Software Requirements Specification

for

Vehicle Tracking System Using GPS and GSM

Version 1.1

Prepared by

Group Members

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Contents

1 Introduction

The project Vehicle Tracking Using GSM AND GPRS tracks the location of a particular vehicle and sends the data in the form of latitude and longitude coordinates through SMS. The data received can be viewed in android app.

Document Purpose

The purpose of the document is to present a detailed description of Vehicle Tracking System using GPS and GSM. The purpose of the document is to collect and analyze all the assorted ideas that have come up to define the system, its requirement with respect to the customer (mobile user). The system can be installed in your automobile in a concealed compartment to prevent temperament. One can track the automobile using the device and know the location of the automobile through mobile phone. The mobile user has to dial the mobile number of the SIM attached to the GSM modem. The location of the mobile will be sent to the user's mobile phone in the form of a SMS (short message) comprising of the coordinates which will then be plotted on the Android app.

Product Scope

The product is mainly intended to increase the security amongst the transportation system. The components or the requirements of the product are readily available and less expensive. When a vehicle is stolen or is lost, the device will send the coordinates of latitudes and longitudes that will help to locate the vehicle on user's mobile. The tracking system covers most of the highways, major cities, towns and most of the accessible villages. In the remote areas where there is poor connectivity, the device may not be able to function accurately. Also, appropriate changes have to be made in the code whenever there is any change in mobile number that is installed in the device.

Intended Audience and Document Overview

The further section of this document provides a description that includes features of the product described explicitly, the product's hardware, functional and geographical requirements of this product. The description of this product has been given in Section 2 of this document. Section 3 gives the functional requirements, geographical requirements, limitations and assumptions while designing the vehicle tracking system.
The document can be read by the development team(we) and the mobile user.

The document is intended to serve several groups of audiences:

- First, SRS will be used by the **application designers.** Designers will use the information recorded here as the basis for creating the application's design. They will review the document and fix the device accordingly if an error occurs.

- Second, the **client** for the project is the user of the mobile in our case. The reviewing of the document will allow the client to understand the functionalities of the product regarding the tracking of the device and use it accordingly.

- Non-Functional and Functional Requirements: **Hardware Developers**

Definitions, Acronyms and Abbreviations

Term	**Definition**
SRS	A document that completely describes all of the functions of a proposed system and the constraints under which it must operate.
Application Designers	They determine what the target groups expectations are for a particular piece of software and design accordingly
Client	Mobile User
GSM	Global System for Mobile Communication
GPS	Global Positing System
LCD	Liquid Crystal Display
Hardware Developers	People engaged in connecting and assembling the hardware components of the vehicle tracking system.
SIM	Subscriber's Identity Module
PWM	Pulse Width Modulation
ADC	Analog to Digital Converter
SMS	Short Message Service
GND	Ground
VCC	Voltage at Common Collector
RISC	Reduced Instruction Set Computer
IDE	Integrated Development Environment
IC	Integrated Chip
TTL	Transistor- transistor Logic
CMOS	Complementary Metal oxide Semiconductor

Document Conventions

This document has been created using the IEEE format. It is straightforward and easy to understand. Bold-faced text has been used to pay more emphasis on section and sub-section headings. The highlighted words correspond to the words in the glossary and italicized text is used to label and recognize diagrams.

References and Acknowledgments

- Dr. Ravi Vijay, Dilip Sharma, Sakshi Sharma, Deepak Mali, Rajesh Solanki "VEHICLE TRACKING SYSTEM USING GPS AND GSM", Dept. of Electronics and Communication Eng, Ujjain Engineering College, Ujjain (M.P.), 2014.

- Krishna Kant, "Microprocessor and microcontroller", Eastern Company Edition, New Delhi 2007. Prawat Chairprapa, Supaporn Kiattisin and Adisorn Leelasantitham "A Real-Time GPS Vehicle Tracking System Displayed on a Google Map Based Website", Computer and Multimedia Engineering, School of Engineering University of the Thai Chamber of Commerce, 2004.

