CELL PHONE BASED CAR TRACKING AND LOCKING SYSTEM

by

Name	Roll No.	Registration No:
Anirban Naskar	**11700314016**	**141170110198** of 2014-2015
Bibhash Saha	**11700314028**	**141170110210** of 2014-2015
Sourav Sarkar	**11700314106**	**141170110288** of 2014-2015
Supratik Bagchi	**11700314114**	**141170110296** of 2014-2015

A comprehensive project report has been submitted in partial fulfillment of the requirements for the degree of

Bachelor of Technology

in

ELECTRONICS & COMMUNICATION ENGINEERING

Under the supervision of

Mr. Arpan Deyasi

Assistant Professor

Department of Electronics & Communication Engineering
RCC INSTITUTE OF INFORMATION TECHNOLOGY
Affiliated to Maulana Abul Kalam Azad University of Technology, WestBengal
CANAL SOUTH ROAD, BELIAGHATA, KOLKATA – 700015

May, 2018

CERTIFICATE OF APPROVAL

This is to certify that the project titled "**Cellphone based car tracking and locking system**" carried out by

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Anirban Naskar	**11700314016**	**141170110198** of 2014-2015
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Supratik Bagchi	**11700314114**	**141170110296** of 2014-2015

for the partial fulfillment of the requirements for B.Tech degree in **Electronics and Communication Engineering** from **Maulana Abul Kalam Azad University of Technology, West Bengal**is absolutely based on his own work under the supervision of Mr. **Arpan Deyasi**. The contents of this thesis, in full or in parts, have not been submitted to any other Institute or University for the award of any degree or diploma.

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....

Dr./Mr./Ms./Mrs. XXXXX XXXXX
Designation and Department
Institute

....

Mr. Sujoy Mondal
Professor , Dept. of ECE
RCC Institute of Information Technology

....

Dr. Abhishek Basu
Head of the Department (ECE)
RCC Institute of Information Technology

DECLARATION

"We Do hereby declare that this submission is our own work conformed to the norms and guidelines given in the Ethical Code of Conduct of the Institute and that, to the best of our knowledge and belief, it contains no material previously written by another neither person nor material (data, theoretical analysis, figures, and text) which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgement has been made in the text."

....

Anirban Naskar

Registration No:141170110198 OF 2014-2015

Roll No: 11700314016

....

Bibhash Saha

Registration No: 141170110210 OF 2014-2015

Roll No: 11700314028

....

Sourav Sarkar

Registration No: 141170110288 OF 2014-2015

Roll No: 11700314106

....

Supratik Bagchi

Registration No: 141170110296 OF 2014-2015

Roll No: 11700314114

Date: 09/05/2018

Place: Kolkata

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Name of the Examiner Signature with Date

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ABSTRACT

The increase in the number of cars on the roads have also led to the increase in the number of crimes such as car theft. To tackle this problem we designed a system that would give the ability to the user to lock the car doors to make the car inaccessible to the thief.

Also it would give the ability to know the exact location of the car in terms of latitude and longitude.

This would make the cars more difficult to steal.

CONTENTS

<u>LIST OF SYMBOLS</u>

SYMBOL	**MEANING**
&	Ampersand
.	Period, Decimal Point
,	Comma
‘	Apostrophe, Prime
“	Quotation Mark
()	Parenthesis
[]	Square Bracket
{}	Braces
<	Less-than Sign
>	Greater-than Sign
/	Slash
%	Percentage
-	Dash/Hyphen
*	Asterisk

<u>LIST OF ABBREVIATIONS</u>

<u>i.e.</u>	**<u>That is</u>**
<u>GSM</u>	**<u>Global System for Mobile</u>**
<u>GPS</u>	**<u>Global Positioning System</u>**
<u>FIG</u>	**<u>Figure</u>**
<u>MHz</u>	**<u>Mega Hertz</u>**
<u>e.g.</u>	**<u>Exempli Gratia</u>**

LIST OF FIGURES

Introduction

The problem of car theft has become more and more serious over the years and requires an accurate and dependable solution. The car owner should be able to have control over his vehicle even after it is stolen. There is a requirement of a system that will be able to provide access to the registered owner to make his vehicle inaccessible to the person who tries to access it against his will. The solution should be efficient and practical both in terms of performance and economy.

Thus we developed a system that will implement GSM and GPRS technology to achieve the mentioned objectives.

1. Problem Definition

1.1 Origin of the requirement

The growth rate of vehicles is the backbone of economic development and the automotive Industry is one of the fastest growing in the world. Travelling from one place to another in means of transport such as cars have become a daily sight with cars becoming more and more affordable to the people. Cars prove to be a comfortable mode of commute and are at times more time efficient and practical than shared means of transport such as buses and trains.

If we consider India itself, about 8 million vehicles are produced annually in the country today. In 2009, the country reported 121.63 million registered motor vehicles, a motorization rate of 22 vehicles per 1000 population (Road Transport Yearbook, 2008). (In comparison, the United States – the world's most motorization nation - reported 675 vehicles per 1000 population).

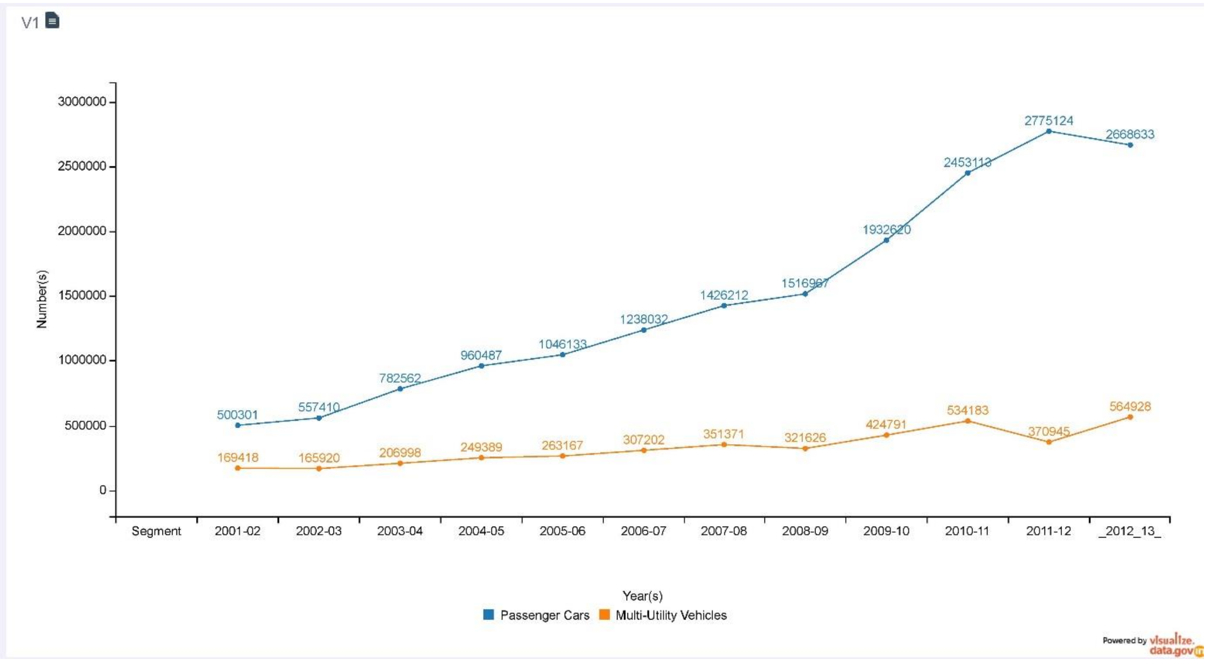


Figure 1.1. This figure shows the growth of number of passenger cars in India over the years from 2001-2013.

