

# Smart Vehicle Security System - Theory and Implementation using GPS & GSM

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## ABSTRACT

SMART VEHICLE SECURITY SYSTEM is a new information & control system for automobile drivers and owners to solve problems caused by automobiles, thieves and any emergency. It is based on the concept of GPS and GSM technology. It deals with three jobs: track the vehicle location by owner, control the vehicle to stop/run vehicle wheels and single switch call-message generation by drivers in emergency.

The smart vehicle security system is an electronic device installed in a vehicle to enable the owner or a third party to track the vehicle's location, control the vehicle. For vehicle tracking, it uses Global Positioning Systems (GPS) modules for accurate location of the vehicle. Many systems also combine a communications component such as cellular or satellite transmitters to communicate the vehicle's location to a remote user. Vehicle information can be viewed on electronic maps via the Internet or specialized software.

This will be very popular in consumer vehicles as a theft prevention and retrieval device. Police can simply follow the signal emitted by the tracking system and locate the stolen vehicle. This makes it possible to control vehicle remotely to start or stop the vehicle engine, in case of emergency vehicle driver has a option to call and sent messages to their owners or nearer police station. The existence of vehicle tracking device then can be used to reduce the insurance cost, because the loss-risk of the vehicle drops significantly.

## INTRODUCTION

A smart vehicle security system combines the installation of an electronic device in a vehicle with purpose-designed computer software at least at one operational base to enable the owner or a third party to track the vehicle's location, stop or run vehicle,

there is a smart technology that generates automatic call or msg to the owner in the case of emergency using a single key. This smart vehicle systems commonly use GPS technology for locating the vehicle and GSM technology to communication among owners and vehicle's driver. Vehicle information can be viewed on electronic maps via the Internet or specialized software.

There are three ways to make a smart vehicle:

<1> track the vehicle &

<2> stop or run the vehicle

<3> single switch automatic call and messages generation in emergency .

This smart systems use Global Positioning Systems (GPS) modules for accurate location of the vehicle. Many systems also combine a communications component such as cellular or satellite transmitters to communicate the vehicle's location to a remote user. Vehicle information can be viewed on electronic maps via the Internet or specialized software.

Vehicle tracking systems are widely used worldwide. Components come in various shapes and forms but most utilize GPS technology and SMS /call services. While most will offer real-time tracking, Others record real time data and store it to be read, similar to data loggers. Systems like these track and record and allow reports after certain points have been solve.

## COMPONENT DESCRIPTION

### RESISTORS

A Resistor is a heat-dissipating element and in the electronic circuits it is mostly used for either controlling the current in the circuit or developing a voltage drop across it, which could be utilized for many applications.

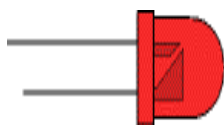
### CAPACITORS

A **capacitor** (or **condenser**) is a passive two-terminal electrical component used to store energy in an electric field. The forms of practical capacitors vary widely, but all contain at least two electrical conductors separated by a dielectric (insulator);

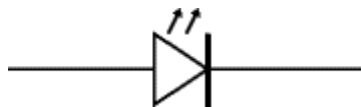
When there is a potential difference (voltage) across the conductors, a static electric field develops across the dielectric, causing positive charge to collect on one plate and negative charge on the other plate. Energy is stored in the electrostatic field. An ideal capacitor is characterized by a single constant value, capacitance, measured in farads. This is the ratio of the electric charge on each conductor to the potential difference between them.

Capacitors are widely used in electronic circuits for blocking direct current while allowing alternating current to pass, in filter networks, for smoothing the output of power supplies, in the resonant circuits that tune radios to particular frequencies, in electric power transmission systems for stabilizing voltage and power flow, and for many other purposes.

### LED (LIGHT EMITTING DIODES)



Typical LED



circuit symbol

As its name implies it is a diode, which emits light when forward biased. Charge carrier recombination takes place when electrons from the N-side cross the junction and recombine with the holes on the P side. Electrons are in the higher conduction band on the N side whereas holes are in the lower valence band on the P side. During recombination, some of the energy is given up in the form of heat and light. In the case of semiconductor materials like Gallium arsenide (GaAs), Gallium phosphide (GaP) and Gallium arsenide phosphide (GaAsP) a greater percentage of energy is released during recombination and is given out in the form of light. LED emits no light when junction is reverse biased.