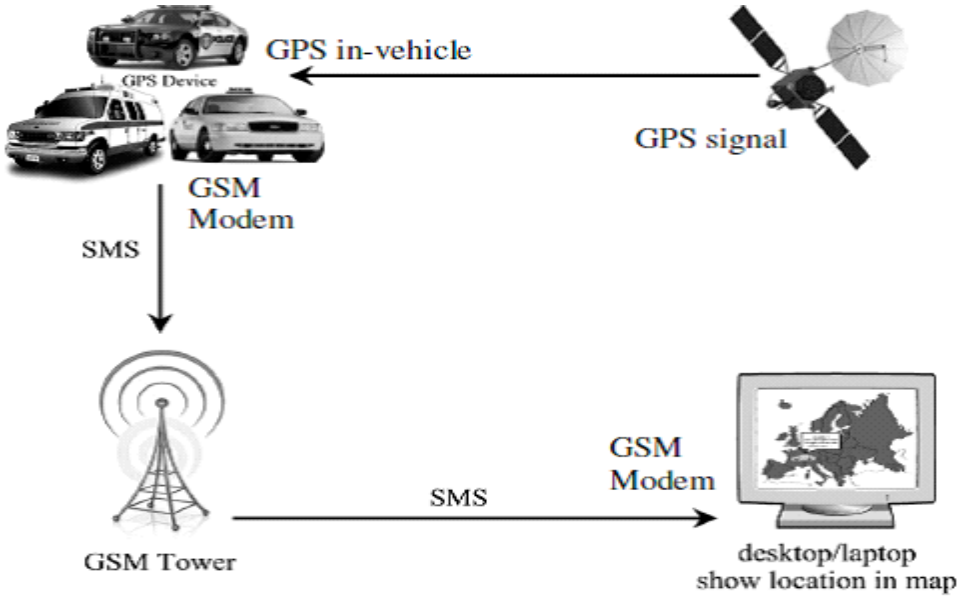
- Kunal Maurya, Mandeep Singh, Neelu Jain "Real Time Vehicle Tracking System using GSM and GPS Technology – An Anti-theft Tracking System", Department of Electronics, PEC Punjab University of Technology, Chandigarh, 2013

Description

Product Perspective

The hardware is a equipped with GPRS, GSM module, LCD to view the coordinates, Microprocessor Arduino, RS232, MAX232 and relay. It is a prototype of existing GPRS tracking devices. It is for vehicles and to ensure security in the transportation system. The interface is user friendly consisting of a simple device and mobile.The number of users supported by the system is one which is the owner of the mobile. The product allows the user to track the device using only registered mobile numbers and hence provides full security as only registered user can access it.

Framework



Product Functionality

The main purpose of the vehicle tracking system using GSM and GPS is to get an accurate position of the vehicle in which the device is installed. The project is made in minimum budget keeping user's requirements in the view.

- The input to the device is the call from the registered mobile number of the user.

- The output in the form of location coordinates is sent to the mobile user in the form of latitudes and longitudes coordinates.
- The device will work effectively irrespective of the company of the SIM.