According to data.gov.in, the production of passenger cars in India was 500301 in 2001-02. It has increased to 2668633 in 2012-13, registering an absolute growth of 2168332 passenger cars. In percentage terms, the growth was 433.4%. Thus the compound annual growth rate is 16.4%. The maximum growth rate of 40% was recorded in year 2003-04.

With such tremendous increase in the numbers of vehicles, the crimes involves with them have also increased over the years. Issues such as car theft have also increased.

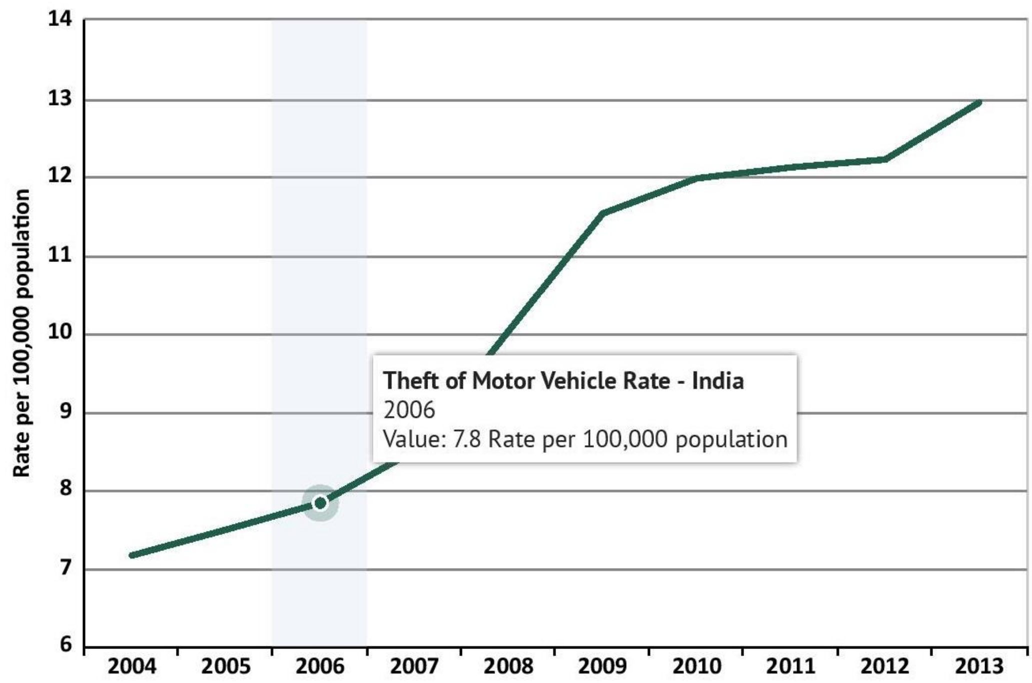


Figure 1.2. The trend of passenger vehicle theft in India per 100,000 population.

The study of the trends shown in **Figure 1.2** clearly indicate an alarming rate of growth of theft related activities involving cars. Thus a solution is required to tackle this trend and provide a viable solution of the increasing car theft problem.

1.2 Objectives

The objective of the “Cell phone Based Car Tracking and Locking System” is to design a system that will:-

- Lock the car door to make it inaccessible to the thief.
- To send live location of the vehicle to the owner in case of theft.

2. Problem Statement

The problem of car theft has become more and more serious over the years and requires an accurate and dependable solution. The car owner should be able to have control over his vehicle even after it is stolen. There is a requirement of a system that will be able to provide access to the registered owner to make his vehicle inaccessible to the person who tries to access it against his will. The solution should be efficient and practical both in terms of performance and economy.

With the advancement of upcoming technologies, cars can be traced using GPS, any hand held device and a good internet network. But what if the signal is weak? What if there is no internet connection at all? We need a solution which would work offline, mainly through SMS services, which is in turn a more viable and cheaper solution.

3. Analysis

3.1 Analysis of the car locking problem

The first problem to be tackled by the system is to be able to communicate with the owner of the car and provide the facility of locking the car doors when the owner intends to. The system should be interactive with the user and provide feedback to the owner when he performs the car locking operation i.e. it should inform the owner by some means whether the operation is successful or unsuccessful.

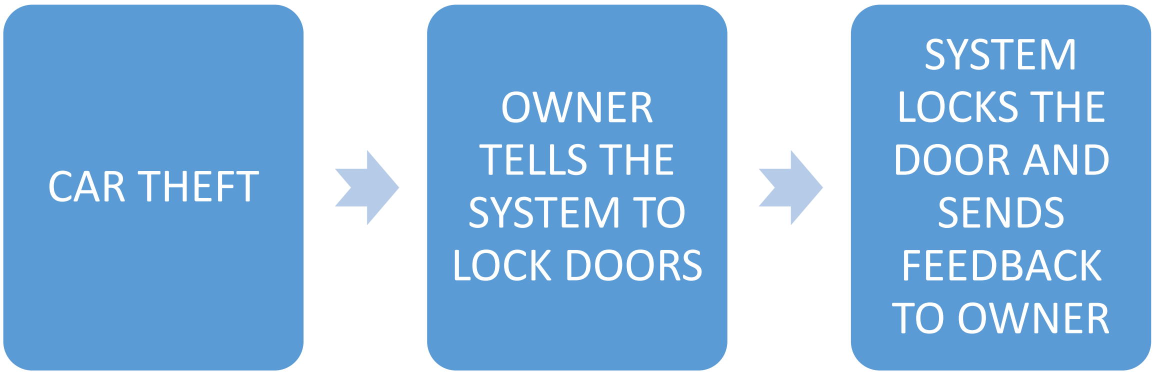


Fig 3.1. Flow of control in case of a car theft.

As shown in **Fig 3.1** the flow of control should take place in the above mentioned manner where the system takes control of the car on behalf of the owner by providing him access to the car doors.

There are many viable solutions to this problem, the communication between the car and the owner for a long range can be established by various methods:-

- The use of satellites for communication

- The use of internet to establish communication between the vehicle and the owner.
- The use of GSM Module.