## TRANSISTOR

A transistor consists of two junctions formed by sandwiching either p-type or n-type semiconductor between a pair of opposite types. Accordingly, there are two types of transistors namely: -

(1) n-p-n transistor

(2) p-n-p transistor

An n-p-n transistor is composed of two n-type semiconductors separated by a thin section of p type. However a p-n-p transistor is formed by two p sections separated by a thin section of n-type. In each type of transistor the following points may be noted.

There are two p-n junctions, therefore a transistor may be regarded as combination of two diodes connected back to back.

There are three terminals taken from each type of semiconductor.

The middle section is a very thin layer, which is the most important factor in the functioning of a transistor.

Transistor can be used as an Amplifier also.

A transistor raises the strength of a weak signal and thus acts as an amplifier. The weak signal is applied between emitter base junction and output is taken across the load  $R_c$  connected in the collector circuit (in common emitter configuration). In order to achieve faithful amplification, the input circuit should always remain forward biased. To do so, a dc voltage is applied in the input in addition to the signal. This dc Voltage is known as biasing voltage and its magnitude and polarity should be such that it always keeps the input circuit forward biased regardless of the polarity to the signal to be amplified.

Transistor may be used in different configuration like CB (common base) & CC (common collector) according to requirements of amplifier (impedance matching, buffer amplifier etc.).

## TRANSFORMER

Transformers convert AC electricity from one voltage to another with a little loss of power. Step-up transformers increase voltage, step-down transformers reduce voltage. Most power supplies use a step-down transformer to reduce the dangerously high voltage to a safer low voltage.

The transformer is a static electro-magnetic device that transforms one alternating voltage (current) into another voltage (current). However, power remains the same during the transformation. Transformers play a major role in the transmission and distribution of ac power.

### A TYPICAL TRANSFORMER

The input coil is called the primary and the output coil is called the secondary. There is no electrical connection between the two coils; instead they are linked by an alternating magnetic field created in the soft-iron core of the transformer. The two lines in the middle of the circuit symbol represent the core. Transformers waste very little power so the power out is (almost) equal to the power in. Note that as voltage is stepped down and current is stepped up.

The ratio of the number of turns on each coil, called the turn's ratio, determines the ratio of the voltages. A step-down transformer has a large number of turns on its

primary (input) coil which is connected to the high voltage mains supply, and a small number of turns on its secondary (output) coil to give a low output voltage.

$$\text{TURNS RATIO} = (V_p / V_s) = (N_p / N_s)$$

Where,

$V_p$  = primary (input) voltage.

$V_s$  = secondary (output) voltage

$N_p$  = number of turns on primary coil

$N_s$  = number of turns on secondary coil

$I_p$  = primary (input) current

$I_s$  = secondary (output) current.

Principle: -

Transformer works on the principle of mutual induction. A transformer consists of laminated magnetic core forming the magnetic frame. Primary and secondary coils are wound upon the two cores of the magnetic frame, linked by the common magnetic flux. When an alternating voltage is applied across the primary coil, a current flows in the primary coil producing magnetic flux in the transformer core. This flux induces voltage in secondary coil.

Transformers are classified as: -

A/c to transformation ratio:

- Step up transformer
- Step down transformer

Diodes

It is a two terminal device consisting of a P-N junction formed either of Ge or Si crystal. The P and N type regions are referred to as anode and cathode respectively. Commercially available diodes usually have some means to indicate which lead is P and which lead is N.

Relay

In this circuit a 12V magnetic relay is used. In magnetic relay, insulated copper wire coil is used to magnetize and attract the plunger. The plunger is normally connected to N/C terminal. A spring is connected to attract the plunger upper side. When output is received by relay, the plunger is attracted and the bulb glows.

### Push Buttons

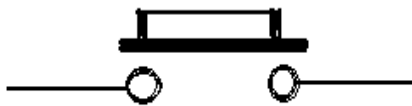


A push-button (also spelled pushbutton) or simply button is a simple switch mechanism for controlling some aspect of a machine or a process. Buttons are typically made out of hard material, usually plastic or metal. Buttons are most often biased switches, though even many un-biased buttons (due to their physical nature) require a spring to return to their un-pushed state. Different people use different terms for the "pushing" of the button, such as press, depress, mash, and punch.

