking and locking systems used to track the theft vehicle by using GPS and GSM technology. This system is in active mode whenever the user leaves the vehicle and in any case of intrusion the system will detect it and inform the owner. Owner can control his vehicle remotely using is android device. When the theft identified, the owner can send SMS to the micro controller, then issue the control signals to stop the engine motor. After that all the doors locked. To open the doors or to restart the engine authorized person needs to enter the passwords [3].

In 2015, M. Ahire [4] proposed Android App for Stolen Vehicle Tracking and Engine-Disengaging System. In this paper the system has Mobile Phone that is embedded in the vehicle with an interfacing to Engine

Control Module (ECM) through microcontroller (ATMEGA328), which in turn communicates to the ECM. The vehicle being stolen can be stopped by using GPS feature of mobile phone and this information is used by owner of the vehicle for further processing. The owner sends a notification to mobile which is embedded in the vehicle that has stolen which in turn controls the engine of vehicle by locking it immediately. The engine can be unlocked by only by the sending the password to microcontroller by Authorized person only [4].

In 2016, Champa [4] proposed paper name Vehicle Theft Detection and Prevention Using GSM and GPS. In this paper the system provides two levels of security, password protection for the vehicle and remote ignition cut-off mechanism. This system also provides provision for vehicle tracking using GPS. GSM technology is used for intimating the owner. An alert message is sent to the owner if the wrong password is entered. Message is also sent when the ignition system of the vehicle is started. The owner can respond with an SMS to stop the engine. A buzzer is also activated to alert the nearby people or the security personnel if the right password is not entered after maximum number of trials. Message is sent to owner even when vehicle is started using correct password [5].

2.3 Microcontroller

Microcontroller is a stripped-down processor which is equipped with memory, timers, parallel I/O pins and other on-chip peripherals. The driving element behind all this is cost: Integrating all elements on one chip saves space

and leads to both lower manufacturing costs and shorter development times. This saves both time and money, which are key factors in embedded systems. Additional advantages of the integration are easy upgradability, lower power consumption, and higher reliability, which are also very important aspects in embedded systems. On the downside, using a microcontroller to solve a task in software that could also be solved with a hardware solution will not give you the same speed that the hardware solution could achieve. Hence, applications which require very short reaction times might still call for a hardware solution. Most applications, however, and in particular those that require some sort of human interaction (microwave, mobile phone), do not need such fast reaction times, so for these applications microcontrollers are a good choice.

Microcontroller already contains all components which allow it to operate standalone, and it has been designed in particular for monitoring and/or control tasks. In consequence, in addition to the processor it includes memory, various interface controllers, one or more timers, an interrupt controller, and last but definitely not least general purpose I/O pins which allow it to directly interface to its environment. Microcontrollers also include bit operations which allow you to change one bit within a byte without touching the other bits [11].

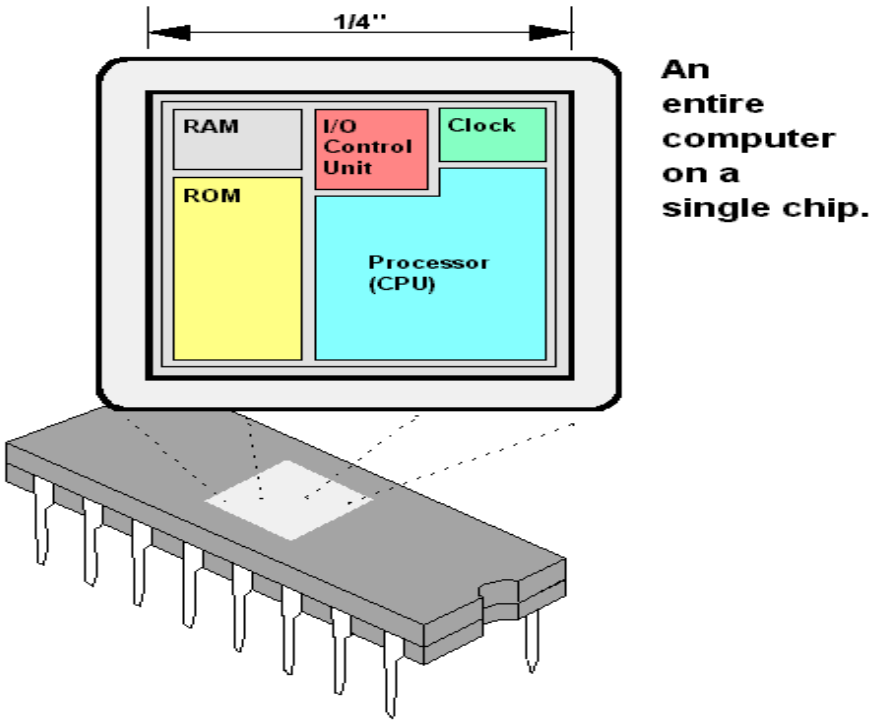

Figure 2.1: Microcontroller [21].

2.3.1 Arduino Microcontroller

Arduino is an open source single board microcontroller, intended to formulate a process of exploiting electronics in multidisciplinary projects more accessible. An Arduino board consists of an Atmel 8-bit AVR microcontroller with complementary components that facilitate programming and incorporation into other circuits. And an important aspect of the Arduino is its standard connectors, which means users connect the CPU board to a variety of interchangeable add-on modules called as shields. Some shields communicate with the Arduino board directly over various pins, but most of the shields are individually addressable via an I^2C serial bus so many shields can be stacked and used in parallel alignment. Official Arduinos have used the megaAVR series of chips, which is ATmega8, ATmega168, ATmega328,

ATmega1280, and ATmega2560. A hand full of other processors have been used by Arduino compatibles. Most boards have include a 5 volt linear regulator and a 16 MHz crystal oscillator , although some designs like the LilyPad run at 8 MHz and dispense with the onboard voltage regulator due to specific form factor restrictions. An Arduino microcontroller is also programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory and compared with other devices that typically need an external programmer, which makes using an Arduino more straightforward by allowing the use of an ordinary computer as the programmer.

At a conceptual level, when using the Arduino software stack, all boards are programmed through an RS-232 serial connection, but the way which is implemented varies by hardware version. Serial Arduino boards contain a special circuit called level shifter circuit to convert between RS-232-level and TTL-level signals. The ongoing Arduino boards are programmed through USB, implemented using USB-to-serial adapter chips such as the FTDI FT232. Some alternatives such as the Arduino Mini and the unofficial Arduino, use a detachable USB-to-serial adapter board or cables, Bluetooth or other methods. (When used with traditional microcontroller tools instead of the Arduino IDE, standard AVR ISP program is used.) The Arduino board exposes most of the microcontroller's I/O pins for use by variant circuits. The Diecimila, Duemilanove, and current Uno provide 14 digital I/O pins, six of fourteen which can produce pulse-width modulated signals, and six analog inputs, this can also be used as six digital I/O pins as seen in figure 2.1.

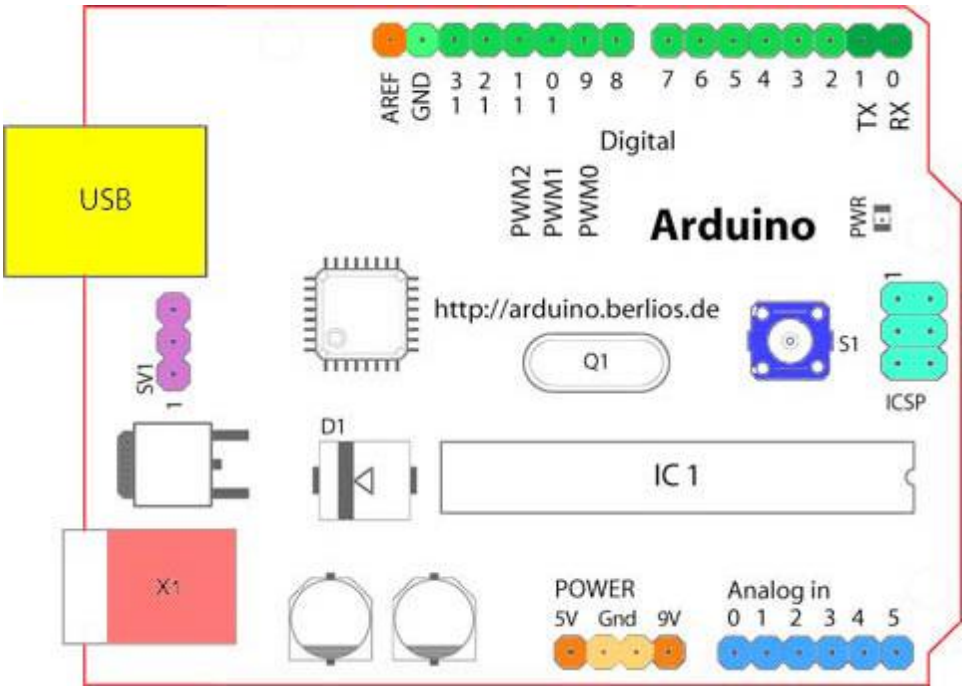

Figure 2.2: Arduino board.

These pins are on the top of the board, via female 0.10- inch (2.5 mm) headers. Several plug-in applications shields are also commercially obtainable. The Arduino Nano, and Arduino-compatible Bare Bones Board and Arduino boards may provide male header pins on the underside of the board that can plug into solderless breadboards. There are many Arduino-compatible and Arduino-derived boards. In which some are functionally equivalent to an Arduino and can be used vice versa. Many enhance the basic Arduino by adding output drivers, often used in school level education to simplify the construction of buggies and small scale robots. Others are electrically equivalent but change the form factor sometimes retaining compatibility with shields, sometimes not. Some revision use completely different processors, with varying levels of similarity.

The Arduino integrated development environment (IDE) is a cross-platform application written in Java and which is obtained from the IDE for the Processing programming language and the Wiring projects. It is sketched to introduce programming to artists and other newcomers unfamiliar with software development. It comprises a code editor with features such as syntax spotlighted, brace matching, and automated indentation and is also capable of compiling and uploading programs to the board with a single click. A program or codes written for Arduino is called a sketch. The Arduino programs are written in C or C++. An Arduino IDE comes with a software library called "Wiring" from the original Wiring projects, which makes many common input/output operations much simple [6].

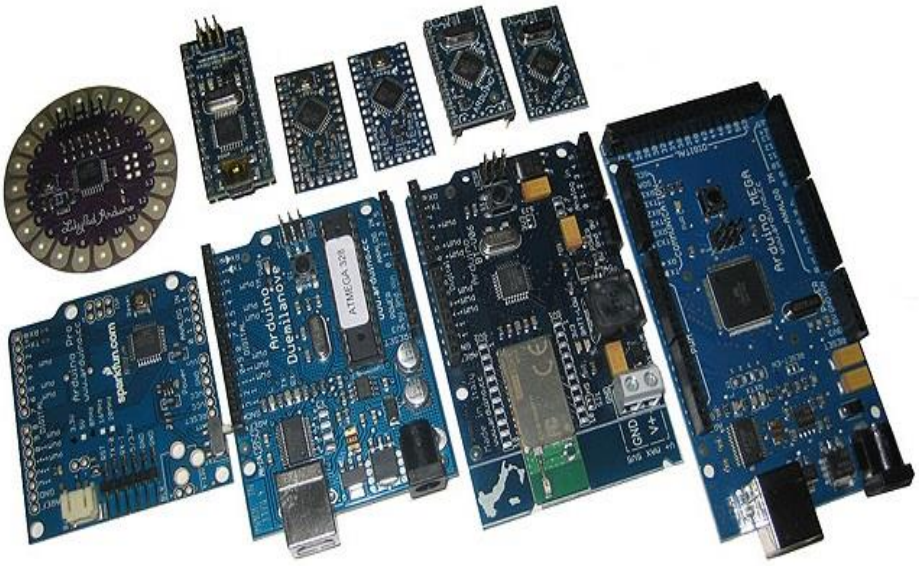

Figure 2.3: Types of Arduino boards [22].

Arduino boards are available with many different types of built-in modules in it. Boards such as Arduino BT come with a built-in Bluetooth module, for wireless communication. These built-in modules can also be

available separately which can then be interfaced (mounted) to it. These modules are known as Shield [12].

Some of the most commonly used Shields are:

- **Arduino Ethernet shield:** It that allows an Arduino board to connect to the internet using the Ethernet library and to read and write an SD card using the SD library.

- **Arduino Wireless shield:** It allows your Arduino board to communicate wirelessly using ZigBee.

- **Arduino Motor Driver Shield:** It allows your Arduino boards to interface with driver of a motor etc.

Here is a list of the different types of Arduino Boards available along with its microcontroller type, crystal frequency and availabilities of auto reset facility [12].

2.3.1.1 Arduino UNO

Arduino is an open-source physical computing platform based on a simple I/O board and a development environment that implements the Processing/Wiring language. Arduino can be used to develop stand-alone interactive objects or can be connected to software on your computer. The open-source IDE can be downloaded for free. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz

Table 2.1: types of Arduino Boards

Arduino Type	Microcontroller	Clock Speed
Arduino Uno	ATmega328	16 MHz with auto-reset
Arduino Duemilanove	ATmega328	16 MHz with auto-reset
Arduino Nano	ATmega328	16 MHz with auto-reset
Arduino Mega 2560 or Mega ADK	ATmega2560	16 MHz with auto-reset
Arduino Leonardo	ATmega32u4	16 MHz with auto-reset
Arduino Mini w/ ATmega328	ATmega328	16 MHz with auto-reset
Arduino Fio	ATmega328	8 MHz with auto-reset
Arduino BT w/ ATmega328	ATmega328	16 MHz with auto-reset
LilyPad Arduino w/ ATmega328	ATmega328	8 MHz (3.3V) with auto-reset
Arduino Pro or Pro Mini	ATmega328	16 MHz with auto-reset
Arduino NG	ATmega8	16 MHz with auto-reset

Quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a DC adapter or battery to get started [18].

The Arduino Uno is the most “standard” Arduino board currently in the market, and is probably the best choice for beginners just getting started with

the platform. The board is well-suited with more shields (add-on boards) than other models [6].