3.1.1 The use of satellites.

Connected and autonomous vehicles are going to forever change the way we move people and products. The connected environment will also change the way auto manufacturers address vehicle operational improvements, which are increasingly software-driven. The savings available from cutting even a single recall visit over the lifespan of a vehicle provide a compelling argument for enabling connectivity to vehicles.

Satellite communications will play an important role in the connectivity and autonomy of intelligent cars with software updates and machine-to-machine (M2M) communications. A key challenge is to create a totally reliable and ubiquitous communication system that is both highly secure and economically viable.

However, it has its own share of disadvantages:-

- Initial cost such as segment and launch costs are too high.
- Congestion of frequencies interference and propagation.
- Not readily accessible to common people.

Thus, owing to the impracticality of a satellite based system due to the present infrastructure,

We considered other means of communication.

3.1.2 The use of internet.

A car connected to its owner by means of internet is called a connected car. A connected car is a car that is equipped with Internet access, and usually also with a wireless local area network. This allows the car to share internet access with other devices both inside as well as outside the vehicle.

Often, the car is also outfitted with special technologies that tap into the internet or wireless LAN and provide additional benefits to the driver such as car locking.

Even this system comes with its own set of disadvantages:-

- Internet connectivity is not uniform all across the globe. Many areas in the world face slow internet speed or no internet connectivity at all.
- Data rates are high. The fast speed of internet at certain places come at a price.
- The power consumption of the system will be more when compared to the GSM system.

Owing to these reasons, Internet based communication is also taken off the table.

3.1.3 The use of GSM Technology

GSM (Global System for Mobile Communications) is a second-generation digital mobile telephone standard using a variation of Time Division Multiple Access (TDMA). It is the most widely used of the three digital wireless telephone technologies - CDMA (Code Division Multiple Access), GSM and TDMA. GSM digitizes and compresses voice data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900, 1800 or 1,900MHz frequency bands.

GSM was initially developed as a pan-European collaboration, intended to enable mobile roaming between member countries. As at March 2003, GSM digital wireless services were offered in some form in over 193 countries. In June 2002, about 69% of all digital mobile subscriptions in the world used GSM phones on GSM networks.

GSM has quite a number of advantages over internet and satellite communication.

- GSM technology has been matured since long and hence GSM mobile phones and modems are widely available across the world.
- It provides very cost effective products and solutions.
- The GSM based networks (i.e. base stations) are deployed across the world and hence same mobile phone works across the globe. This leverages cost benefits as well as provides seamless wireless connectivity. This will help users avail data and voice services without any disruption. Hence international roaming is not a concern.
- Advanced versions of GSM with higher number of antennas will provide high speed download and upload of data.
- SAIC and DAIC techniques provide very high transmission quality. SAIC stands for Single Antenna Interference Cancellation technique while DAIC stands for Dual antenna interference cancellation.
- It is easy to maintain GSM networks due to availability of large number of network engineers at affordable cost. This will help in revenue increase by the telecom operators.
- The phone works based on SIM card and hence it is easy to change the different varieties of phones by users.
- The GSM signal does not have any deterioration inside the office and home premises.

3.2 Analysis of location sending problem

The second problem to be tackled by the system is to be able to send the location of the stolen car when the owner intends to. The system should be interactive with the user and provide feedback to the owner when he performs the car tracking operation i.e. it should inform the owner by some means whether the operation is successful or unsuccessful. Once the owner has sent the request to the system to send the location of the stolen car, the system should acknowledge the request and send the location of the car and other aspects such as altitude, speed etc. of the car.

Fig 3.2 Flow of control in case of car theft.

This problem can be solved by using Global Positioning System.

3.2.1 The use for GPS to know the location of the car.

The Global Positioning System (GPS) is a U.S.-owned utility that provides users with positioning, navigation, and timing (PNT) services. This system consists of three segments: the space segment, the control segment, and the user segment. The U.S. Air Force develops, maintains, and operates the space and control segments. GPS satellites provide service to civilian and military users. The civilian service is freely available to all users on a continuous, worldwide basis. The military service is available to U.S. and allied armed forces as well as approved Government agencies.

The GPS system currently has 31 active satellites in orbits inclined 55 degrees to the equator. The satellites orbit about 20,000km from the earth's surface and make two orbits per day. The orbits are designed so that there are always 6 satellites in view, from most places on the earth.

GPS uses a lot of complex technology, but the concept is simple.

The GPS receiver gets a signal from each GPS satellite. The satellites transmit the exact time the signals are sent. By subtracting the time the signal was transmitted from the time it was received, the GPS can tell how far it is from each satellite. The GPS receiver also knows the exact position in the sky of the satellites, at the moment they sent their signals. So given the travel time of the GPS signals from three satellites and their exact position in the sky, the GPS receiver can determine your position in three dimensions - east, north and altitude.

4. Outcome

In order to solve the above stated problems, we have developed a model that can both unlock a car from a standard cellular phone working on GSM network, and at the same time locate a car by sending a location 'link' to a the desired cell phone in case of a theft or accident. This done by interfacing a GPS module with a microcontroller to receive location on one hand and then an interfaced GSM module sends the data to the target cell phone.

4.1 SIM 300 GSM Module

Designed for global market, SIM300 is a Tri-band GSM/GPRS engine that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS1900 MHz. SIM300 provides GPRS multi-slot class 10 capability and support the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4. With a tiny configuration of 40mm x 33mm x 2.85 mm , SIM300 can fit almost all the space requirement in your application, such as Smart phone, PDA phone and other mobile device. The physical interface to the mobile application is made through a 60 pins board-to-board connector, which provides all hardware interfaces between the module and customers' boards except the RF antenna interface. SIM300 provide RF antenna interface with two alternatives: antenna connector and antenna pad. The antenna connector is MURATA MM9329-2700. And customer's antenna can be soldered to the antenna pad. The SIM300 is designed with power saving technique, the current consumption to as low as 2.5mA in SLEEP mode. The SIM300 is integrated with the TCP/IP protocol， Extended TCP/IP AT commands are developed for customers to use the TCP/IP protocol easily, which is very useful for those data transfer applications.

4.1.1. **General Specifications**

- Works on all three bands i.e GSM 900, 1800 and 1900MHz.
- Compliant to GSM phase 2/2+ [class 4 @2W on 900Mhz band, class 1 @1W on 1800/1900 MHz band]
- SIM application toolkit
- Operating voltage 12V
- Controlled by microcontroller via AT commands.

- Point to point MO and MT
- SMS cell broadcast
- Text and PDU mode available

Fig 4.1 SIM300 GSM Module

3.2 NEO 6-M GPS Module

The NEO-6 module series is a family of stand-alone GPS receivers featuring the high performance u-blox 6 positioning engine. These flexible and cost effective receivers offer numerous connectivity options in a miniature 16 x 12.2 x 2.4 mm package. Their compact architecture and power and memory options make NEO-6 modules ideal for battery operated mobile devices with very strict cost and space constraints. The 50-channel u-blox 6 positioning engine boasts a Time-To-First-Fix (TTFF) of under 1 second. The dedicated acquisition engine, with 2 million correlators, is capable of massive parallel time/frequency space searches, enabling it to find satellites instantly. Innovative design and technology suppresses jamming sources and mitigates multipath effects, giving NEO-6 GPS receivers excellent navigation performance even in the most challenging environments.