In industrial and commercial applications push buttons can be linked together by a mechanical linkage so that the act of pushing one button causes the other button to be released. In this way, a stop button can "force" a start button to be released.

Pushbuttons are often color-coded to associate them with their function so that the operator will not push the wrong button in error. Commonly used colors are red for stopping the machine or process and green for starting the machine or process.

Red pushbuttons can also have large heads (mushroom shaped) for easy operation and to facilitate the stopping of a machine. These pushbuttons are called emergency stop buttons and are mandated by the electrical code in many jurisdictions for increased safety.

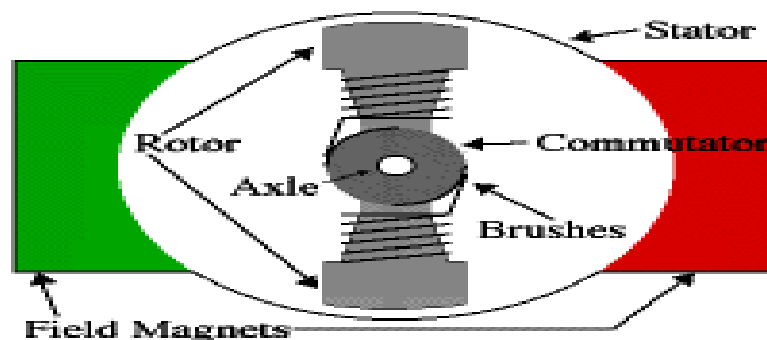


push on button

Initially the two contacts of the button are open. When the button is pressed they become connected. This makes the switching operation using the push button.

### DC MOTOR

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. where opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.



Every DC motor has six basic parts -- axle, rotor (a.k.a., armature), stator, commutator, field magnet(s), and brushes. In most common DC motors, the external magnetic field is produced by high-strength permanent magnets<sup>1</sup>. The stator is the stationary part of the motor -- this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotor rotates with respect to the stator. The rotor consists of windings (generally on a core), the windings being electrically connected to the commutator.

#### PCB (Printed Circuit Boards)

The PCB provides an ideal baseboard upon which to assemble and hold firmly most of the small components. From the constructor's point of view, the main attraction of using PCB is its role as the mechanical support for small components. Most straight forward circuit designs can be easily converted in to printed wiring layer the thought required to carry out the inversion cab footed high light an possible error that would otherwise be missed in conventional point to point wiring .The finished project is usually neater and truly a work of art.

### DESIGN SPECIFICATION

#### COMPONENT ASSEMBLY

From the greatest variety of electronic components available, which runs into thousands of different types it is often a perplexing task to know which is right for a given job.

The most popular method of holding all the items is to bring the wires far apart after they have been inserted in the appropriate holes. This will hold the component in position ready for soldering.

It is best to start mounting the smallest first and progressing through to the largest components.

#### SOLDERING

This is the operation of joining the components with PCB after this operation the circuit will be ready to use to avoid any damage or fault during this operation following care must be taken.

#### POWER SUPPLY UNIT

As we all know any invention of latest technology cannot be activated without the source of power. So it this fast moving world we deliberately need a proper power source which will be apt for a particular requirement. All the electronic components starting from diode to Intel IC's only work with a DC supply ranging from  $-+5v$  to  $-+12v$ . We are utilizing for the same, the cheapest and commonly available energy source of 230v-50Hz and stepping down, rectifying, filtering and regulating the voltage. This will be dealt briefly in the forth-coming sections.

When AC is applied to the primary winding of the power transformer it is stepped down and 230V AC appears as 15V AC across the secondary winding.

The current rating of the transformer used in our project is 1A.

### RECTIFIERER

In the power supply unit, rectification is normally achieved using a solid state diode. As AC is applied to the diode, electrons only flow when the anode and cathode is negative. Reversing the polarity of voltage will not permit electron flow.

A commonly used circuit for supplying large amounts of DC power is the bridge rectifier. A bridge rectifier of four diodes (4\*IN4007) are used to achieve full wave rectification. Two diodes will conduct during the negative cycle and the other two will conduct during the positive half cycle. The DC voltage appearing across the output

terminals of the bridge rectifier will be somewhat less than 90% of the applied rms value. Normally one alteration of the input voltage will reverse the polarities.