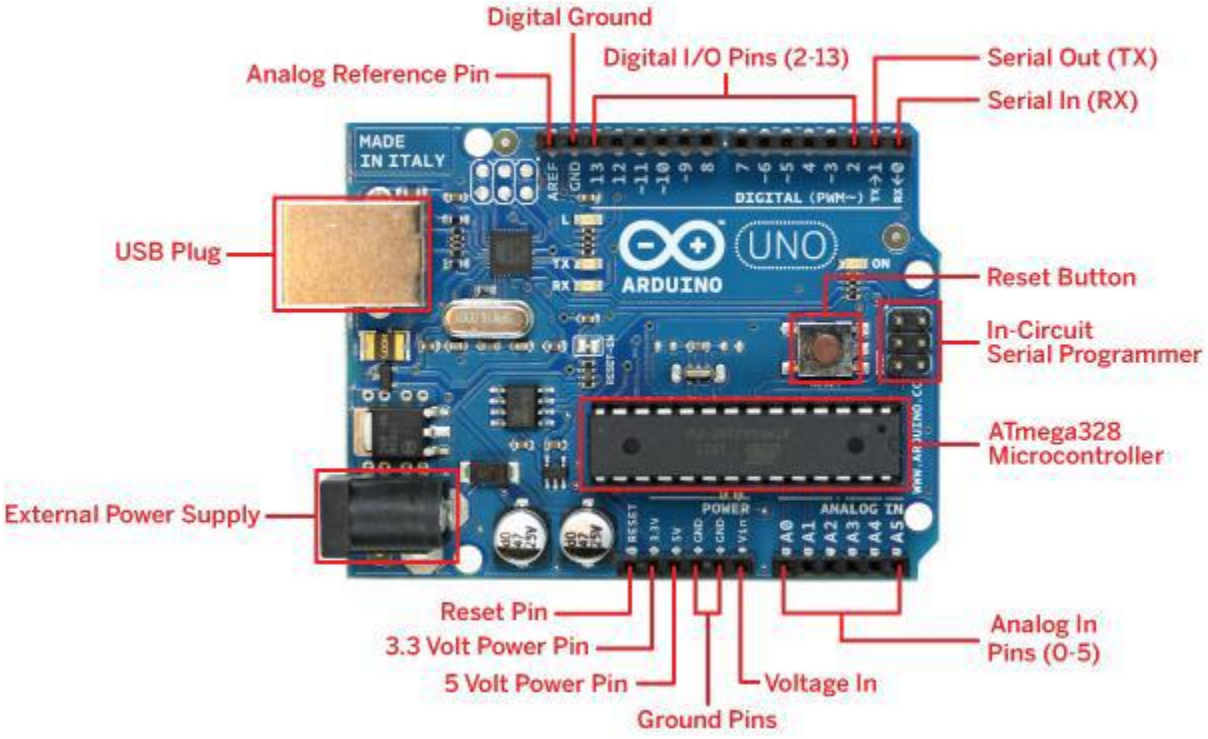

Figure 2.4: Arduino UNO board [12].

2.5 Wireless Communications

Wireless communications is, by any measure, the fastest growing segment of the communications industry. As such, it has captured the attention of the media and the imagination of the public. Cellular systems have experienced exponential growth over the last decade and there are currently around two billion users worldwide. Indeed, cellular phones have become a critical business tool and part of everyday life in most developed countries, and are rapidly supplanting antiquated wireline systems in many developing

countries. In addition, wireless local area networks currently supplement or replace wired networks in many homes, businesses, and campuses. Many new applications, including wireless sensor networks, automated highways and factories, smart homes and appliances, and remote telemedicine, are emerging from research ideas to concrete systems. The explosive growth of wireless systems coupled with the proliferation of laptop and palmtop computers indicate a bright future for wireless networks, both as stand-alone systems and as part of the larger networking infrastructure. However, many technical challenges remain in designing robust wireless networks that deliver the performance necessary to support emerging applications.

The first wireless networks were developed in the Pre-industrial age. These systems transmitted information over line-of-sight distances (later extended by telescopes) using smoke signals, torch signaling, flashing mirrors, signal flares, or semaphore flags. An elaborate set of signal combinations was developed to convey complex messages with these rudimentary signals. Observation stations were built on hilltops and along roads to relay these messages over large distances. These early communication networks were replaced first by the telegraph network (invented by Samuel Morse in 1838) and later by the telephone. A few decades after the telephone was invented, Marconi demonstrated the first radio transmission from the Isle of Wight to a tugboat 18 miles away, and radio communications was born. Radio technology advanced rapidly to enable transmissions over larger distances with better quality, less power, and smaller, cheaper devices, thereby enabling public and private radio communications, television, and wireless networking.

There are some current wireless systems:

1. Cellular telephone systems are extremely popular and lucrative worldwide: these are the systems that ignited the wireless revolution. Cellular systems provide two-way voice and data communication with regional, national, or international coverage. Cellular systems were initially designed for mobile terminals inside vehicles with antennas mounted on the vehicle roof. Today these systems have evolved to support lightweight handheld mobile terminals operating inside and outside buildings at both pedestrian and vehicle speeds. Cellular systems in urban areas now mostly use smaller cells with base stations close to street level transmitting at much lower power. These smaller cells are called microcells or Pico cells, depending on their size. This evolution to smaller cells occurred for two reasons: the need for higher capacity in areas with high user density and the reduced size and cost of base station electronics.

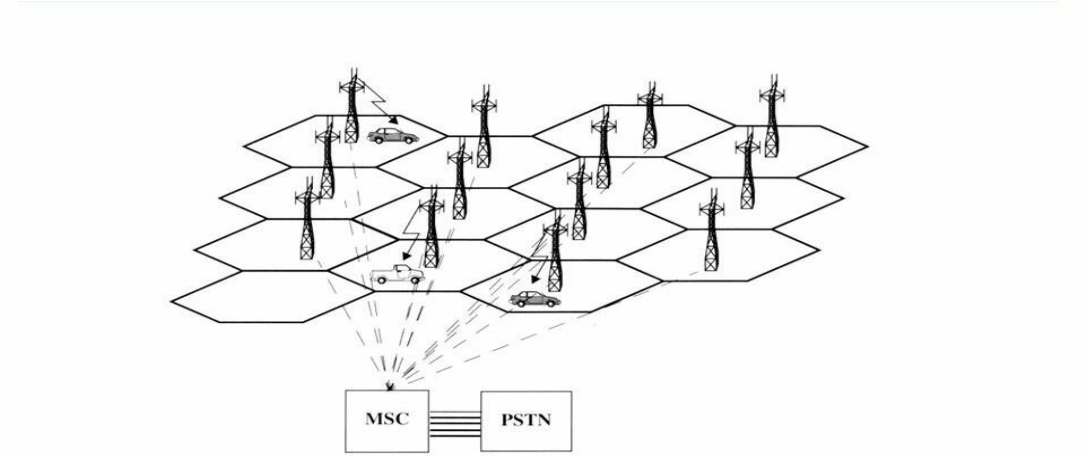

Figure 2.5: Cellular telephone systems [23]

2. Cordless telephones first appeared in the late 1970's and have experienced spectacular growth ever since. Many U.S. homes today have only cordless phones, which can be a safety risk since these phones don't work in a power outage, in contrast to their wired counterparts. Cordless phones were originally designed to provide a low-cost, low-mobility wireless connection to the PSTN, i.e. a short wireless link to replace the cord connecting a telephone base unit and its handset. Since cordless phones compete with wired handsets, their voice quality must be similar. Initial cordless phones had poor voice quality and were quickly discarded by users. The first cordless systems allowed only one phone handset to connect to each base unit, and coverage was limited to a few rooms of a house or office. This is still the main premise behind cordless telephones in the U.S. today, although some base units now support multiple handsets and coverage has improved. In Europe and Asia digital cordless phone systems have evolved to provide coverage over much wider areas, both in and away from home, and are similar in many ways to cellular telephone systems.

3. Wireless LANs provide high-speed data within a small region, e.g. a campus or small building, as users move from place to place. Wireless devices that access these LANs are typically stationary or moving at pedestrian speeds. All wireless LAN standards in the U.S. operate in unlicensed frequency bands. The primary unlicensed bands are the ISM bands at 900 MHz, 2.4 GHz, and 5.8 GHz, and the Unlicensed National Information Infrastructure (U-NII) band at 5 GHz. In the ISM bands unlicensed users are secondary users so

must cope with interference from primary users when such users are active. There are no primary users in the U-NII band. An FCC license is not required to operate in either the ISM or U-NII bands. However, this advantage is a double-edged sword, since other unlicensed systems operate in these bands for the same reason, which can cause a great deal of interference between systems. The interference problem is mitigated by setting a limit on the power per unit bandwidth for unlicensed systems. Wireless LANs can have either a star architecture, with wireless access points or hubs placed. /455498ethroughout the coverage region, or a peer-to-peer architecture, where the wireless terminals self-configure into a network.

Figure 2.6: wireless LAN [24].

4. Wide area wireless data services provide wireless data to high-mobility users over a very large coverage area. In these systems a given geographical region is serviced by base stations mounted on towers, rooftops, or mountains. The base stations can be connected

to a backbone wired network or form a multi hop ad hoc wireless network. Initial wide area wireless data services had very low data rates, below 10 Kbps, which gradually increased to 20 Kbps. There were two main players providing this service: Motient and Bell South Mobile Data (formerly RAM Mobile Data). Metricom provided a similar service with a network architecture consisting of a large network of small inexpensive base stations with small coverage areas. The increased efficiency of the small coverage areas allowed for higher data rates in Metricom, 76 Kbps, than in the other wide-area wireless data systems.

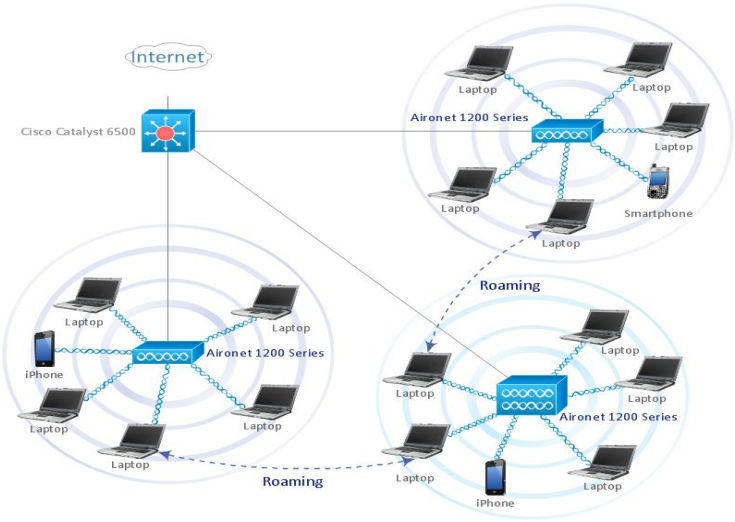

Figure 2.7: Roaming WAN [25].

5. Broadband wireless access provides high-rate wireless communications between a fixed access point and multiple terminals. These systems were initially proposed to support interactive video service to the home, but the application emphasis then shifted to providing high speed data access (tens of Mbps) to the Internet, the WWW, and to high speed data networks for both

homes and businesses. In the U.S. two frequency bands were set aside for these systems: part of the 28 GHz spectrum for local distribution systems (local multipoint distribution systems or LMDS) and a band in the 2 GHz spectrum for metropolitan distribution systems (multichannel multipoint distribution services or MMDS). LMDS represents a quick means for new service providers to enter the already stiff competition among wireless and wireline broadband service providers. MMDS is a television and telecommunication delivery system with transmission ranges of 30-50 Km. MMDS has the capability to deliver over one hundred digital video TV channels along with telephony and access to emerging interactive services such as the Internet. MMDS will mainly compete with existing cable and satellite systems. Europe is developing a standard similar to MMDS called Hiperaccess. WiMAX is an emerging broadband wireless technology based on the IEEE 802.16 standard, the core 802.16 specification is a standard for broadband wireless access systems operating at radio frequencies between 10 GHz and 66 GHz. Data rates of around 40 Mbps will be available for fixed users and 15 Mbps for mobile users, with a range of several kilometers.

Figure 2.8: Broadband wireless access [26].

6. Paging systems broadcast a short paging message simultaneously from many tall base stations or satellites transmitting at very high power (hundreds of watts to kilowatts). Systems with terrestrial transmitters are typically localized to a particular geographic area, such as a city or metropolitan region, while geosynchronous satellite transmitters provide national or international coverage. In both types of systems no location management or routing functions are needed, since the paging message is broadcast over the entire coverage area. The high complexity and power of the paging transmitters allows low-complexity, low-power, and pocket paging receivers with a long usage time from small and lightweight batteries. In addition, the high transmit power allows paging signals to easily penetrate building walls. Paging service also costs less than cellular service, both for the initial device and for the monthly usage charge, although this price advantage has declined considerably in recent

years as cellular prices dropped. The low cost, small and lightweight handsets, long battery life, and ability of paging devices to work almost anywhere indoors or outdoors are the main reasons for their appeal.

Figure 2.9: Radio paging broadcast [28].

7. Satellite Networks Commercial satellite systems are another major component of the wireless communications infrastructure. Geosynchronous systems include Inmarsat and OmniTRACS. The former is geared mainly for analog voice transmission from remote locations. For example, it is commonly used by journalists to provide live reporting from war zones. The first generation Inmarsat-A system was designed for large (1m parabolic dish antenna) and rather expensive terminals. Newer generations of Inmarsat use digital techniques to enable smaller, less expensive terminals, around the size of a briefcase. Qualcomm's OmniTRACS provides two-way communications as well as location positioning. The system is used primarily for alphanumeric messaging and

location tracking of trucking fleets. There are several major difficulties in providing voice and data services over geosynchronous satellites. It takes a great deal of power to reach these satellites, so handsets are typically large and bulky. In addition, there is a large round-trip propagation delay: this delay is quite noticeable in two-way voice communication. Geosynchronous satellites also have fairly low data rates, less than 10 Kbps. For these reasons lower orbit LEO satellites were thought to be a better match for voice and data communications.