In order to operate, this device first needs to establish a strong connection to at least 6 satellites. After establishing the link, it collects the necessary data and supplies it through the serial port of the microcontroller. This data is the NMEA reading which is in the form of characters. The characters are looped repeatedly to form complete sentences, which contains information such as date, time, number of connected satellites, latitude, longitude, altitude speed etc. The desired data, in our case latitude and longitude, are extracted by the microcontroller and sent through the GSM module.

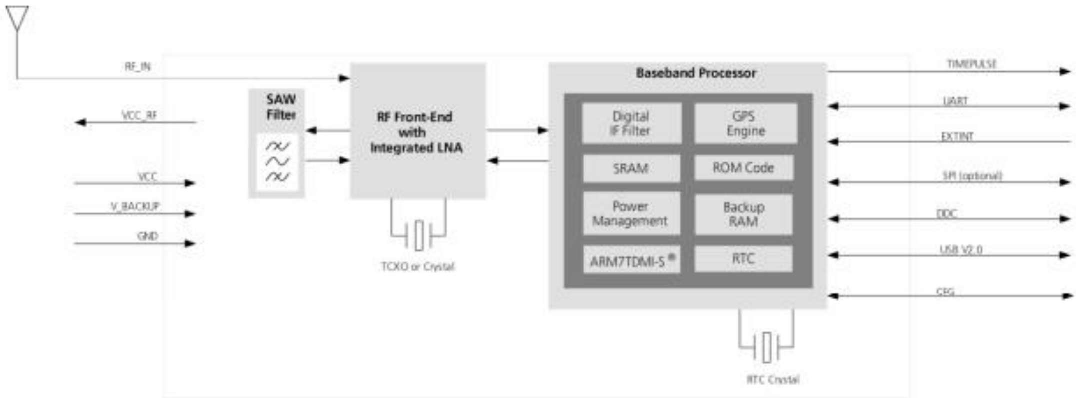


Fig 4.2 NEO 6M GPS Module internal block diagram

3.3 Time Mode

NEO-6T provides a special Time Mode to provide higher timing accuracy. The NEO-6T is designed for use with stationary antenna setups. The Time Mode features three different settings described in Table 3: Disabled, Survey-In and Fixed Mode. For optimal performance entering the position of the antenna (when known) is recommended as potential source of errors will be reduced.

3.4 Time pulse and frequency reference

NEO-6T comes with a timepulse output which can be configured from 0.25 Hz up to 10 MHz. The timepulse can either be used for time synchronization (i.e. 1 pulse per second) or as a reference frequency in the MHz range. A timepulse in the MHz range provides excellent long-term frequency accuracy and stability.

3.5 Raw Data

NEO-6T comes with a timepulse output which can be configured from 0.25 Hz up to 10 MHz. The timepulse can either be used for time synchronization (i.e. 1 pulse per second) or as a reference frequency in the MHz range. A timepulse in the MHz range provides excellent long-term frequency accuracy and stability.

Fig 4.2.2 NEO 6M GPS Module

4.3 ATMEGA 328p Microcontroller

The need of microcontroller arises from the fact that there should be an intermediate link between the GPS and GSM module. Moreover both GPS and GSM modules are not stand alone devices. They need another device to process the data. So, microcontroller plays a vital role in this model.

The high-performance Microchip 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts.

4.3.1 General Features

- Advanced RISC Architecture :

  131 Powerful Instructions ; Most Single Clock Cycle Execution ; 32 x 8 General Purpose Working Registers ; Fully Static Operation ; Up to 20 MIPS Throughput at 20MHz ; On-chip 2-cycle Multiplier.

- High Endurance Non-volatile Memory Segments:

  32KBytes of In-System Self-Programmable Flash program memory; 1KBytes EEPROM; 2KBytes Internal SRAM; Write/Erase Cycles: 10,000 Flash/100,000 EEPROM; Data Retention: 20 years at 85°C/100 years at 25°C(1) ;Optional Boot Code Section with Independent Lock Bits

- Peripheral Features:

  Two 8-bit Timer/Counters with Separate Prescaler and Compare Mode ; One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode ; Real Time Counter with Separate Oscillator ; Six PWM Channels ; 8-channel 10-bit ADC in TQFP and QFN/MLF package • Temperature Measurement ; 6-channel 10-bit ADC in PDIP Package • Temperature Measurement ; Two Master/Slave SPI Serial Interface ; One Programmable Serial USART ; One Byte-oriented 2-wire Serial Interface (Philips I2C compatible) ; Programmable Watchdog Timer with Separate On-chip Oscillator ; One On-chip Analog Comparator ; Interrupt and Wake-up on Pin Change.

- Special Microcontroller Features:

  Power-on Reset and Programmable Brown-out Detection; Internal Calibrated Oscillator; External and Internal Interrupt Sources; Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby

- I/O and Packages:

  23 Programmable I/O Lines; 28-pin PDIP, 32-lead TQFP, 28-pad QFN/MLF and 32-pad QFN/MLF.

- Operating Voltage: 1.8V to 5.5V

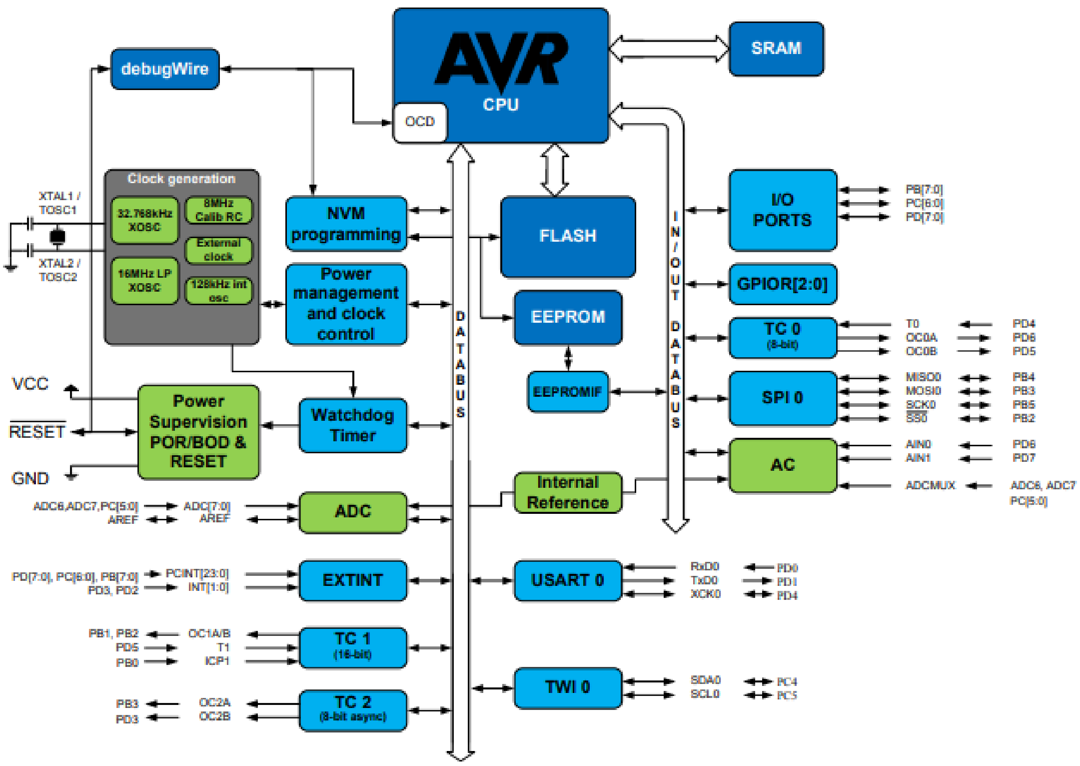


Fig. 4.3.1 Internal Block Diagram of ATMEGA 328 microcontroller

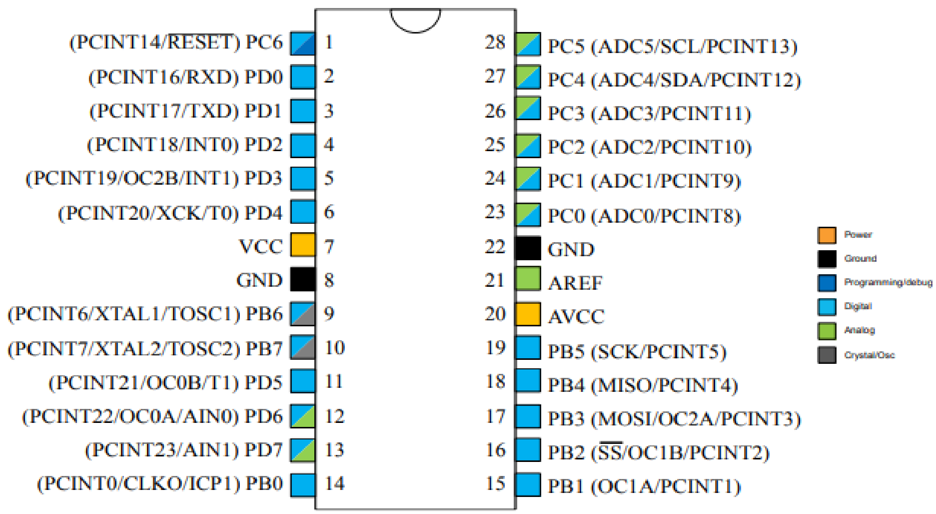


Fig. 4.3.2 Pin Diagram of ATMEGA 328p

4.3.2 Pin descriptions:

- **Port B (PB[7:0]) XTAL1/XTAL2/TOSC1/TOSC2:** Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock is not running. Depending on the clock selection fuse settings, PB6 can be used as input to the inverting Oscillator amplifier and input to the internal clock operating circuit.

- **Port C (PC[5:0]):** Port C is a 7-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The PC[5:0] output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tri-stated when a reset condition becomes active, even if the clock is not running.

- **PC6/RESET:** If the RSTDISBL Fuse is programmed, PC6 is used as an I/O pin. Note that the electrical characteristics of PC6 differ from those of the other pins of Port C. If the RSTDISBL Fuse is unprogrammed, PC6 is used as a Reset input. A low level on this pin for longer than the minimum pulse length will generate a Reset, even if the clock is not running. Shorter pulses are not guaranteed to generate a Reset. The various special features of Port C are elaborated in the Alternate Functions of Port C section.

- **Port D (PD[7:0])**: Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active, even if the clock is not running.

- **AVCC:** AVCC is the supply voltage pin for the A/D Converter, PC[3:0], and PE[3:2]. It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter. Note that PC[6:4] use digital supply voltage, VCC.

- **AREF:** AREF is the analog reference pin for the A/D Converter.

- **ADC [7:6]:** (TQFP and VFQFN Package Only) In the TQFP and VFQFN package, ADC [7:6] serve as analog inputs to the A/D converter. These pins are powered from the analog supply and serve as 10-bit ADC channels.

4.3.3 Arduino:

Arduino is an open source hardware project. The hardware reference designs are distributed under a Creative Commons Attribution Share-Alike 2.5 license and are available on the Arduino website. Layout and production files for some versions of the hardware are also available.

Most Arduino boards consist of an Atmel 8bit -
AVR microcontroller (ATmega8, ATmega168, ATmega328, ATmega1280, ATmega2560) with varying amounts of flash memory, pins, and features.

Arduino microcontrollers are pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory. The default bootloader of the Arduino UNO is the optiboot bootloader. Boards are loaded with program code via a serial connection to another computer. Some serial Arduino boards contain a level shifter circuit to convert between RS-232 logic levels and transistor–transistor logic(TTL) level signals. Current Arduino boards are programmed via Universal Serial Bus (USB), implemented using USB-to-serial adapter chips such as the FTDI FT232

The following figure shows a demo code where, pin 3 will be HIGH if the corresponding voltage on pin2 is HIGH and vice versa. A statement will be printed accordingly on the serial monitor.

Open

DigitalReadSerial §

```
void setup()
{

 pinMode(2, INPUT); //definning pins
 pinMode(3, OUTPUT);   //definning pins
 Serial.begin(9600);    //Starting serial communication
}
void loop()
{
  if(digitalRead(2)==HIGH)
  {
    Serial.println("PD2 is HIGH");
    digitalWrite(3, HIGH);
    Serial.println("LED ON PD3 IS GLOWING");
  }
  else
  {
    Serial.println("PD2 is LOW");
    digitalWrite(3, LOW);
    Serial.println("LED ON PD3 IS NOT GLOWING");

  }
  delay(1000);    //delay of 1000ms
}
```

Done uploading.

```
Sketch uses 2206 bytes (6%) of program storage space. Maximum is 32256 bytes.
Global variables use 258 bytes (12%) of dynamic memory, leaving 1790 bytes for local variables. Maximum is 2048 bytes.
```

Fig 4.3.3 Arduino IDE with a demo code.