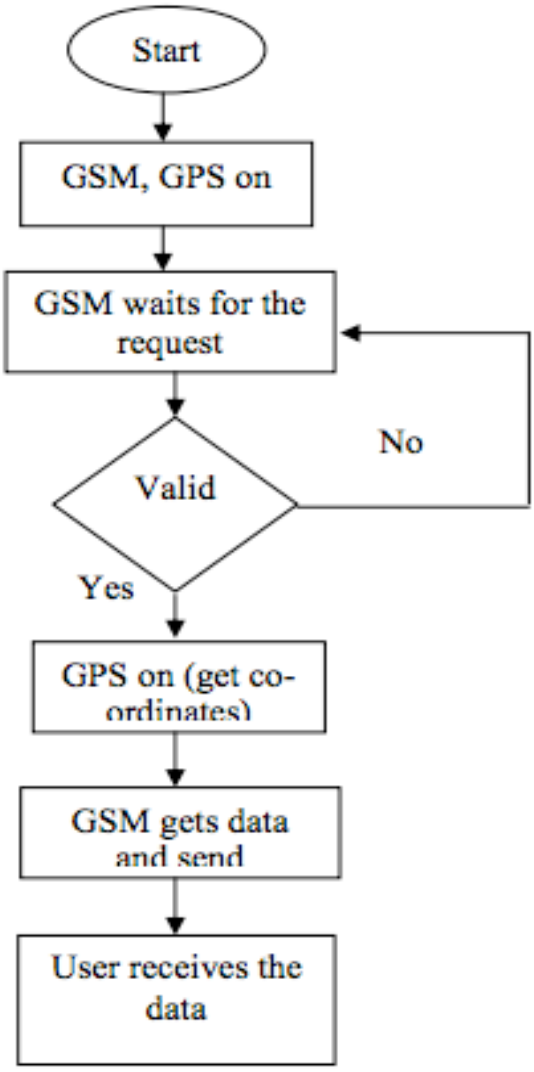


Figure 4.Program flow chart of the tracking system

Working of the Product

This system takes input from GPS and which goes into RS232. This RS232 sends data into MAX232 and it converts the data format and sends it to the Rx (receiver pin) of

microcontroller. This microcontroller Arduino stores this data in USART buffer and the data stored is sent again through TX pin into MAX232. It sends the data into GSM via RS232. This is how vehicle tracking works using GSM and GPS. When the user presses the "Track Location" button, an SMS asking for location is sent to GSM module. It authenticates the user. If authenticated, it then sends an SMS comprising the coordinates of the system to the user's mobile. The location is then plotted on the app and the vehicle's location is known.

Users and Characteristics

- The main users of the product are the transportation companies. Companies and start-ups that provide cabs can install the device in their vehicles to ensure the safety of passengers.
- Other users could be traffic police, who can view the traffic on the roads and can effectively manage the existing traffic by diverting them to another route.
- Schools could also install the device in school vans can keep a constant check on the route of the vans for the sake of students' safety.
- It could be used in Bus stands by the managers to effectively predict and display the timing of the arriving buses for the waiting passengers.

Operating Environment

In this project 8052 microcontroller is used for interfacing to various hardware peripherals. The GSM Modem and GPS Receiver are interfaced serially to the 8052 microcontrollers. A **GSM** modem is a specialized type of modem to send the position and which accepts a **SIM** card. It operates over a subscription to a mobile operator. The **GPS** modem will continuously give the data i.e. the latitude and longitude indicating the position of the vehicle.

The design uses RS-232 protocol for serial communication between the modems and the microcontroller. A serial driver IC is used for converting TTL voltage levels to RS-232 voltage levels. The code for the device will be written and tested in Arduino IDE. The Arduino IDE is a cross-platform application written in Java, and is derived from the **IDE** for the Processing programming language and the Wiring project.

Design and Implementation Constraints

- Proper functioning of a GPS receiver requires undisturbed reception of signals from at least four GPS satellites.

- In any measuring system, there is a limit to the accuracy with which measurements can be made. GPS module gives an error of 5-10 meters.
- In order to determine the route of the vehicle, we need a storage device. We need to provide an external storage unit to store the coordinates of the entire journey.
- GPS modem is very power consuming.
- The location of the vehicle can be seen only on the registered mobile number. Hence the user must update the changes in the mobile number.

Assumptions and Dependencies

- Signal Propagation Error: We assume that atmosphere has no effect on the signal sent by the satellites to the GPS module. Such an error is called spherical error.
- Receiver's Error: We assume that there is no receiver clock error and measurement noise. Under worst case scenarios, the receiver clock error could be very large.
- We assume that the mobile number that user will provide is not going to change in the future.
- It is assumed that the user has the basic knowledge of using a mobile in order to use the product effectively.
- The functioning of the product depends on the quality of the GPS, strength of GPS signal, GSM module, the signal strength of the mobile network and the coverage area of the company's SIM.