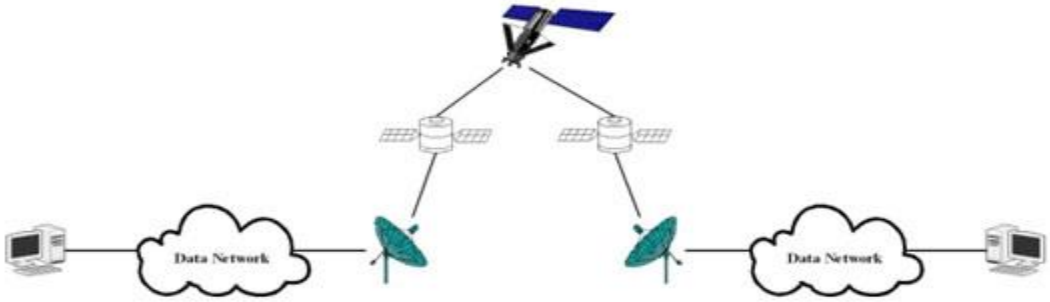

Figure 2.10: Satellite [27].

8. Low-Cost Low-Power Radios: Bluetooth and ZigBee As radios decrease their cost and power consumption, it becomes feasible to embed them in more types of electronic devices, which can be used to create smart homes, sensor networks, and other compelling applications. Two radios have emerged to support this trend: Bluetooth and ZigBee. Bluetooth radios provide short range connections between wireless devices along with rudimentary networking capabilities. The Bluetooth standard is based on a tiny microchip incorporating a radio transceiver that is built into digital

devices. The transceiver takes the place of a connecting cable for devices such as cell phones, laptop and palmtop computers, portable printers and projectors, and network access points. Bluetooth is mainly for short range communications, e.g. from a laptop to a nearby printer or from a cell phone to a wireless headset.

Figure 2.11: Bluetooth module [29].

The ZigBee radio specification is designed for lower cost and power consumption than Bluetooth. The specification is based on the IEEE 802.15.4 standard. The radio operates in the same ISM band as Bluetooth, and is capable of connecting 255 devices per network. The specification supports data rates of up to 250 Kbps at a range of up to 30 m. These data rates are slower than Bluetooth, but in exchange the radio consumes significantly less power with a larger transmission range. The goal of ZigBee is to provide radio operation for months or years without recharging, thereby targeting applications such as sensor networks and inventory tags.

Figure 2.12: ZigBee module [30].

9. Ultra-wideband (UWB) radios are extremely wideband radios with very high potential data rates. The concept of ultra-wideband communications actually originated with Marconi's spark gap transmitter, which occupied a very wide bandwidth. However, since only a single low-rate user could occupy the spectrum, wideband communications was abandoned in favor of more efficient communication techniques. UWB radios come with unique advantages that have long been appreciated by the radar and communications communities. Their wideband nature allows UWB signals to easily penetrate through obstacles and provides very precise ranging capabilities. Moreover, the available UWB bandwidth has the potential for very high data rates. Finally, the power restrictions dictate that the devices can be small with low power consumption [13].

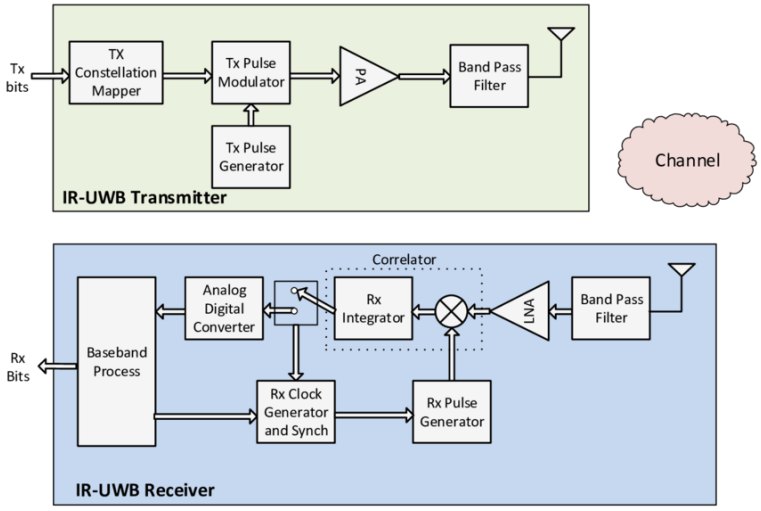

Figure 2.13: UWB Transmitter and Receiver [31].

2.6 GSM Modem

The idea of cell-based mobile radio systems appeared at Bell Laboratories in the early 1970s. In 1982 the Conference of European Posts and Telecommunications formed the Grouped Special Mobile (GSM) to develop a pan-European mobile cellular radio system (the acronym later became Global System for Mobile communications). In 1988, GSM system is validated. The currently available technologies for mobile data transfer are Circuit Switched Data (CSD), High Speed Circuit Switched Data (HSCSD), General Packet Radio Systems (GPRS) and Third Generation (3G). Just as with audio transmission on landline phones, both CSD and HSCSD charges are based on the time spent using the dial-up connection. However, GPRS systems are sometimes referred to be as being always connected and dial-up modem connection is not necessary, so in comparison to CSD, immediacy is one of the advantages of GPRS and SMS. GPRS is a non-voice value added service that allows data to be sent and received across a mobile telephone

network that was designed to run on GSM, a worldwide standard for cellular communications [16].

A GSM (Global System for Mobile Communication) modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS messages. In most parts of the world, GSM modems are a cost effective solution for receiving SMS messages, because the sender is paying for the message delivery [9]. The features of GSM that account for its popularity and wide acceptance. Improved spectrum efficiency, International roaming, low-cost mobile sets and base stations (BSs), high-quality speech, compatibility with Integrated Services Digital Network (ISDN) and other telephone company services, also support for new services.

1. AT Commands

AT Commands are used to control a modem. AT means Attention. Every command line starts with “AT”. In GSM, Using AT command to perform particular tasks. Both dial-up modems and GSM modem supports a common sets of standard AT commands. In addition to the standard AT commands, GSM modems supports extended set of AT commands. These

extended AT commands are defined in the GSM standards. With the extended AT commands, you can do things like [19].

Table 2.2: Applied AT Commands

AT Command	**Function**
AT+CPIN	Set the pin code of SIM card
AT+CPMS	Preferred SMS message storage
AT+CNMI	New SMS message indication
AT+CMGF	Choose SMS message format
AT+CMGD	Delete SMS message
AT+CMGR	Read SMS message
AT+CMGS	Send SMS message
AT+CLCC	Incoming calling indication
ATH	Hang up the calling
ATD	Dial

2.6.1 SIM900A GSM Module

SIM900A Quad-band GSM/GPRS RS232 Modem, works on frequencies 850 MHZ, 900 MHZ, 1800 MHZ and 1900 MHZ. It is very miniature in size and easy to use as plug in GSM Modem. The Modem is designed with TTL to RS232 Level converter circuitry, which will allow the user to directly interface PC Serial port .The baud rate can be configurable from 9600-115200 through AT command. Initially Modem is in Auto baud rate mode. This GSM/GPRS RS232 Modem is has an internal TCP/IP stack which will enable the user to connect with internet via GPRS. It will be suitable for sending SMS as well as DATA transfer application in M2M interface. The modem needed only 3 wires (TX, RX, and GND) except Power supply to interface with microcontroller/Host PC. The built in low dropout

linear voltage regulator will allow the user to connect wide range of unregulated power supply (4.2V -13V). In most of the cases 5 V will be used. Using this modem, the user will be able to send SMS, receive SMS and connect to internet via GPRS through simple AT commands [17].

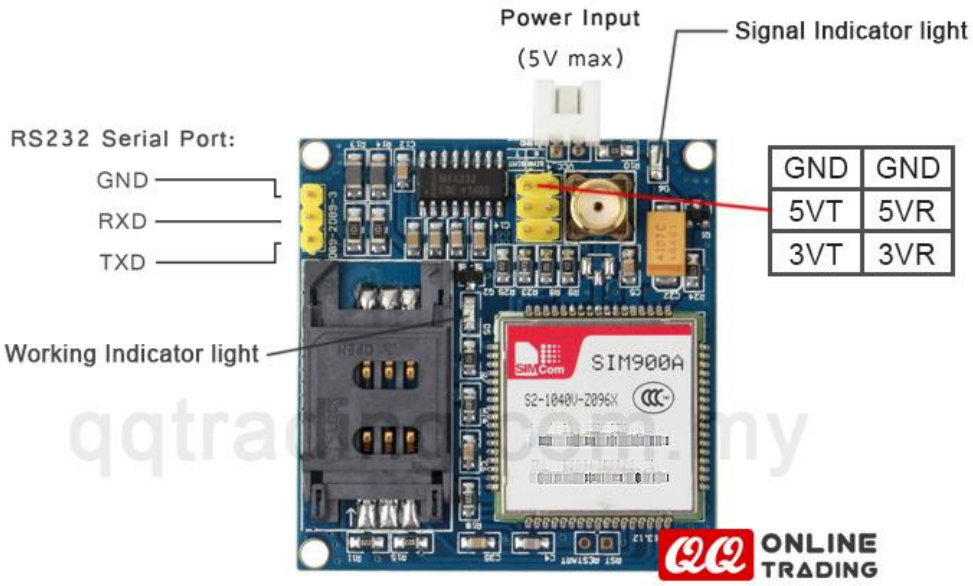

Figure 2.14: SIM900A GSM Module [32].

2.7 GPS Technology

The Global Positioning System (GPS) is actually a constellation of 27 Earth-orbiting satellites (24 in operation and three extras in case one fails). The U.S. military developed and implemented this satellite network as a military navigation system, but soon opened it up to everybody else. Each of these 3,000- to 4,000-pound solar-powered satellites circles the globe at about

12,000 miles (19,300 km), making two complete rotations every day. The orbits are arranged so that at anytime, anywhere on Earth, there are at least four satellites "visible" in the sky. A GPS receiver's job is to locate four or more of these satellites, figure out the distance to each, and use this information to deduce its own location. This operation is based on a simple mathematical principle called Trilateration [15].

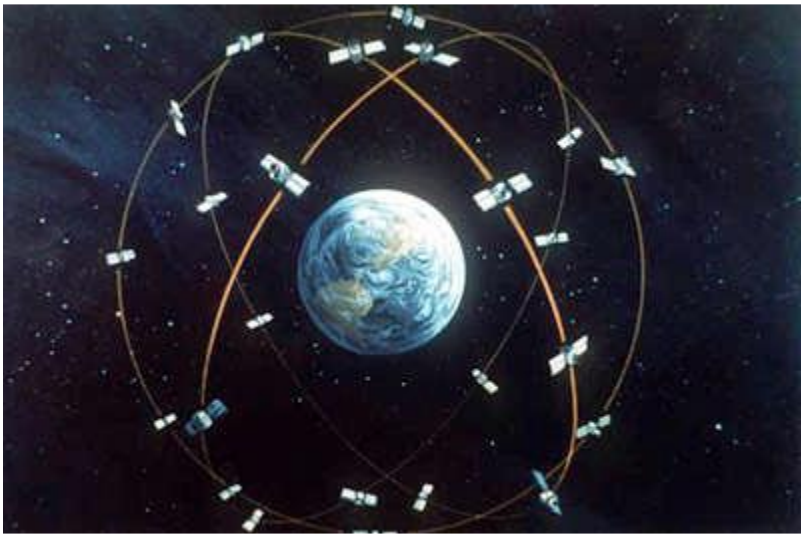

Figure 2.15: Photo courtesy U.S. Department of Defense [15].

The system provides essential information to military, civil and commercial users around the world and which is freely accessible to anyone with a GPS receiver. GPS works in any weather circumstances at anywhere in the world. Normally no subscription fees or system charges to utilize GPS. A GPS receiver must be locked on to the signal of at least three satellites to estimate 2D position (latitude and longitude) and track movement. With four or more satellites in sight, the receiver can determine the user's 3D position (latitude, longitude and altitude). Once the vehicle position has been

determined, the GPS unit can determine other information like, speed, distance to destination, time and other [8].

In order to make the simple calculation of the location, then, the GPS receiver has to know two things the location of at least three satellites above you and the distance between you and each of those satellites.

2.7.1 GPS Tracking

A GPS tracking unit is a device that uses the Global Positioning System to determine the precise location of a vehicle, person, or other asset to which it is attached and to record the position of the asset at regular intervals. The recorded location data can be stored within the tracking unit, or it may be transmitted to a central location database, or internet-connected computer, using a cellular (GPRS), radio, or satellite modem embedded in the unit. This allows the asset's location to be displayed against a map backdrop either in real-time or when analyzing the track later, using customized software [15].

GPS tracking device calculates its position by measuring distances between itself and other GPS satellites. In return, the signals emitted by the satellites carry information about the GPS carrier’s location.

2.7.2 GPS Tracking Map

GPS and GIS technology is widely used for determining the position of an object and measuring distance. However, the whole technology is based on maps. Maps taken by satellites and then the application of GIS technology

make the whole process successful. The GIS technology generally uses digital information with the help of digitized data creation methods. By this digitized method a map is converted into a digital format through the use of a computer aided drafting (CAD) program. Any particular place is marked by its longitudes, latitude and elevation by co-ordinate points. In this way digital satellite images are analyzed and the data in map form represents real world objects with digital form [14].