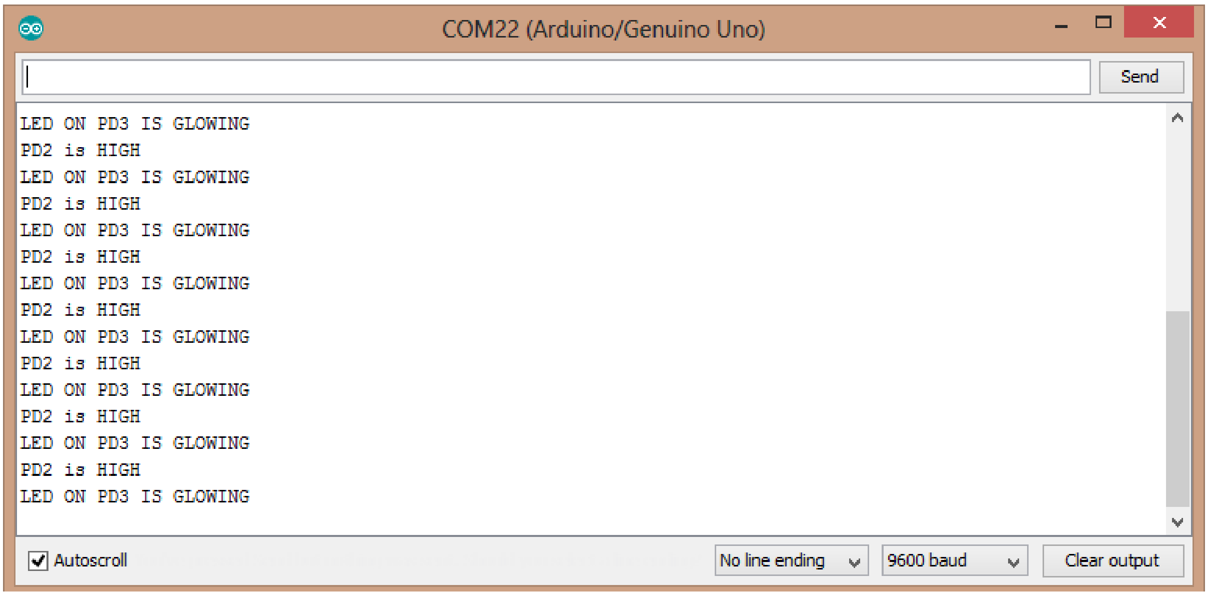


Fig 4.3.4 Arduino Serial Monitor

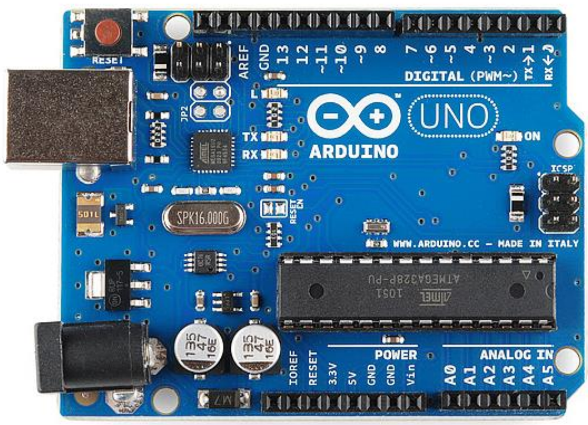


Fig 4.3.5 Arduino UNO development board with onboard ATMEGA 328p

For the sake of simplicity and convenience of the language, we have burned the code onto the microcontroller using Arduino UNO development board and then placed the chip on our model.

4.3.4 Connection and interfacing:

Locking and Unlocking: In order to use the system we must have a cell phone and a SIM card with a working SMS plans on both the SIM cards as the command for opening and closing the doors are sent through SMS.

We have chosen two passwords that need to be sent as an SMS to open and close the doors, (PARIS and TOKYO respectively). The SMS must be coming only from a cell phone number that is recognized by the system. It would be inactive for other phone number thus protecting the car from unauthorized personnel.

Theft and tracking: If the car door is opened without the owner's consent, then it will immediately trigger the microcontroller. The microcontroller on receiving the trigger will send an SMS to the desired cell phone number. Then the serial communication with the GSM service will be temporarily stopped and connection with the GPS service will be established. The GPS module will send the NMEA readings in the form of sentences to the microcontroller where the string will be processed to get the desired datas i.e, latitude and longitude. This datas are used to generate a Google Map link which will direct us to the Google map app directly on our phone . The connection with SIM300 module is reestablished and the link is sent to the target phone number.

As Atmega 328 can communicate serially with only one device at a time, there is a slight loss in GPS data while communicating with the GSM.

An additional switch is present on the model which can be pressed in order to send an SOS message in times of emergency.

4.3.4.1 Connections:

- Pin D2 and D3 is connected to the SIM300 module where D2 is the Tx pin and D3 is the Rx pin. Serial communication between microcontroller and GSM Module is established through these two pins.
- Pin D6 and D7 is connected to the NEO 6M GPS module where 6 is the Tx pin and 7 is the Rx pin. Serial communication between microcontroller and GPS Module is established through these two pins.
- An IR sensor is connected to pin D9 which detects the opening and closing of the door.
- A servo is connected to D8 which is instructed by the microcontroller to open or close the door.
- Two LEDs are connected on pin D13 and D5 which glows as the GSM and GPS modules becomes ready to operate respectively.
- The GSM module is powered directly using a 12V DC adapter or a 9V battery while the voltage is regulated down to 5V using 7805 which is used to power the GPS module and the microcontroller.