#### FILTER

Filter circuits which are usually capacitors acting as a surge arrester always follow the rectifier unit. This capacitor is also called as a decoupling capacitor or a bypassing capacitor, is used not only to 'short' the ripple with frequency of 120Hz to ground but also to leave the frequency of the DC to appear at the output. A load resistor R1 is connected so that a reference to the ground is maintained. C1R1 is for bypassing ripples. C2R2 is used as a low pass filter, i.e. it passes only low frequency signals and bypasses high frequency signals. The load resistor should be 1% to 2.5% of the load.

#### VOLTAGE REGULATORS 7805 & 7807

The voltage regulators play an important role in any power supply unit. The primary purpose of a regulator is to aid the rectifier and filter circuit in providing a constant DC voltage to the device. With a regulator connected to the DC output, the voltage can be maintained within a close tolerant region of the desired output. IC7805 and 7905 is used in this project for providing +5v and -5v DC supply.

Specifications:

Resistors R1 and R2 maintain line load regulation.

At the secondary side of the transformer,

Applied voltage = 12v

Conducting drop across the diodes =  $2 * 0.6 = 1.2v$ .

Features

- Output Current up to 1A
- Output Voltages of 5, 6, 8, 9, 10, 12, 15, 18, 24V
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area Protection

. Each regulator type employs internal current limiting, thermal shutdown and safe operating area protection, making it essentially indestructible

#### 8051 MICROCONTROLLER UNIT

A microcontroller is an economical computer-on-a-chip built for dealing with specific tasks, such as displaying or receiving information through LEDs or remote controlled devices. The most commonly used set of microcontrollers belong to 8051 Family. 8051 Microcontrollers continue to remain a preferred choice for a vast community of hobbyists and professionals.

Through 8051, the world became witness to the most revolutionary set of microcontrollers.



8051 Family

Intel fabricated the original 8051 which is known as MCS-51. The other two members of the 8051 family are 8052 and 8031.

Comparison of 8051 family members:

Features	8051	8052	8031
RAM(bytes)	128	256	128
ROM	4K	8K	0K
Timers	2	3	2
Serial port	1	1	1
I/O pins	32	32	32
Interrupt sources	6	8	6

The Intel 8051 microcontroller is one of the most popular general purpose microcontrollers in use today.

The Intel 8051 is an 8-bit microcontroller which means that most available operations are limited to 8 bits. There are 3 basic "sizes" of the 8051: Short, Standard, and Extended. The Short and Standard chips are often available in DIP (dual in-line package) form, but the Extended 8051 models often have a different form factor, and are not "drop-in compatible". All these things are called 8051 because they can all be programmed using 8051 assembly language, and they all share certain features (although the different models all have their own special features).

Some of the features that have made the 8051 popular are:

4 KB on chip program memory

128 bytes on chip data memory(RAM)

4 reg banks

128 user defined software flags

8-bit data bus

16-bit address bus

32 general purpose registers each of 8 bits

16 bit timers (usually 2, but may have more, or less)

3 internal and 2 external interrupts

Bit as well as byte addressable RAM area of 16 bytes

Four 8-bit ports, (short models have two 8-bit ports)

16-bit program counter and data pointer

1 Microsecond instruction cycle with 12 MHz Crystal

Typical applications

8051 chips are used in a wide variety of control systems, telecom applications, robotics as well as in the automotive industry. By some estimations, 8051 family chips make up over 50% of the embedded chip market.



Pin diagram of the 8051 DIP

Basic Pins

**PIN 9:** PIN 9 is the reset pin which is used to reset the microcontroller’s internal registers and ports upon starting up. (it is high for 2 machine cycles.)

**PINS 18 & 19:** The 8051 has a built-in oscillator amplifier hence we need to only connect a crystal at these pins to provide clock pulses to the circuit.

**PIN 40 and 20:** Pins 40 and 20 are VCC and ground respectively. The 8051 chip needs +5V 500mA to function properly.

**PINS 29, 30 & 31:** 8051 contains a built-in flash memory. In order to program this we need to supply a voltage of +12V at pin 31. If external memory is connected then

PIN 31 is called EA/VPP, should be connected to ground to indicate the presence of external memory.

PIN 30 is called ALE (address latch enable), which is used when multiple memory chips are connected to the controller and only one of them needs to be selected. We will deal with this in depth in the later chapters.

PIN 29 is called PSEN. This is "program store enable". In order to use the external memory it is required to provide the low voltage (0) on both PSEN and EA pins.