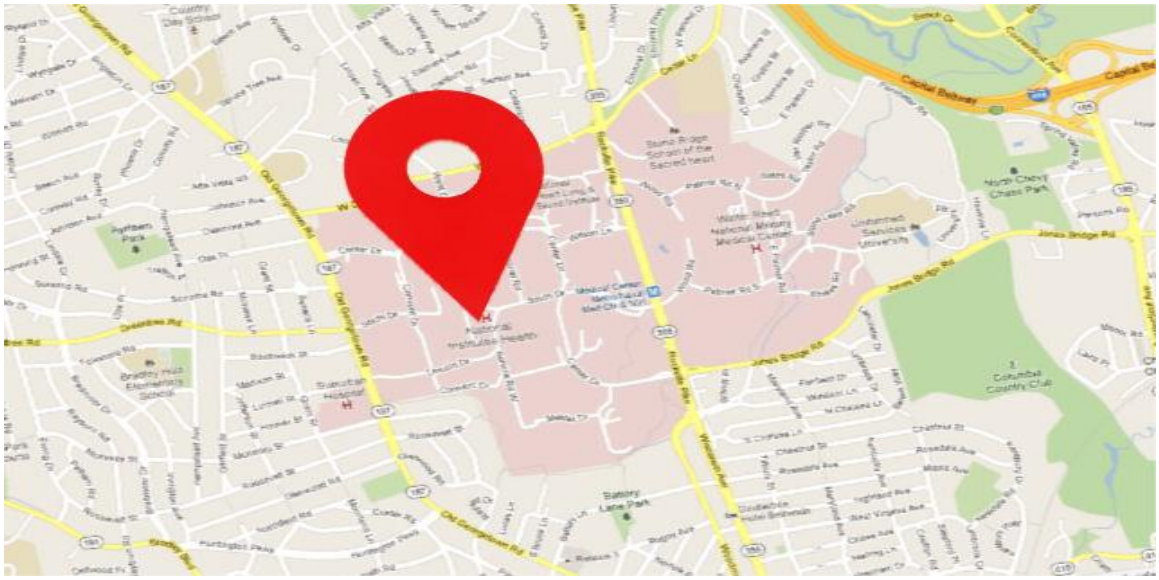

Figure 2.16: GPS tracking map [33].

2.7.3 SKYLAP GPS Module

The SkyNav SKM53 Series with embedded GPS antenna enables high performance navigation in the most stringent applications and solid fix even in harsh GPS visibility environments. It is based on the high performance features of the MediaTek 3329 single-chip architecture, its 165dBm tracking sensitivity extends positioning coverage into place like urban canyons and dense foliage environment where the GPS was not possible before. The 6-pin UART connector design is the easiest and convenient

solution to be embedded in a portable device and receiver like PND, GPS mouse, car holder, personal locator, speed camera detector and vehicle locator.

Features

- Ultra-high sensitivity: -165dBm
- 22 tracking/66 acquisition-channel receiver
- WAAS/EGNOS/MSAS/GAGAN support
- NMEA protocols (default speed: 9600bps)
- Internal back-up battery
- One serial port
- Embedded patch antenna 18.2 x 18.2 x 4.0 mm
- Operating temperature range: -40 to 85℃
- RoHS compliant (Lead-free)
- Tiny form factor： 30mm x20mm x 8.5mm

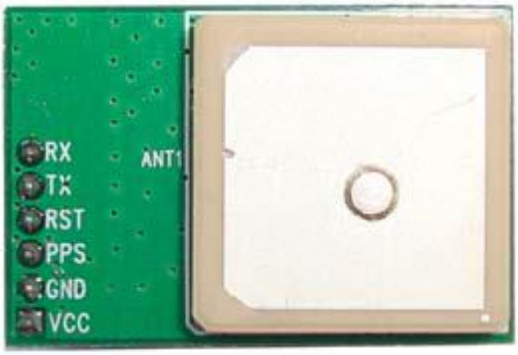

Figure 2.18: SKM53 Top View [20].

2.6 DC Motor

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

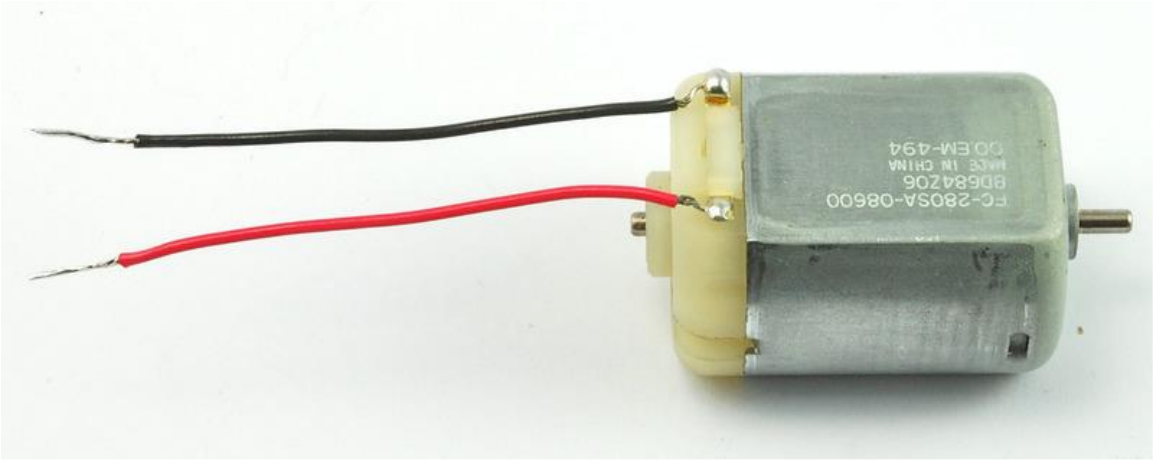

Figure 2.19: Dc Motor [34].

2.7: Android Application

ANDROID (Automated Numeration of Data Realized by Optimized Image Detection) Android is an operating system for mobile devices such as Smartphone and tablet computers. It is developed by the Open Handset Alliance led by Google. Android consists of a kernel based on the Linux kernel, with middleware, libraries and Computer Engineering and Intelligent Systems APIs written in C and application software running on an application framework which includes Java-compatible libraries based on Apache

Harmony. Android uses the Dalvik virtual machine with just-in-time compilation to run Dalvik dex-code (Dalvik Executable), which is usually translated from Java byte code [4].

2.7.1 MIT App Inventor

MIT App Inventor is a web-based tool for building Android apps figure 2.17. This is often referred to as visual programming, which means the user is able to perform programming tasks without entering any computer code. App Inventor is actively managed and developed by MIT's Mobile Learning Lab (the project was originally built by Google).

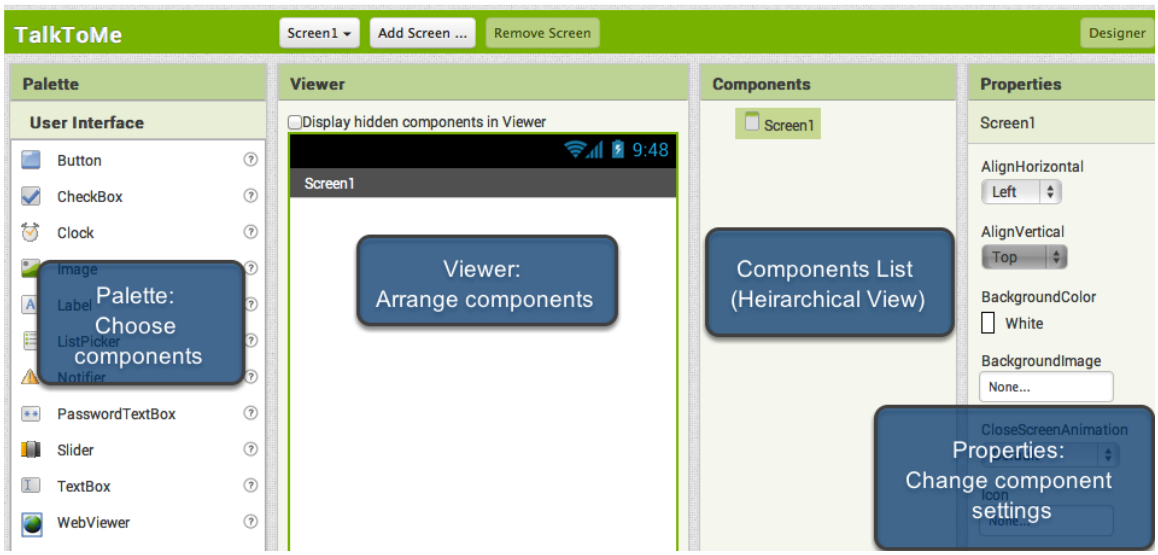

Figure 2.20: MIT app inventor [10]

App Inventor is growing in popularity among educators as a way to introduce those with no programming experience to the principles of

computer science and app development. It also serves as a great first step for those dabbling with programming or looking to increase their knowledge of how smartphone apps work. The programming takes place in the Blocks Editor as shown in figure 2.18. There you tell the app what it should do and give specific instructions for making that happen. The specific capabilities are programmed through connecting puzzle pieces. Over time, you will learn what each block does and find multiple ways for them to interact with one another. The pieces that do not interact will not connect with each other helpful way for beginners to get a sense of introductory programming principles [10].

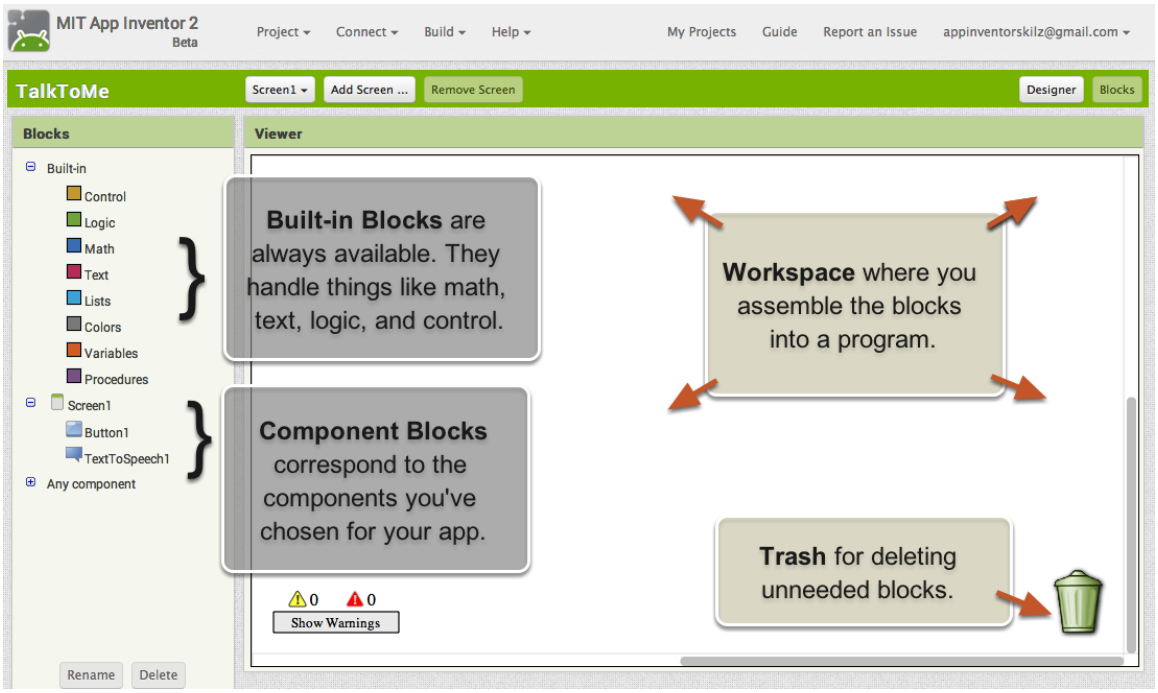

Figure 2.21: App inventor block editor [10].

Chapter Three

Methodology

3.1 System Design

As shown in block diagram figure 3.1 the system design consist of Arduino UNO, GSM module, GPS module and android application for make user control his vehicle from mobile phone whenever his vehicle has been stolen, to interface GSM as well as GPS module simultaneously to Arduino need two serial port, but Arduino has one hardware serial port, the other can interface with software serial port using SoftwareSerial library, or both of them can connect to software serial port. The user communicate with the system within vehicle through GSM module.

A simple system has been designed which help the user discover when his vehicle has stolen, the controller will send triggering signal to GSM, GSM will send SMS. Then the user can control his vehicle using android app to lock/unlock the engine. Also user can track his vehicle by receiving the location information from the satellite through GPS.

The user communicate with the system within vehicle through GSM, when then the key of the vehicle is switched, the GSM will sent SMS. Based on SMS the user press button or ignore the SMS. When press lock button the GSM will sent trigger signal to Arduino to lock the engine, when press unlock button the GSM will sent trigger signal to Arduino to unlock the engine, when press the view button The GSM sent trigger signal to Arduino to get location

through GPS, the Arduino get the location from GPS and sent it to user mobile through GSM.

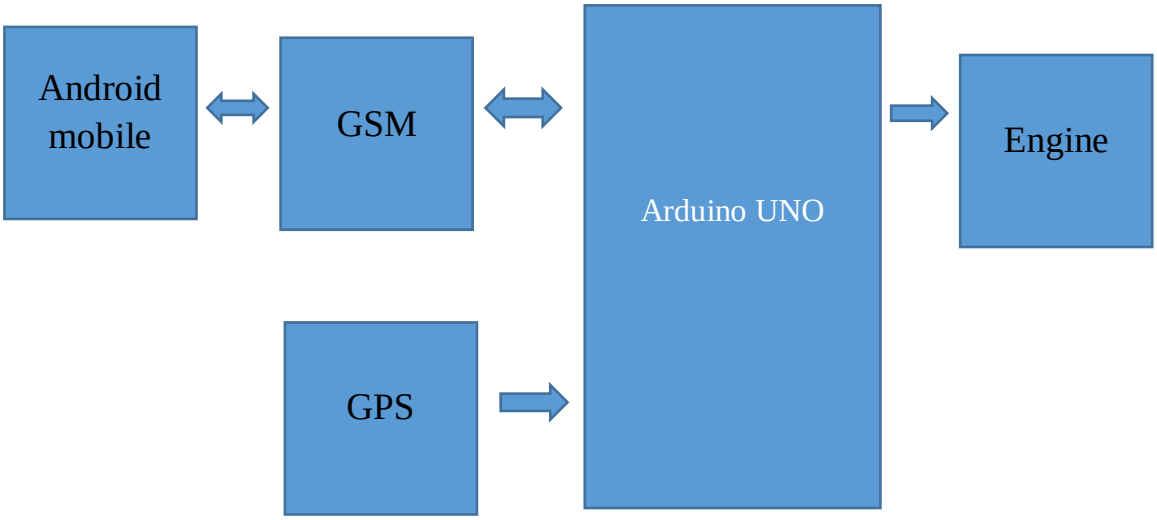

Figure 3.1: System Block Diagram.

3.2 Ignition Locking System

Design an embedded system for implementing an efficient ignition locking system that will be useful to find the car and catch the thief.