4.3.4.2 Block Diagram:

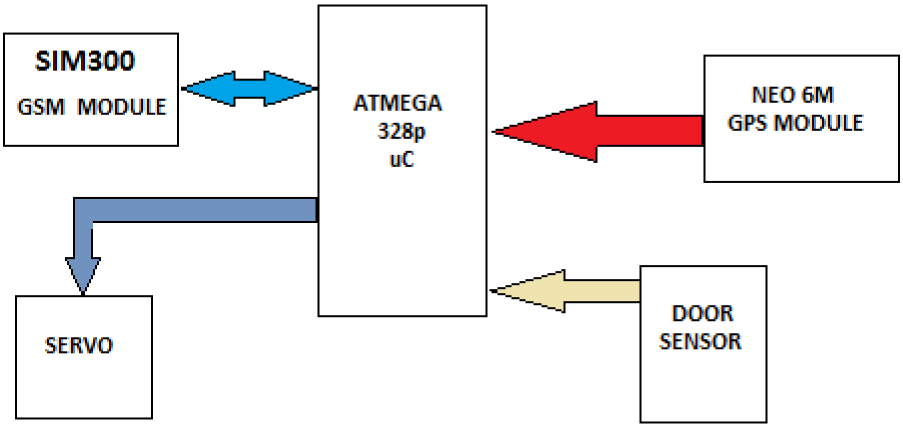


Fig 4.3.6 Block diagram of the model

4.3.4.4 Circuit Diagram

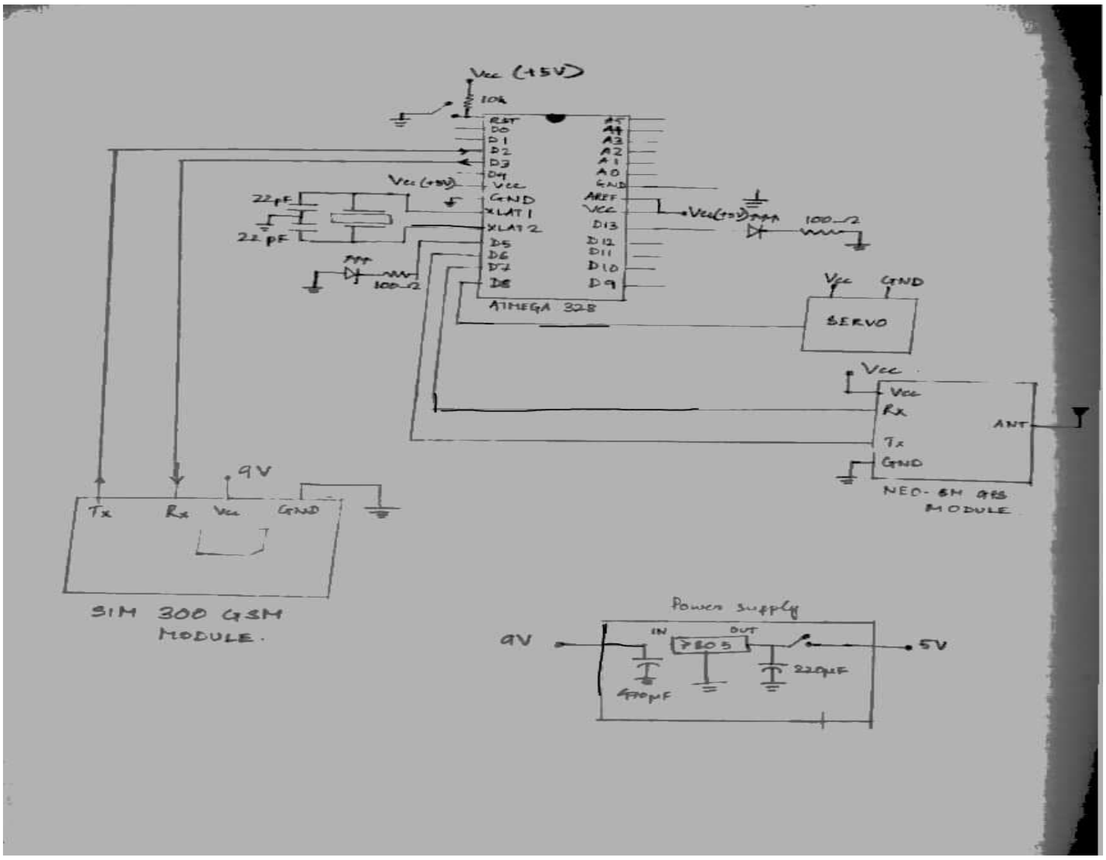


Fig 4.3.7 Circuit Diagram of the system

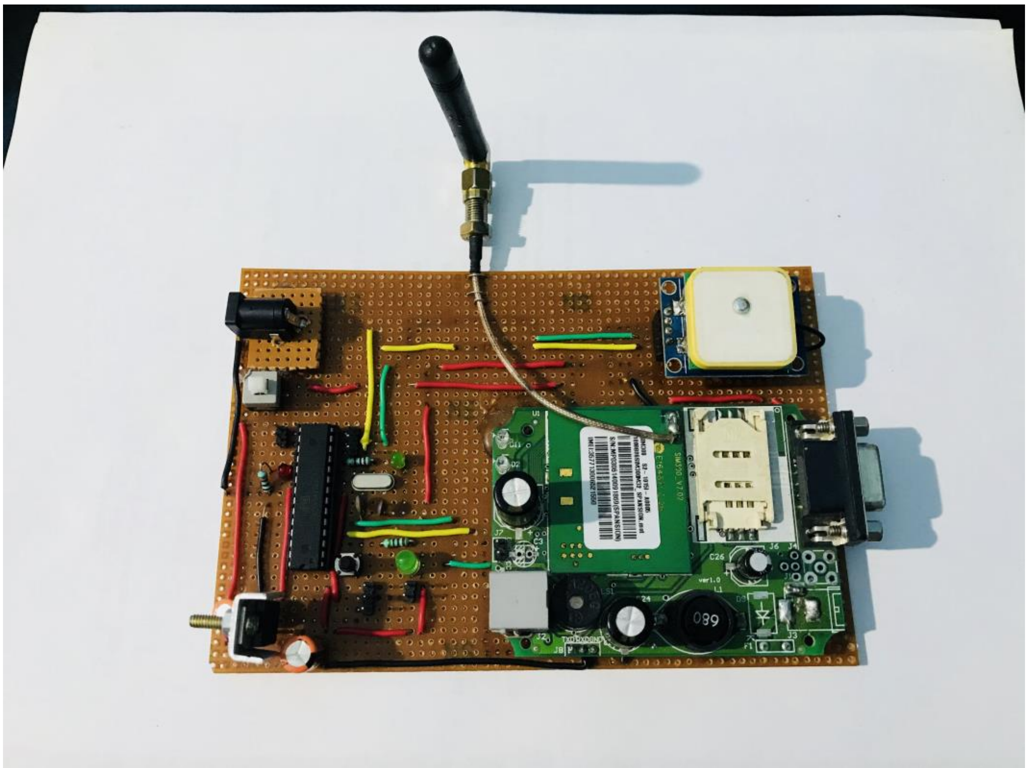


Fig 4.3.8 Cellphone based tracking and locking system

Fig 4.3.9 Demo Car door

4.3.4.5 Code

```
#include <TinyGPS.h>
#include <Servo.h>
String S="";
//This string stores the location link
Servo myservo;
#include <SoftwareSerial.h>
TinyGPS gps;
SoftwareSerial ss(6, 7);     //allocating port for GPS communication
#include "SIM900.h"
int pos =0;
#include "sms.h"
SMSGSM sms;


boolean started=true;  //variable to check whether GSM service isnactive or not
bool newData = false;  //variable to check whether GPS sevice is active or not
char smsbuffer[160];  // stores the SMS content sent by the user
char charbuf[80]; //stores the location link to be sent by the gsm module
char n[20]; //s tores user's phone number
boolean flagdoor=false; //variable to store the condition of door.
void setup()
{


  pinMode(8, OUTPUT); //allocating pins
  pinMode(13, OUTPUT);
  pinMode(9, INPUT);
  pinMode(5, OUTPUT);
    ss.begin(9600);  //starting GPS communication
  Serial.begin(9600);  //staring Serial communication of the uC
  Serial.println("GSM Shield testing.");
 // gsm.begin(9600);
 if (gsm.begin(9600))
  {
    Serial.println("\nstatus=READY");
    started=true;
    digitalWrite(13, HIGH);
  }




   ss.begin(9600);
}
```