Specific Requirements

External Interface Requirements

User Interfaces

Message for location:
latitude: 2400.0090, N longitude: 12100.0000, E time: 12:00”

Hardware Interfaces:

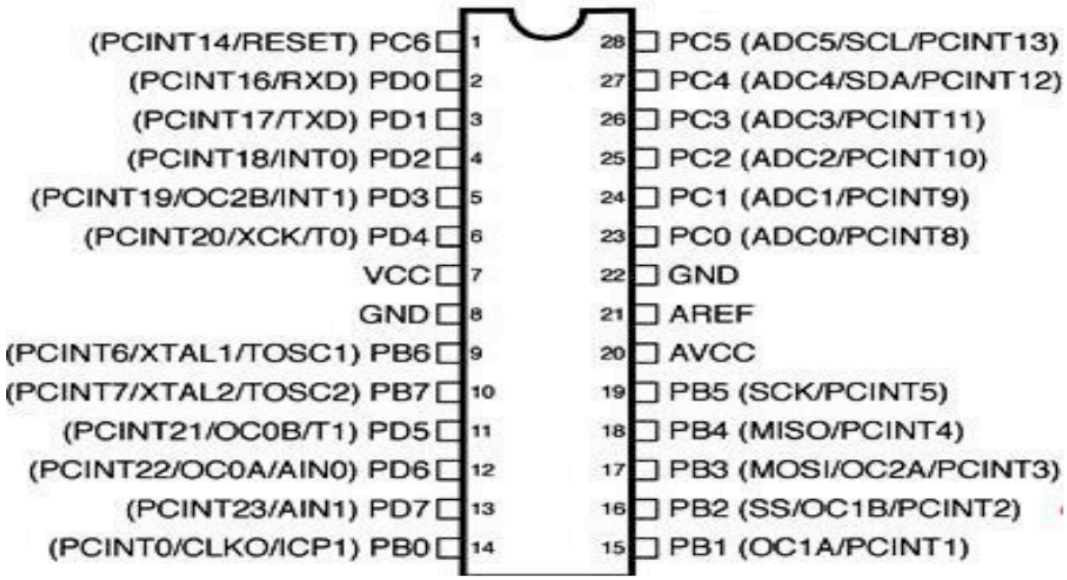
3.2.2 MICROCONTROLLER ATMEGA328:

Arduino Uno is based on ATMega328. ATMega328 is the ATMEL Microcontroller. It is a single chip microcontroller and belongs to the mega AVR family.

The Atmega328 provides the following features:

Features	ATmega328/P
Pin Count	28/32
Flash (Bytes)	32K
SRAM (Bytes)	2K
EEPROM (Bytes)	1K
General Purpose I/O Lines	23
SPI	2
TWI (I^2C)	1
USART	1
ADC	10-bit 15kSPS
ADC Channels	8
8-bit Timer/Counters	2
16-bit Timer/Counters	1

PIN Diagram Description:



The Atmega328 has 28 pins.
14 pins are digital of which 6 can give PWM output and 6 can give analog input/output. **PWM** is a technique for getting analog results. 2 pins are crystal oscillator, which are used as a clock pulse. These I/O pins account for 20 of the pins.
The Atmega328 chip has an analog-to-digital converter (ADC) inside of it. The

microcontroller needs power so 2 pins VCC and GND are dedicated, so that it can operate. The power required by the Atmega328 is 1.8-5.5V of power operate.
Because there is an **ADC**, the chip can interpret analog input, which is why the chip has 6 pins for analog input.
The ADC has 3 pins set aside for it to function-

- AVCC – It is the positive voltage power supply. **ADC** uses this, as it requires its own power supply in order to work.
- AREF – It is the reference voltage. **ADC** uses to convert an analog signal to its corresponding digital value.
- GND. **GND** is the power supply ground.