This project consist of GSM modem SIM900A which is the heart of the system, the GSM modem is interfaced with Arduino's software serial port. The TX of Arduino which is pin 11 is connected to RX of GSM and RX of Arduino which is pin 10 is connected to TX of GSM modem as seen in figure 3.3. An arduino board which act as brain of project. The project offers security to igintion system of the car which is more vulnerable to be hacked.

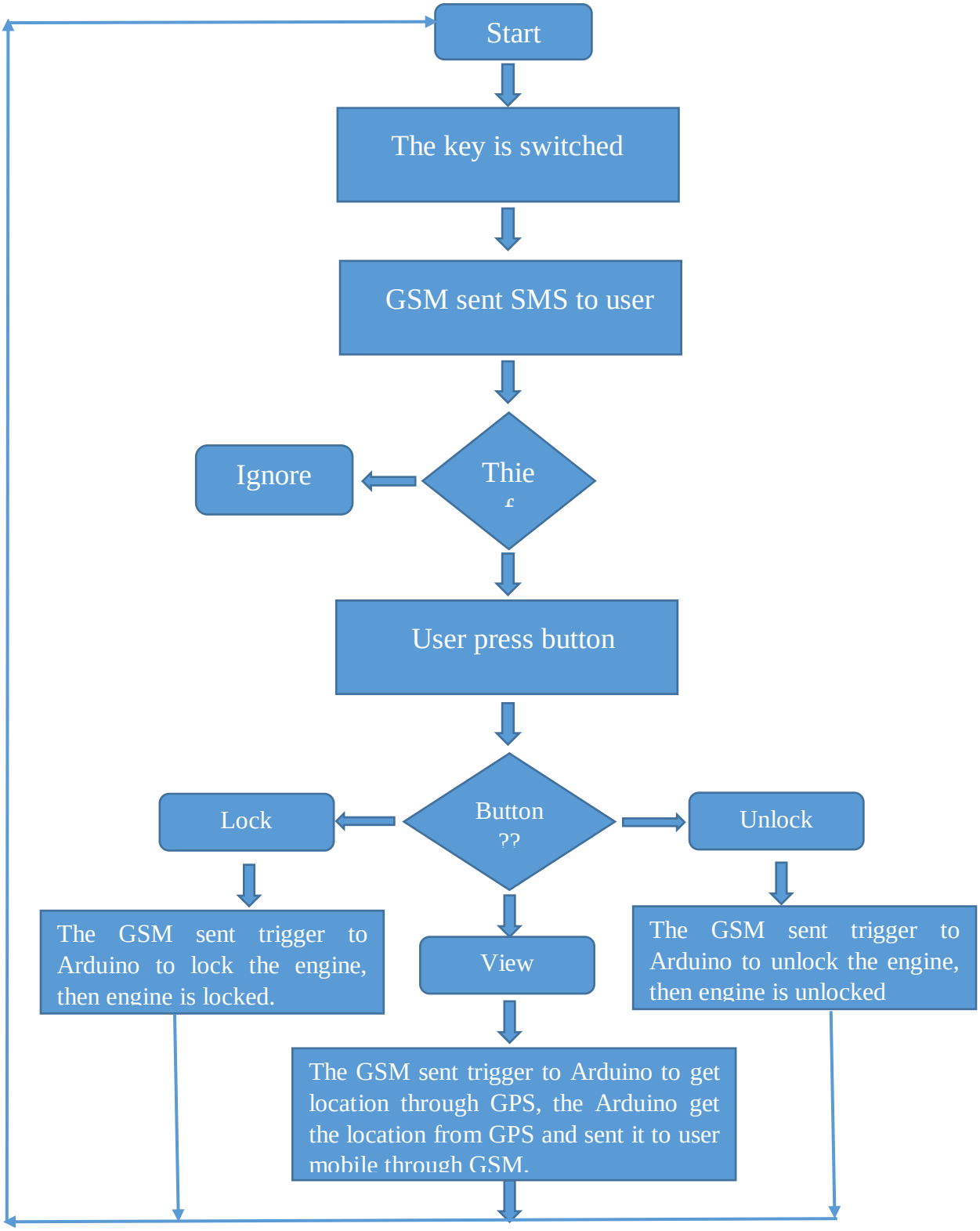

Figure 3.2: System Flow Chart.

The ignition system and central lock of the car can be enabled or disabled by the relay circuit interfaced to the Arduino board. As soon as the engine starts the system sends a confirmation message to the owner using valid sim in the GSM modem. In case there is a theft the owner react accordingly using the application installed in his android phone.

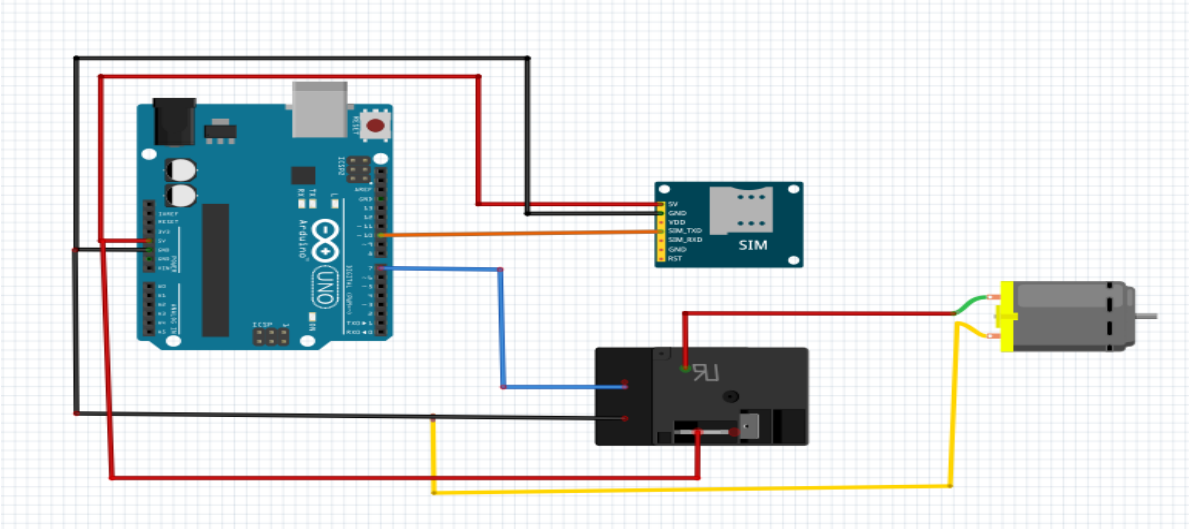

Figure 3.3: Ignition Locking System by GSM.

3.3 Vihicle Tracking System

Design an embedded system for implementing an efficient tracking of the car. Vehicle tracking system is made up with Arduino Uno, SIM900A module including GPS and GSM antenna. The core part of tracking system is microcontroller Arduino Uno. The geo location of a vehicle can be captured through GPS receiver which is interfaced to software serial port to pin 8 and 9 shown in figure 3.4, and that data will be transmitted to the cellphone by using GSM technology. That data will be stored in a database. For monitoring

the location of the vehicle on the map. A mobile application was developed to view location of the vehicle in mobile device by using MIT app inventor.

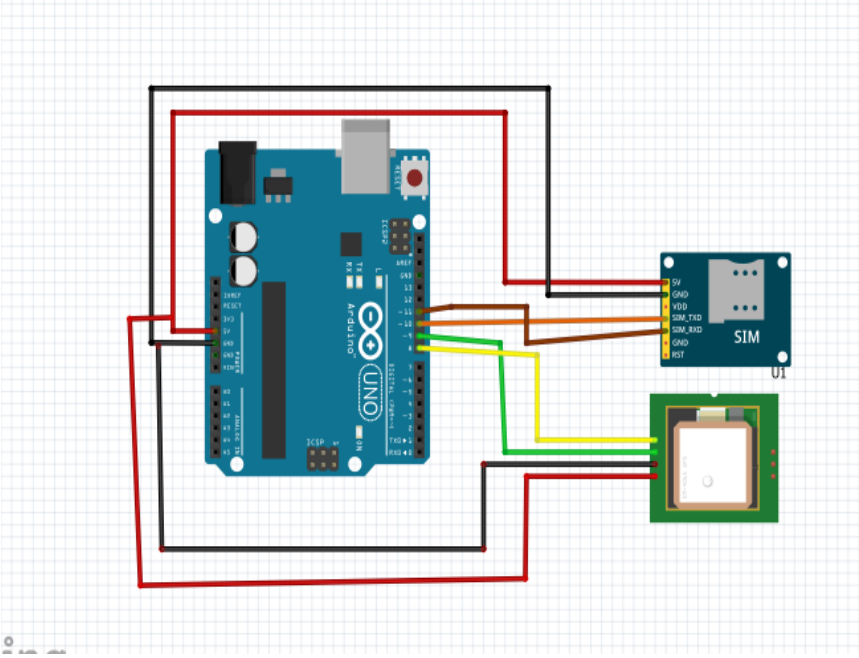

Figure 3.4: Vihicle Tracking System uing GPS and GSM technology.

3.4 Android APP Module

An android application devoloped using map beaed on GPS tracker and remot control system. There are three buttons in the app, lock button is used to lock the vehicle, unlocked button is used to unlock the locked vehicle and the last one is view button is used to view the current location of the vehicle. When the engine start the owner of the vehicle receives a confirmation message the owner click the lock button on the anti-theft app installed on his mobile phone. When the anti-theft system installed in the vehicle receives the lock msg ,it lock the vehicle and keep locked untill the owner click the unlock button.

Then the owner clicks the veiw button and receives msg contain the longitude and latitude of the current location of the vehicle. The owner enters the longitude and latitude to track the vehicle using google earth.

3.4.1 Android Software

To design android application I use MIT app inventor program. In app inventor the work takes place in two key sections of App Inventor: the Designer and the Blocks Editor. In the Designer, I decide what actions the app will perform and how it will look (see Figure 3.4). in this project need three button to control vehicle and keep tracking.

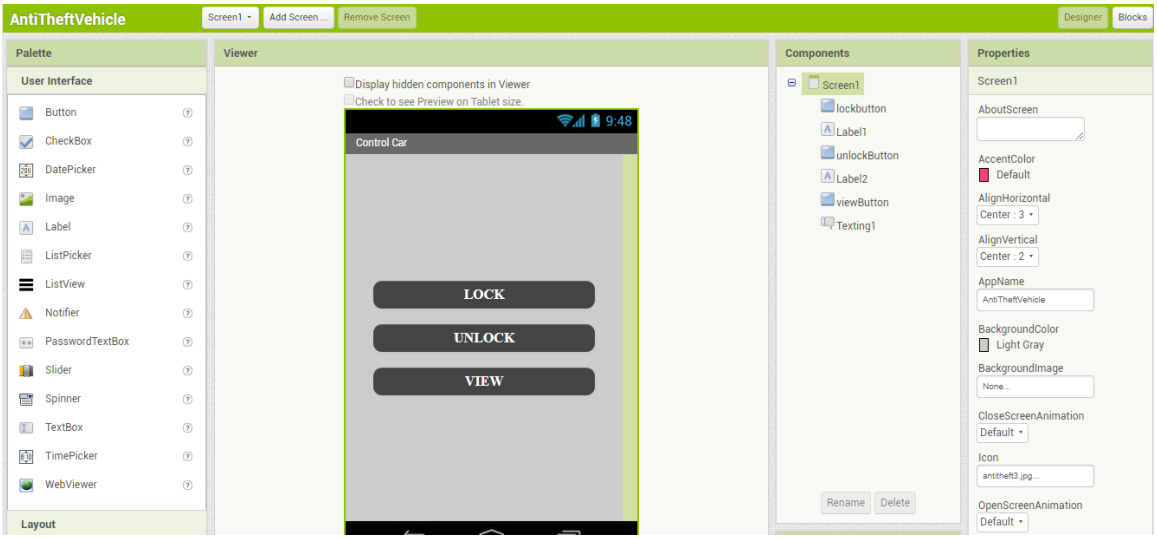

Figure 3.5: Designer Editor for android application.

The programming takes place in the Blocks Editor. There you tell the app what it should do and give specific instructions for making that happen see figure 3.5. Each button need to program as the task must be did.

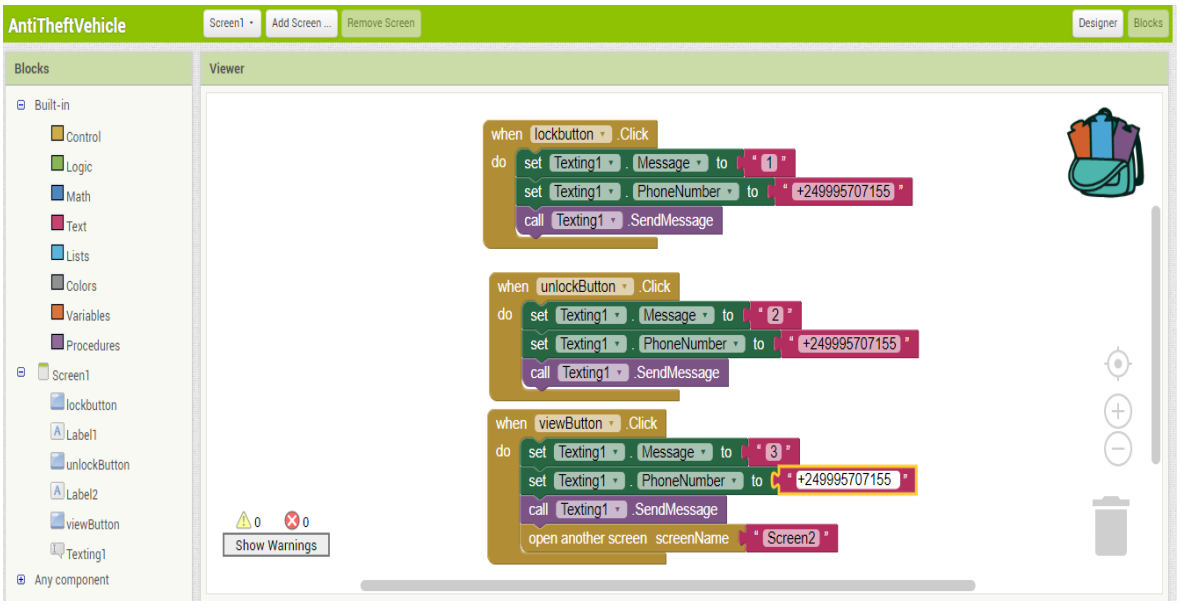

Figure 3.6: Blocks Editor for android application.