### Ports

There are 4 8-bit ports:

**PORT P1 (Pins 1 to 8):** The port P1 is a general purpose input/output port which can be used for a variety of interfacing tasks. The other ports P0, P2 and P3 have dual roles or additional functions associated with them based upon the context of their usage. The port 1 output buffers can sink/source four TTL inputs.

When 1s are written to portn1 pins are pulled high by the internal pull-ups and can be used as inputs.

**PORT P3 (Pins 10 to 17):** PORT P3 acts as a normal IO port, but Port P3 has additional functions such as, serial transmit and receive pins, 2 external interrupt pins, 2 external counter inputs, read and write pins for memory access.

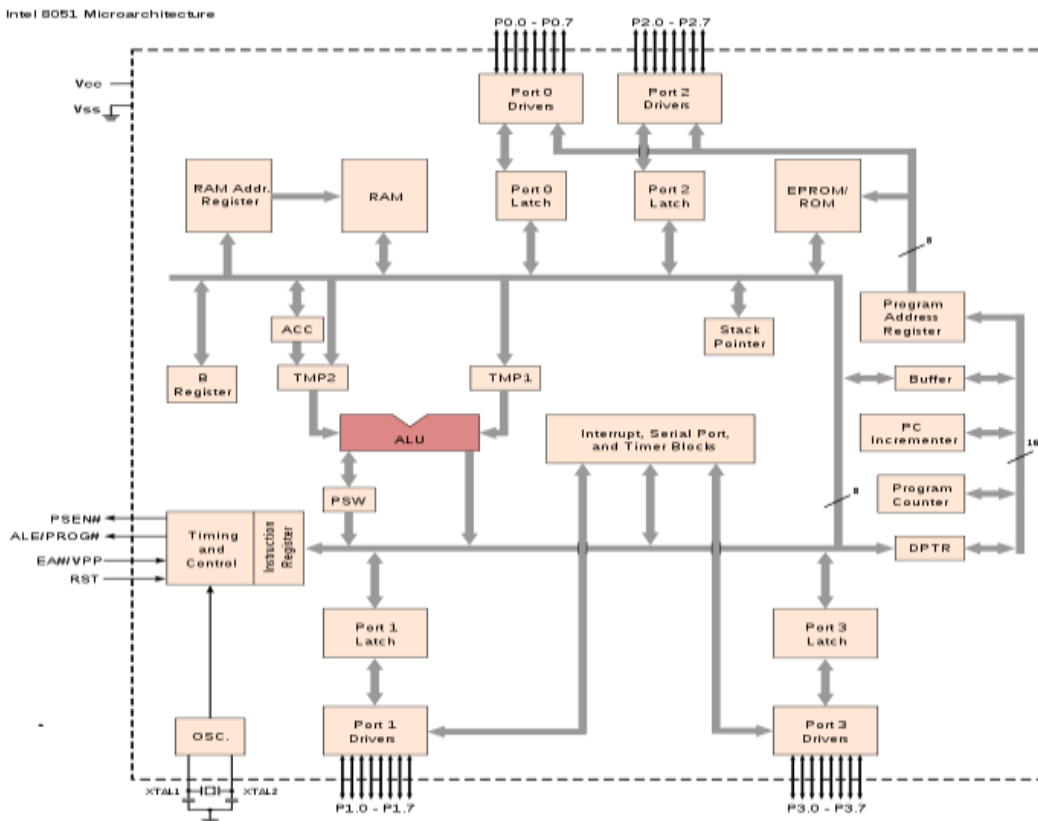
**PORT P2 (pins 21 to 28):** PORT P2 can also be used as a general purpose 8 bit port when no external memory is present, but if external memory access is required then PORT P2 will act as an address bus in conjunction with PORT P0 to access external memory.

**PORT P0 (pins 32 to 39)** PORT P0 can be used as a general purpose 8 bit port when no external memory is present, but if external memory access is required then PORT P0 acts as a multiplexed address and data bus that can be used to access external memory in conjunction with PORT P2.

### OSCILLATOR CIRCUITS

The 8051 requires an external oscillator circuit. The oscillator circuit usually runs around 12MHz, although the 8051 (depending on which specific model) is capable of running at a maximum of 40MHz. Each machine cycle in the 8051 is 12 clock cycles, giving an effective cycle rate at 1MHz (for a 12MHz clock) to 3.33MHz (for the maximum 40MHz clock). The oscillator circuit generates the clock pulses so that all internal operations are synchronized.