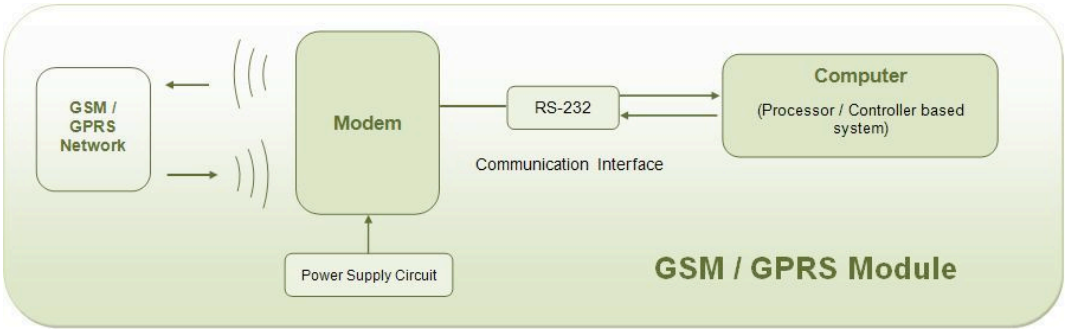
Analog voltages higher than the reference voltage will be assigned to a digital value of 1, while analog voltages below the reference voltage will be assigned the digital value of 0. The last pin is the RESET pin. This allows a program to be rerun and start over.

The table below gives a description for each of the pins, along with their function.

Pin Number	Description	Function
1	PC6	Reset
2	PD0	Digital Pin (RX)
3	PD1	Digital Pin (TX)
4	PD2	Digital Pin
5	PD3	Digital Pin (PWM)
6	PD4	Digital Pin
7	Vcc	Positive Voltage (Power)
8	GND	Ground
9	XTAL 1	Crystal Oscillator
10	XTAL 2	Crystal Oscillator
11	PD5	Digital Pin (PWM)
12	PD6	Digital Pin (PWM)
13	PD7	Digital Pin
14	PB0	Digital Pin
15	PB1	Digital Pin (PWM)
16	PB2	Digital Pin (PWM)
17	PB3	Digital Pin (PWM)
18	PB4	Digital Pin
19	PB5	Digital Pin
20	AVcc	Positive voltage for ADC (power)
21	Aref	Reference Voltage
22	GND	Ground
23	PC0	Analog Input
24	PC1	Analog Input
25	PC2	Analog Input
26	PC3	Analog Input
27	PC4	Analog Input
28	PC5	Analog Input

3.3.3 GSM MODULE

Global System for Mobile communication (GSM) is an architecture used for mobile communication.
GSM module includes a GSM modem combined with a power supply circuit and communication interfaces (like RS-232) for mobile. The MODEM act as a soul of such modules.



3.3.4 GPS MODULE:

The Global Positioning System (**GPS)** is a satellite-based navigation system. Developed by the American Army for the soul purpose of defending the American Nation from enemies. GPS can work in all kind of weather conditions, storms or even a flood or earthquake can't affect the functionality of GPS. It covers the entire world 24*7 through out the year. But however American Army can turn the GPS off completely for the purpose to prevent their enemies from seeing their position. GPS satellites circle the Earth twice a day in a precise orbit. Each and every satellite sends a unique signal to the GPS receivers. GPS receivers use trilateration for calculation. The receiver basically takes the time taken by it to receive signals as the source of calculating position. However, to calculate the location of the user the user need 3 satellites minimum. It can easily help you measure your running route, map a golf course, find a way home or adventure anywhere.

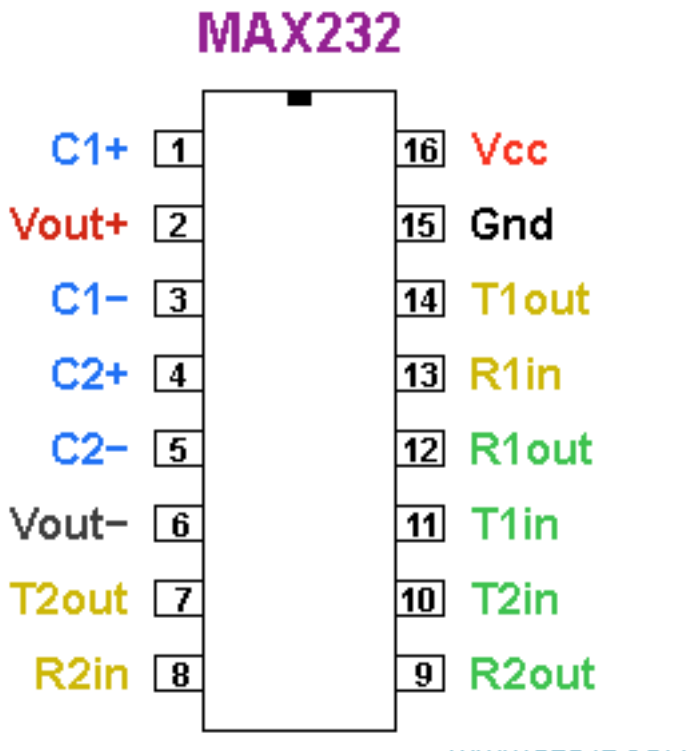
For 2-D positioning (latitude and longitude) and tracking the movement, a GPS receiver must receive signal from 3 satellites.
The information received can be used for calculating:

- Speed
- Bearing
- Track
- Trip distance
- Distance to destination
- Sunrise and sunset time

3.3.5 MAX232:

In 1987, Maxim Integrated Product created MAX232 which is basically an IC that is used to convert signals from RS232 serial port to signals suitable for use in TTL-compatible digital logic circuits. The MAX232 is a dual transmitter / dual receiver that typically is used to convert the RX, TX, CTS, RTS signals.

TIA-232 line type and logic level	TIA-232 voltage	TTL voltage to/from MAX232
Data transmission (Rx/Tx) logic 0	+3 V to +15 V	0 V
Data transmission (Rx/Tx) logic 1	−3 V to −15 V	5 V
Control signals (RTS/CTS/DTR/DSR) logic 0	−3 V to −15 V	5 V
Control signals (RTS/CTS/DTR/DSR) logic 1	+3 V to +15 V	0 V



3.3.6 RS232:

RS-232 stands for Recommend Standard number 232 and C is the latest revision of the standard. The serial ports on most computers use a subset of the RS-232C standard. The full RS-232C standard specifies a 25-pin "D" connector of which 22 pins are used.

The RS-232 standard describes that DTE devices use a 25-pin male connector, and DCE devices use a 25-pin female connector.

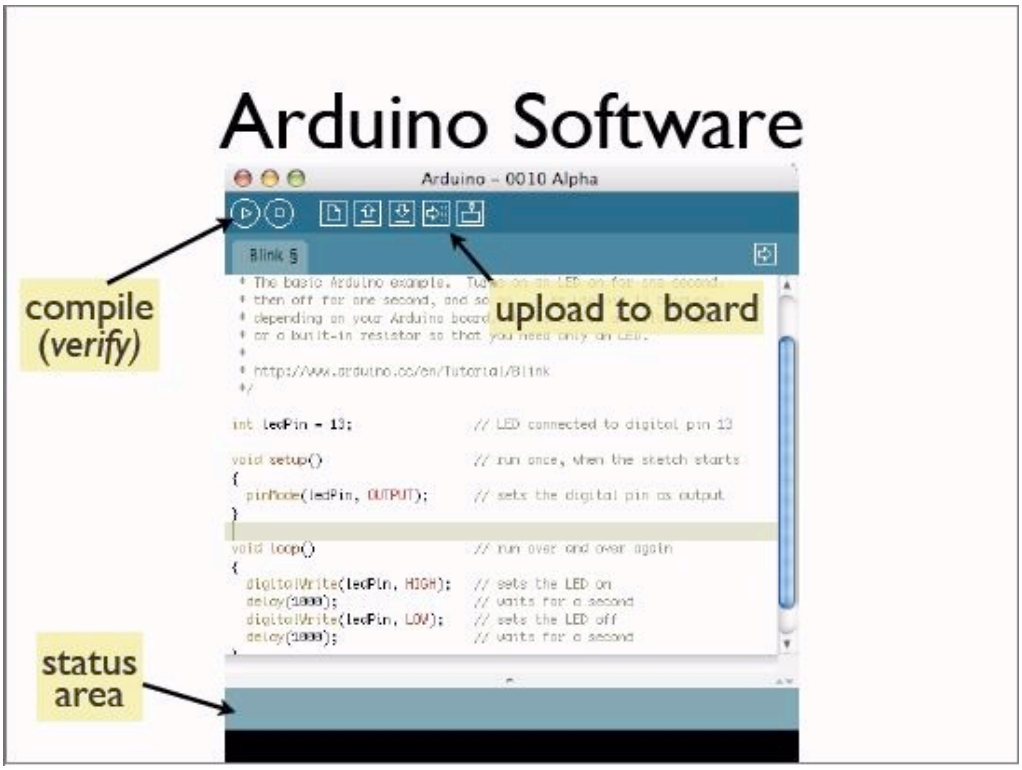
25 Pin Connector on a DTE device (PC connection)