Chapter Four

Result and discussion

4.1 System Simulation

To simulate the control circuit a virtual system modeling is used and a circuit simulation application (Proteus), GSM module simulated in Proteus by using virtual terminal for send and receive as seen in figure 4.1. Anti-vehicle theft and tracking device is made up with Arduino Uno R3, GPS and GSM antenna. The core part of locking/unlocking engine and tracking system is microcontroller Arduino Uno. The geo location of a vehicle can be captured through GPS receiver and that data will be transmitted to the mobile phone by using GSM technology. When SMS is sent from virtual terminal to Arduino, Arduino will read that SMS .Based of SMS text the motor is being controlled to turn ON or OFF, or send the location of the vehicle based on the value of the latitude and longitude was sent by VGPS.

4.2 Result and Discussion

The result of the simulation and the android application will be discussed in this section.

4.2.1 Simulation Result

Case 1 when the simulation run a messages were viewed, the massages are AT command such as AT+CMMI=2, 2,0,0,0 this mean make GSM ready to receive SMS, AT+CMGF=1 put GSM in a text mode then AT+ CMGS=phone number this command for choose the phone number that for send message to it, then the message that wanted to send to tell the owner his car is moving by someone else.

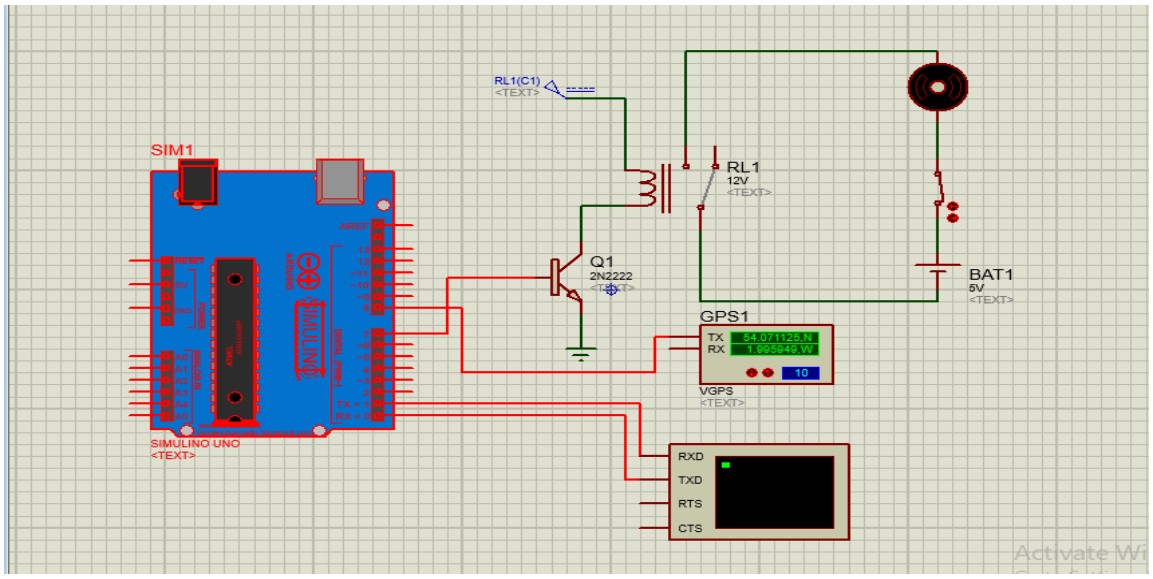

Figure 4.1: system simulation.

Case 2 the user should press 1 in keyboard to lock the motor as shown in figure 4.3,when number one in keyboard was pressed the relay is change from normal close to normal open to lock the motor and a SMSs were appear in virtual terminal AT commands and the message that engine has locked .

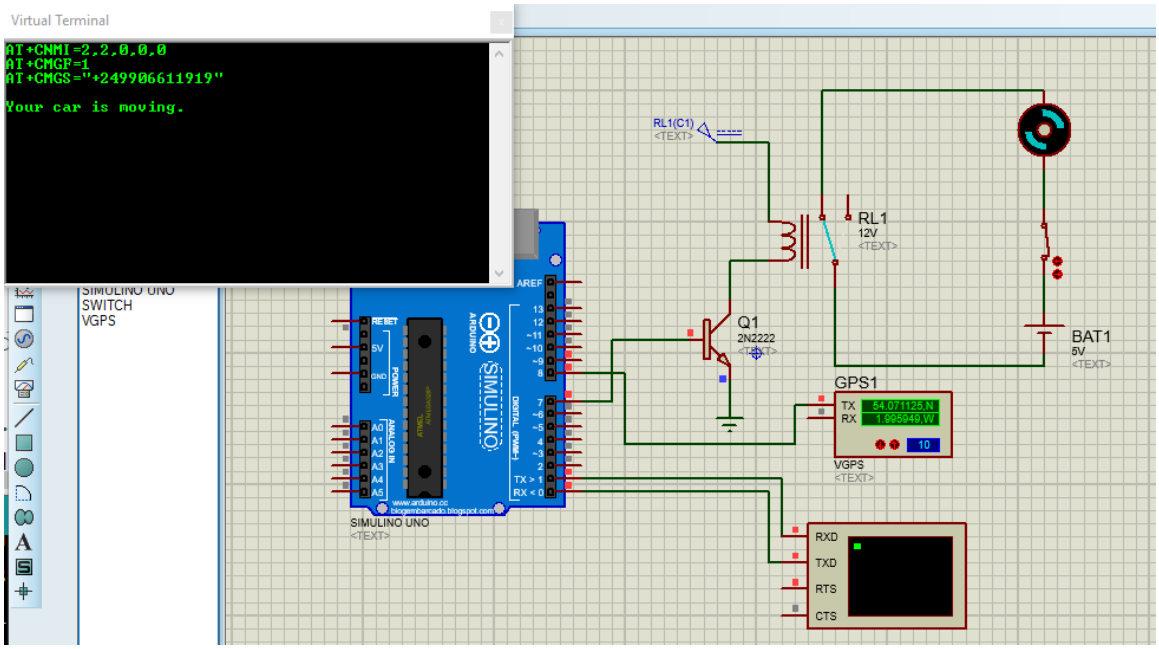

Figure 4.2: Simulation running.

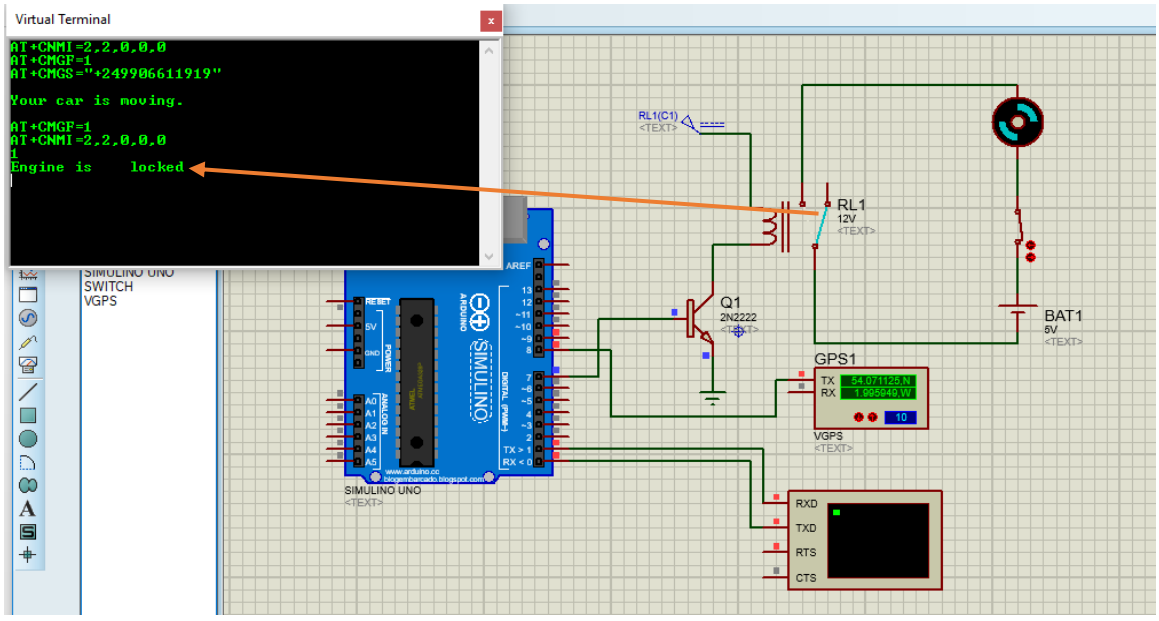

Figure 4.3: locked engine.

Case 3 after locked the engine user should get the location as latitude and longitude.to get location number 3 should press then longitude and latitude that were setting in VGPS will appear in virtual terminal.

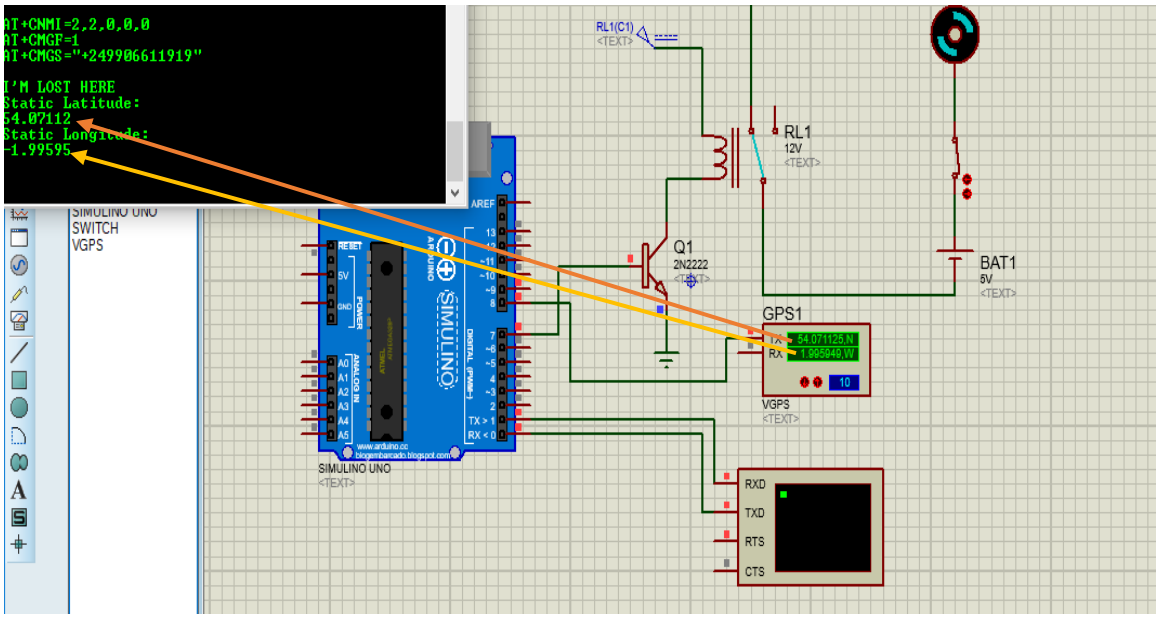

Figure 4.4: simulation of vehicle location by VGPS.

In simulation user can change the location from the properties of VGPS as shown in figure 4.5.and can put any longitude and latitude to simulate the real GPS when the vehicle move from place to another.

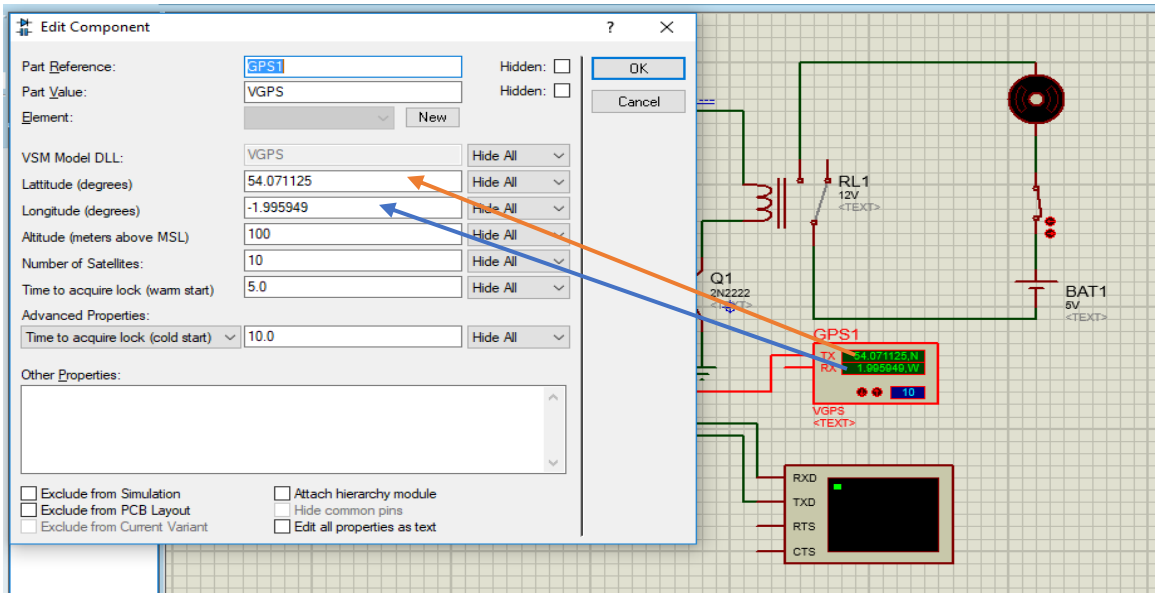

Figure 4.5: VGPS properties.

Case 4 to unlock the DC motor again press number 2 in the keyboard as shown in figure 4.6. After press number two the relay change from normal open to normal close, to run the motor again, the virtual terminal show the that motor was unlocked and AT command.