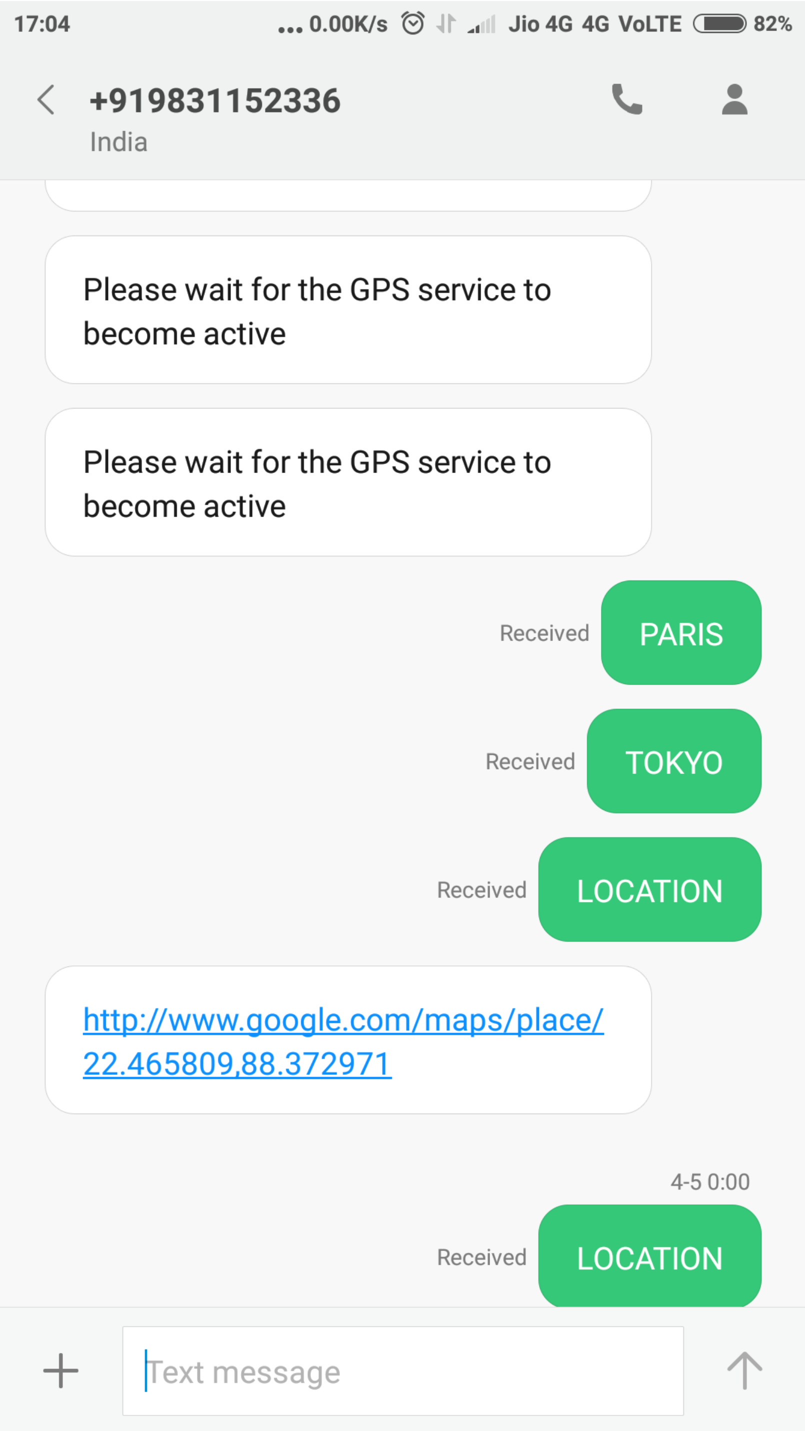
```
void loop()
{

  for (unsigned long start = millis(); millis() - start < 1000;)
  {


    while (ss.available())
    {

      char c = ss.read(); //Variable to store the NMEA readings

      if (gps.encode(c)) //checks whetehr two succesive NMEA readings are same
      {

        newData = true; //signifies GPS is working
        digitalWrite(5, HIGH);

      }
    }
  }
  if (newData)
  {
    float flat, flon;
    gps.f_get_position(&flat, &flon);
    S="http://www.google.com/maps/place/";// generating the link
    String slat=String(flat == TinyGPS::GPS_INVALID_F_ANGLE ? 0.0 : flat, 6);
    String slon=String(flon == TinyGPS::GPS_INVALID_F_ANGLE ? 0.0 : flon, 6);
    S=String(S+slat);
    S=String(S+",");
    S=String(S+slon); //cooncating the link
  }
  if(newData==false)
  digitalWrite(5, LOW);

  S.toCharArray(charbuf, 60);
  if(started && digitalRead(9)==LOW && flagdoor==false)// condition to detect the presence
of an intruder
  {

     gsm.begin(9600);
     if(newData==true)
     {
      sms.SendSMS("8240053908", charbuf);
      //Serial.println(charbuf);
     }
```

```
    else if(newData==false)
     sms.SendSMS("8240053908", "Please wait for the GPS service to become active");

  }

   if(gsm.readSMS(smsbuffer, 160, n, 20))
   {// lock unlock block
     if(n[2]=='8' && n[3]=='2' && n[4]=='4' && n[5]=='0' && n[6]=='0' && n[7]=='5' && n[8]=='3'
&& n[9]=='9' && n[10]=='0' && n[11]=='8')
    {
     //Serial.println(smsbuffer);
     if(smsbuffer[0]=='P' && smsbuffer[1]=='A' && smsbuffer[2]=='R' && smsbuffer[3]=='I' &&
smsbuffer[4]=='S')
     { //PARIS is the password to unlock
      for (pos = 0; pos <= 180; pos += 1)
      { // goes from 0 degrees to 180 degrees
          // in steps of 1 degree
        myservo.write(pos);
      }// tell servo to go to position in variable 'pos'

     flagdoor=true;
     }
     if(smsbuffer[0]=='T' && smsbuffer[1]=='O' && smsbuffer[2]=='K' && smsbuffer[3]=='Y'
&& smsbuffer[4]=='O')
     { //TOKYO IS the password to lock
      for (pos = 180; pos >= 0; pos -= 1)
      { // goes from 180 degrees to 0 degrees
          myservo.write(pos);              // tell servo to go to position in variable 'pos'
      }
     flagdoor=false;
     }
     if(smsbuffer[0]=='L' && smsbuffer[1]=='O' && smsbuffer[2]=='C' && smsbuffer[3]=='A'
&& smsbuffer[4]=='T' && smsbuffer[5]=='I' && smsbuffer[6]=='O' && smsbuffer[7]=='N')
     { //requesting a location

       if(newData==false)
       sms.SendSMS("8240053908", "Please wait for the GPS service to become active");
       else if(newData==true)
       sms.SendSMS("8240053908", charbuf);

    }
   }

  }

}
```

4.3.4.6 Result and Interaction with the system in real world

1) Locking: - Sending "PARIS" to the system via SMS locks the car door and sending "TOKYO" to the system via SMS unlock the door.

2) Tracking: - Sending "LOCATION" to the system via SMS initiates sending the location of the vehicle (Google maps link) to the user by the system.



References

1. Data.gov.in for all the data and statistics.
2. Blewitt, G., Carrier phase ambiguity resolution for the Global Positioning System
3. Wikipedia.org