25 Pin Connector on a DTE device (PC connection)	
Male RS232 DB25	
Pin Number	**Direction of signal:**
1	Protective Ground
2	Transmitted Data (TD) Outgoing Data (from a DTE to a DCE)
3	Received Data (RD) Incoming Data (from a DCE to a DTE)
4	Request To Send (RTS) Outgoing flow control signal controlled by DTE
5	Clear To Send (CTS) Incoming flow control signal controlled by DCE
6	Data Set Ready (DSR) Incoming handshaking signal controlled by DCE
7	Signal Ground Common reference voltage
8	Carrier Detect (CD) Incoming signal from a modem
20	Data Terminal Ready (DTR) Outgoing handshaking signal controlled by DTE
22	Ring Indicator (RI) Incoming signal from a modem

Software Interfaces

3.1.1 Arduino Compiler:

The Arduino IDE is a platform which is used to write or edit programs for Arduino. It is a cross-platform application written in a language known as JAVA. It provides the user with a lot of additional features which helps the user to code properly, such as syntax highlighting, brace matching, provide automatic indentation and provide the facility of verifying the code. The IDE is also used to upload the code into the Arduino. It supports many built-in libraries which is quite helpful. Arduino Programs are written in C language.



Functional Requirements

This system takes input from GPS and which goes into RS232. This RS232 sends data into MAX232 and it converts the data format and sends it to the Rx (receiver pin) of microcontroller and this microcontroller stores this data in USART buffer and the data stored is sent again through Tx pin into MAX232 this max 232 sends the data into GSM via RS232. This is how vehicle tracking works using GSM and GPS. The LCD interfaced to the microcontroller also shows the display of the coordinates. This LCD display is only used to know the working condition of the vehicle tracking system.

Other Non-functional Requirements

1. Access to the location of the vehicle should be restricted to people that are authenticated to view information.
2. Passwords and ID's should be regulated to be at least a certain length and must contain non-alphanumeric characters in both the password and ID to make the system more secure.

3. The device should be installed in such a way that it can't be affected by any atmospheric factors such as rain.

Future Scope:
The hardware can be installed with fire sensors and shock sensors. In case of fire, the device will automatically send the message to the registered mobile user. Shock sensors will be highly helpful in case the vehicle installed with the product has met with an accident. There will be a threshold value only after which the device installed will send the message to the registered mobile user.

Appendix A – Data Dictionary

SRS: Software Requirements Specification
GPS: Global Positioning System
GSM: Global System for Mobile Communication
VTS: Vehicle Tracking System
SIM: Subscriber's Identity Module.
ADC: Analog to Digital Converter.
SMS: Short Message Service.
LCD: Liquid Crystal Display.

Appendix B - Group Log

SRS Draft 1: The draft was generic and made more specific in draft 2.
SRS Draft 2: Specifications of all the hardware, software and working of the product were listed clearly. The draft was appreciated for the quality of the content. The draft lacked some
SRS Draft 3: The draft did not qualify for the formatting standards as described in IEEE.
SRS Draft 4: The draft has been strictly prepared by following the IEEE 830 standards. Specifications of all the hardware, software, working and framework of the product are listed clearly.

Jessica Saini 15BCE0164: Analyses all the requirements of the end user.

Mayank Agarwal 15BCE0836: Works on the designing part i.e. What are the hardware things required for this project and how to connect all the components with each other

Akriti Gupta: 15BCE0728: Working on the implementation phase of the software developing process.