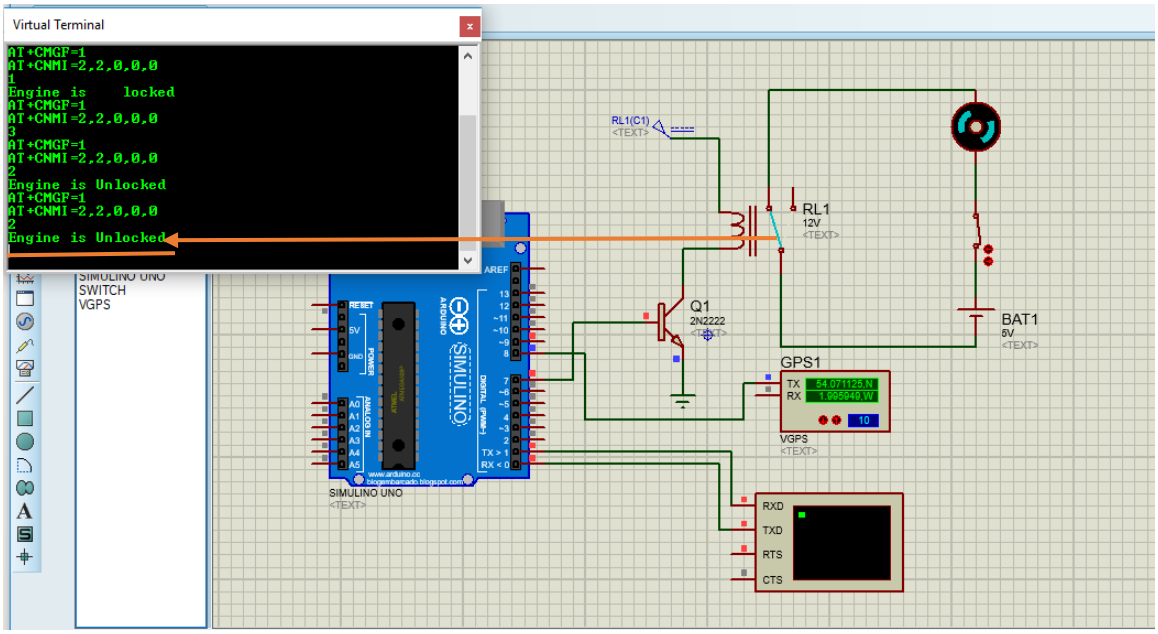

Figure 4.6: unlocked engine.

If other numbers are pressed or any character nothing will happened as shown in figure 4.7.there is no change on relay and no massage was appear in the virtual terminal except AT command it appear when SMS was sent but will not change anything.

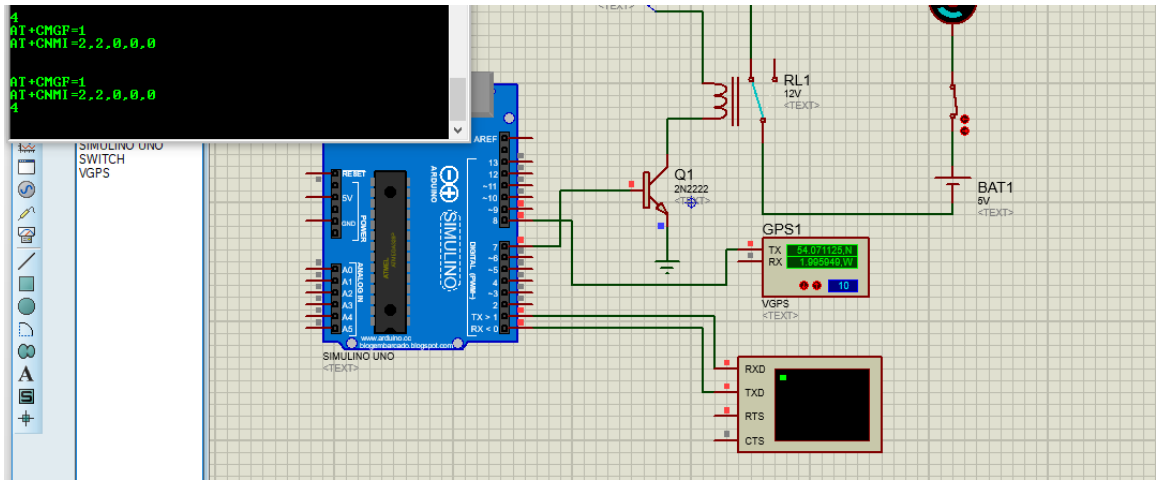

Figure 4.7: unchangeable result.

4.2.2 Mobile Phone Application

The anti-theft vehicle and tracking application is installed in the android mobile. In case there is a theft the owner can react accordingly using application installed in his android phone. There are three button in application the first button is lock use to lock the vehicle when is moving by the theft, the second button is unlocked is used to unlocked the vehicle after found it, and the last button is used to view the current location of the vehicle after enter the longitude and latitude and press locate to view location in map.

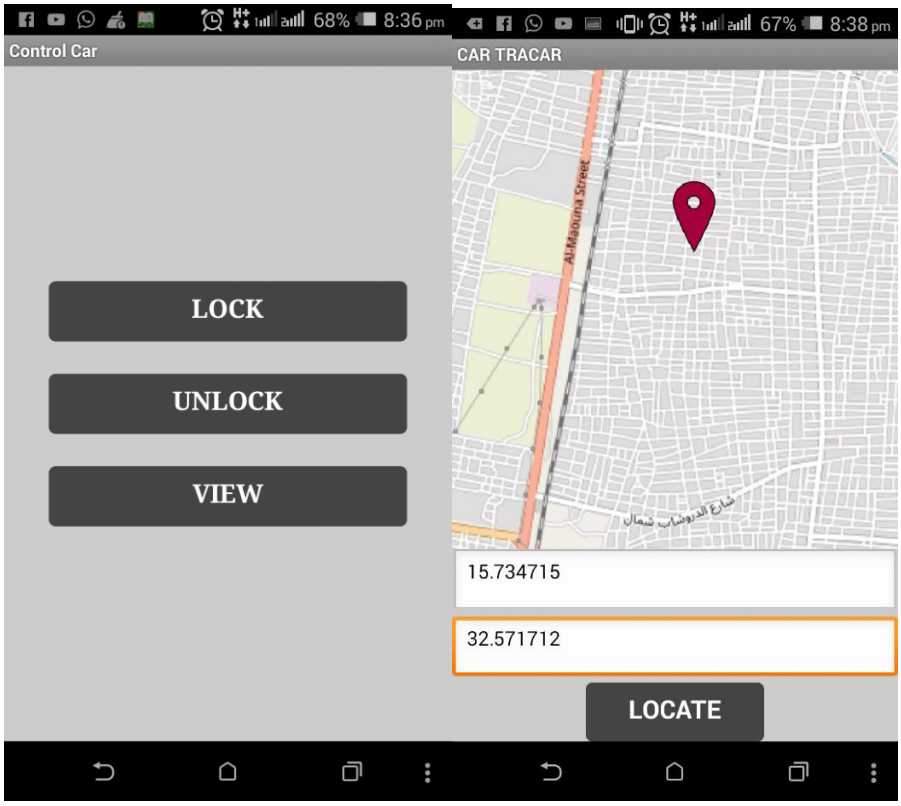

Figure 4.8: implementation of Android application.

4.3 Hardware implementation

As shown in figure 4.9 all the components interfaced to Arduino UNO which is a main part of the hardware. The GSM and GPS were connected to the software serial port which GSM interfaced to pin 10 and 11 as well as GPS is connected to pin 8 and 9, relay interface to pin 7 to lock/unlock the motors. When the car move the Arduino will send a message to the owner tell him the car is moving if move by himself or someone know him the owner will ignore the massage , else he will press lock button to lock the engine of the car and

press the view button to get location of the car and trace it. After car has been found the owner press unlock button to unlock the engine again.

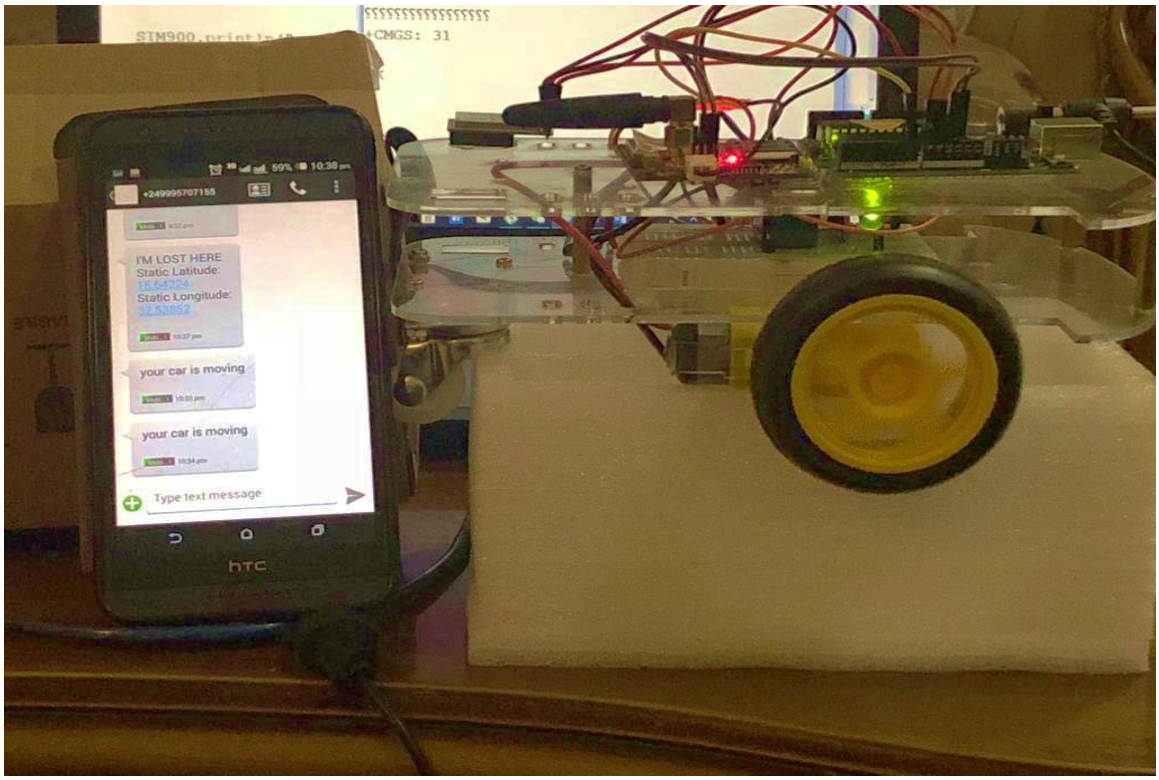

Figure 4.9: Hardware implementation.

As seen in figure 4.9 the green led is on and the car is move then a massage was sent to mobile phone that car is moving.

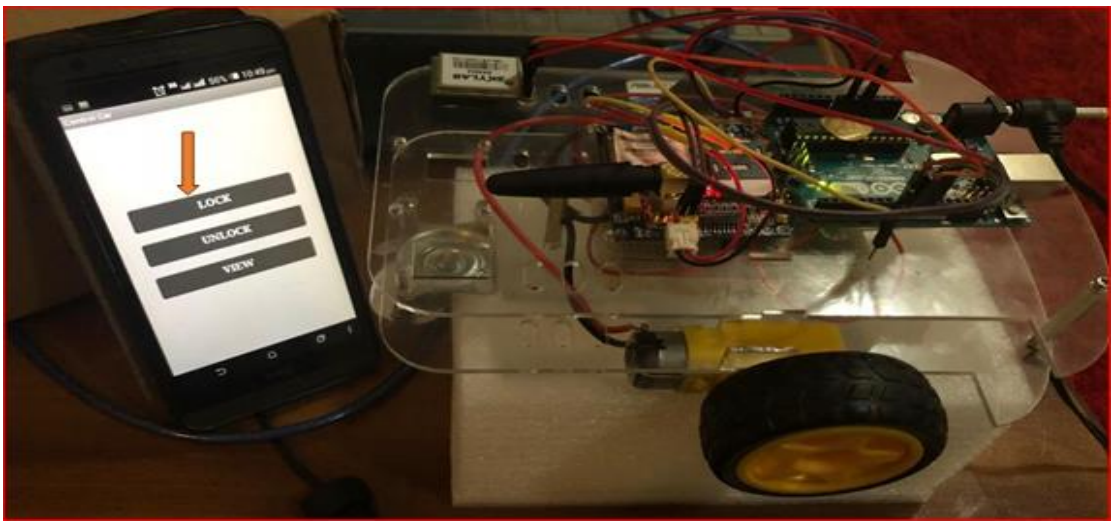

Figure 4.10: the owner locked the car.

If the car moving by the owner the message will be ignored, else the owner press the lock button within android app then the car has stopped and the green LED is off as seen in figure 4.10.

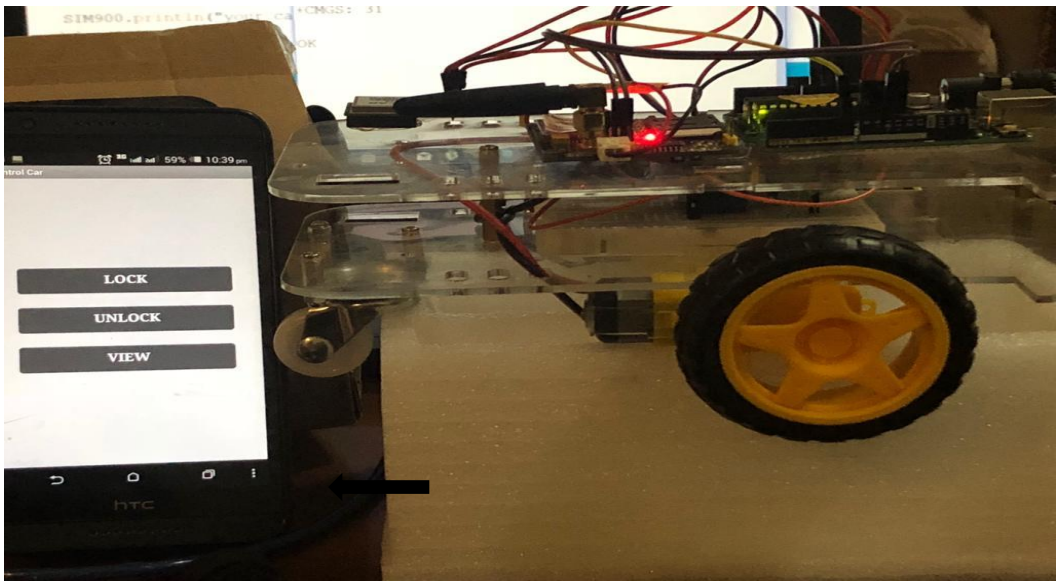

Figure 4.11: press view button to get location.

In figure 4.11 press view button to get location and the system within car will send a message to mobile phone contain the car location as seen in figure 4.12.

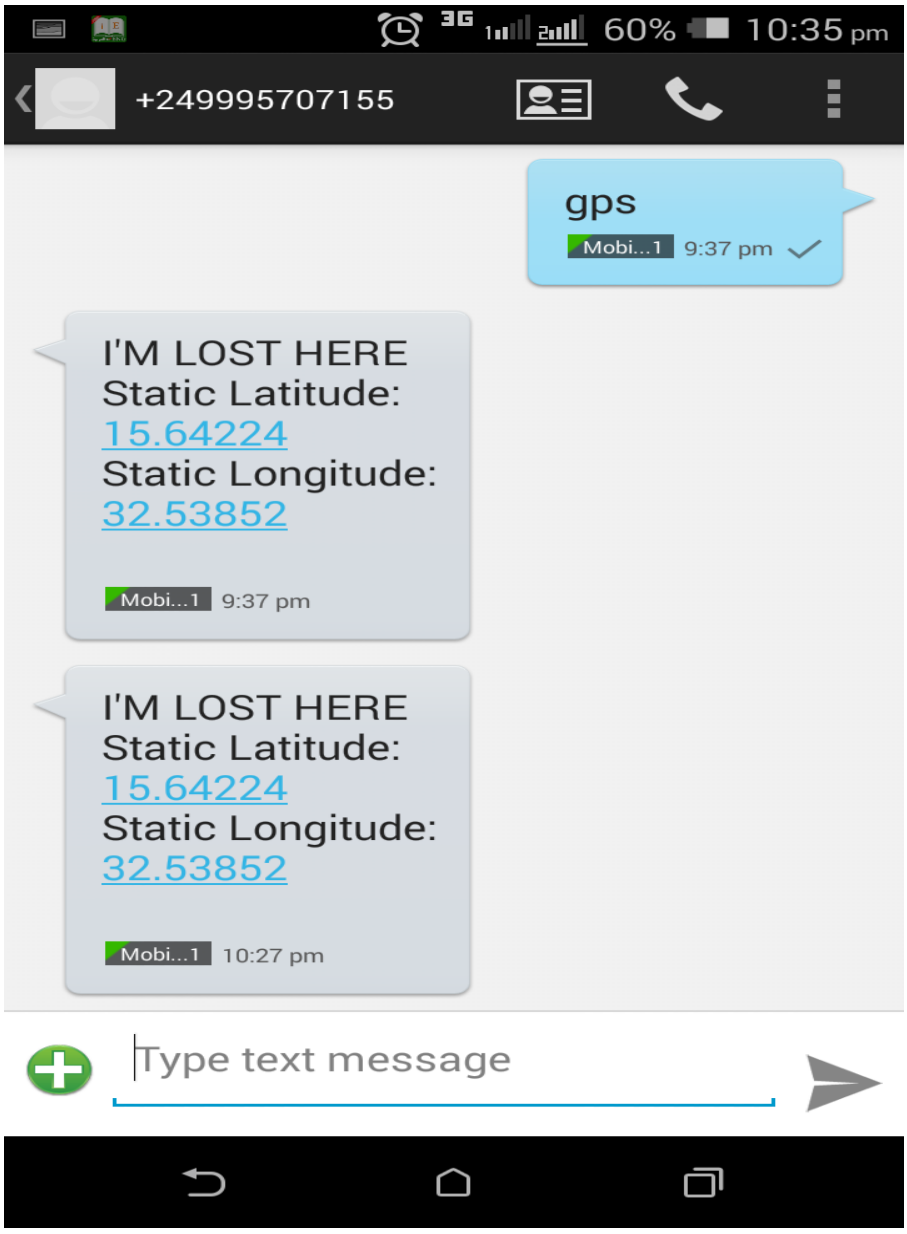

Figure 4.12: A Massage of Vehicle Location.

Then the owner should enter the longitude and latitude in their place and press locate to get location in the map as seen in figure 4.13.

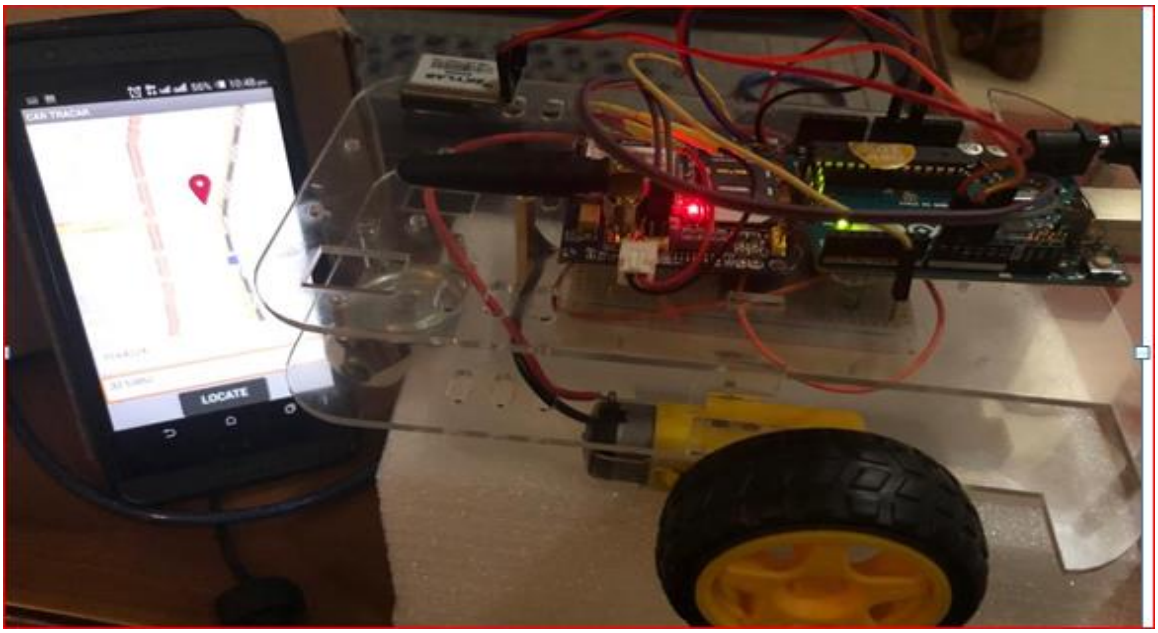

Figure 4.13: Location of the Vehicle.

After the owner find his car to unlock the engine should press unlocked button then the car is move and green led is on as seen in figure 4.14.

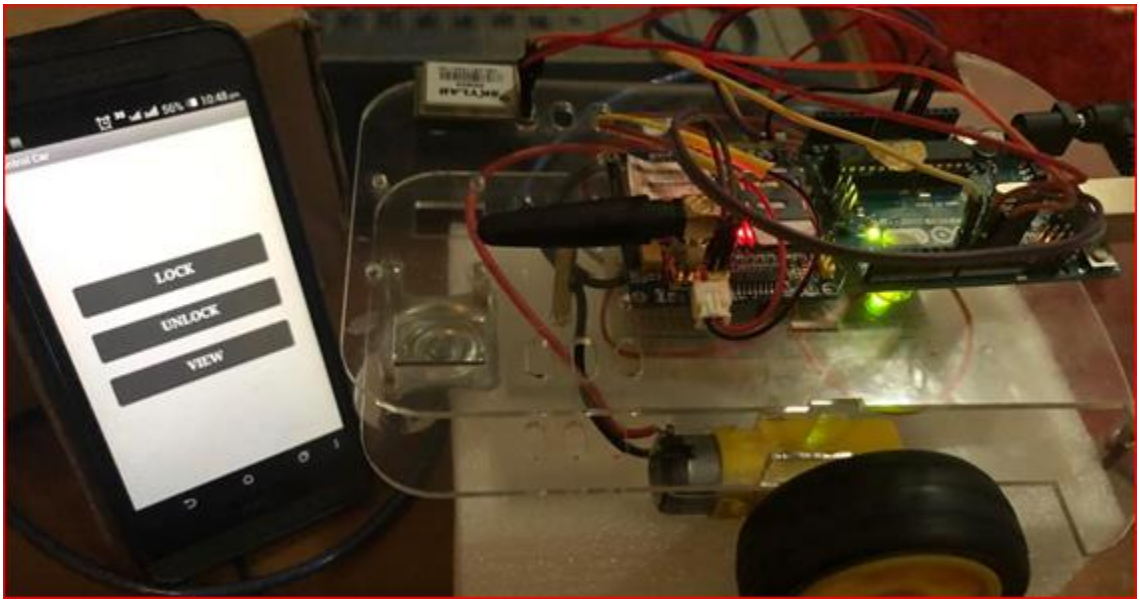

Figure 4.14: The Owner Unlocked Car.

4.4 System Result

The system take about 10 second in order to establish the GSM modem, then a message will be received. Often GPS takes time to connect with the network due to poor weather conditions. For the GPS to work properly, it needs to have a clear view of the sky. That it is unlikely to work indoor or may even have problem outside where it has no clear path of transmitting to and receiving signal from satellites. In the other condition the system will run properly.

Chapter Five

Conclusions and Recommendation

5.1 Conclusion

Developing this system, was a successful experience and a great accomplishment, as it allowed not only to brush up a great deal of skills developed during the studies, but also discover many other exciting technologies and learn how to use them in this project. And learned how to be responsible of a certain task, although being constrained by a deadline.

Anti-theft vehicle and tracking system based on GSM is implemented. Dedicated android application is designed for control the engine of vehicle and tracking through Arduino UNO, GSM and GPS are interfaced with Arduino UNO, when the car move the Arduino send message to the owner's mobile phone, then the owner's lock the vehicle and press the view button to get the current location through GPS device.

Finally working on this project help to define what skills and what knowledge are needed to improve in the future, and inspired to explore more career opportunities either related to Android design or hardware design.

5.2 Recommendation

- Upgrading android application to be more reliable by taking the real time database practically, and easy to use and more secure by making registration page.

- Add alert button within android application to alert the owner's close friends and relatives which is optional.

- Set a spy camera which detects the face ID of the person who tries to steal the vehicle, this will make the police arrest the particular person more easily and accurately.

- Make the system more secure and protective by making lock for the doors to lock the theft inside the vehicle to facilitate arrest him.

- Additionally, a small buzzer can also be installed with Arduino o that whenever a person tries to unlock the door it immediately alerts the owner with its highly audible sound and alert the owner to take appropriate steps in order to protect the vehicle.

- After detecting the route and direction of the snatched vehicle, the special alert message can be sent to upcoming police station.

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Appendix A

```
#include <TinyGPS++.h>

#include <AltSoftSerial.h>

#define RX 8

#define TX 9

AltSoftSerial SoftSerial(RX,TX);

TinyGPSPlus gps;

float o_lng =0;

float o_lat =0;

char msg =0;

const int LOCK = 7;

void setup() {

  SoftSerial.begin(9600);

  Serial.begin(9600);

  delay(1000);

  pinMode(LOCK, OUTPUT);

  digitalWrite(LOCK, HIGH);

  pinMode(TX, OUTPUT);

  pinMode(RX, INPUT);

  Serial.println("AT+CNMI=2,2,0,0,0");
```

```
  delay(1000);
  Serial.println("AT+CMGF=1");
  delay(500);
  Serial.println("AT+CMGS=\"+249XXXXXXXXX\"\r"); // Replace x with your mobile number
  delay(1000);
  Serial.println("Your car is moving.");// The SMS text you want to send
  delay(100);
  Serial.println((char)26); // ASCII code of CTRL+Z
  delay(1000);
}
void loop() {
  if (Serial.available()>0)
  {

    showSMS();
  }

  while(Serial.available() > 0)
  {
```

```
 Serial.write(Serial.read());
 }

 if ( msg == '2')
 {
   digitalWrite(LOCK, HIGH);
   Serial.println("Engine is Unlocked");
   delay(1000);

 }
 else if (msg == '1')
 {
  digitalWrite(LOCK, LOW);
  Serial.println("Engine is    locked");
  delay(1000);

 }
 else if(msg == '3'){
   while(SoftSerial.available())//While there are characters to come from the
GPS
```

```
{
gps.encode(SoftSerial.read());//This feeds the serial NMEA data into the library one char at a time
if(gps.location.isUpdated())//This will pretty much be fired all the time anyway but will at least reduce it to only after a package of NMEA data comes in
 {
float o_lng =0;
float o_lat =0;
o_lng =gps.location.lng();
o_lat =gps.location.lat();
Serial.println("AT+CNMI=2,2,0,0,0"); // AT Command to receive a live SMS
Serial.println("AT+CMGF=1");    //Sets the GSM Module in Text Mode
Serial.println("AT+CMGS=\"+249906611919\"\r"); //  mobile number
delay(1000);
Serial.println("I'M LOST HERE");
Serial.println("Static Latitude:");
Serial.println(o_lat, 5);
Serial.println("Static Longitude:");
Serial.println(o_lng, 5);
```

```
    delay(100);
    Serial.println((char)26);// ASCII code of CTRL+Z
    delay(100);
}
  }
  }
 if(msg != 0) msg = 0;
}

void showSMS()
{
 Serial.print("AT+CMGF=1\r");
 Serial.print("AT+CNMI=2,2,0,0,0\r");
 delay(1000);
 msg = 0;
 while(Serial.available() > 0)
 {
  msg += Serial.read();
 }
 Serial.println(msg); }
```