### INTERNAL ARCHITECTURE



## DATA AND PROGRAM MEMORY

The 8051 Microcontroller can be programmed in PL/M, 8051 Assembly, C and a number of other high-level languages. Many compilers even have support for compiling C++ for an 8051.

Program memory in the 8051 is read-only, while the data memory is considered to be read/write accessible. When stored on EEPROM or Flash, the program memory can be rewritten when the microcontroller is in the special programmer circuit.

### Program Start Address

The 8051 starts executing program instructions from address 0000 in the program memory. The A register is located in the SFR memory location 0xE0. The A register works in a similar fashion to the AX register of x86 processors. The A register is called the accumulator, and by default it receives the result of all arithmetic operations.

### Special Function Register

The **Special Function Register** (SFR) is the upper area of addressable memory, from address 0x80 to 0xFF. A, B, PSW, DPTR are called SFR. All port input and output can therefore be performed by memory **mov** operations on specified addresses in the SFR. Also, different status registers are mapped into the SFR, for use in checking the status of the 8051, and changing some operational parameters of the 8051.

## GENERAL PURPOSE REGISTERS

The 8051 has 4 selectable banks of 8 addressable 8-bit registers, R0 to R7. This means that there are essentially 32 available general purpose registers, although only 8 (one bank) can be directly accessed at a time. To access the other banks, we need to change the current bank number in the flag status register.

### MAX232



The MAX232 is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals.

The drivers provide RS-232 voltage level outputs (approx.  $\pm 7.5$  V) from a single +5 V supply via on-chip charge pumps and external capacitors. This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to +5 V range, as power supply design does not need to be made more complicated just for driving the RS-232 in this case.

It is helpful to understand what occurs to the voltage levels. When a MAX232 IC receives a TTL level to convert, it changes a TTL Logic 0 to between +3 and +15V, and changes TTL Logic 1 to between -3 to -15V, and vice versa for converting from RS232 to TTL.

## LCD (LIQUID CRYSTAL DISPLAY)

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

## GPS (GLOBAL POSITIONING SYSTEM) MODEM



The **Global Positioning System (GPS)** is a space-based satellite navigation system that provides location and time information in all weather, anywhere on or near the Earth, where there is an unobstructed line of sight to four or more GPS satellites.

When people talk about "a GPS," they usually mean a GPS receiver. A GPS receiver's job is to locate the vehicle/person location in term of longitude and latitude. , within an accuracy of 10 to 100 meters

Global Positioning System was developed by the United States' Department of Defense. It uses between 24 and 32 Medium Earth Orbit satellites that transmit precise microwave signals. This enables GPS receivers to determine their current location, time and velocity. The GPS satellites are maintained by the United States Air Force.

### APPLICATIONS

GPS has become a widely deployed and useful tool for commerce, scientific uses,

tracking, and surveillance. GPS's accurate time facilitates everyday activities such as banking, mobile phone operations, and even the control of power grids by allowing well synchronized hand-off switching.

Civilian applications of GPS include:

1. absolute location and timing capabilities
2. Geofencing: relative movement, tracking system for vehicle, pet and person
3. gps tour ,map making ,navigation ,robotics and

Military applications of GPS include:

1. Navigation: GPS allows soldiers to find objectives, even in the dark or in unfamiliar territory, and to coordinate troop and supply movement
2. Target tracking Missile and projectile guidance
3. Search and Rescue: Downed pilots can be located faster if their position is known.
4. Patrol movement can be managed more closely.
5. Communication

### GPS SIGNALS

The navigational signals transmitted by GPS satellites encode a variety of information including satellite positions, the state of the internal clocks, and the health of the network. These signals are transmitted on two separate carrier frequencies that are common to all satellites in the network. Two different encodings are used: a public encoding that enables lower resolution navigation, and an encrypted encoding used by the U.S. military.

### GSM MODEM



GSM (Global System for Mobile Communications, originally Groupe Spécial Mobile), is a standard set developed by the European Telecommunications Standards Institute (ETSI) to describe technologies for second generation (2G) digital cellular networks. Developed as a replacement for first generation (1G) analog cellular networks, the GSM standard originally described a digital, circuit switched network optimized for full duplex voice telephony. The standard was expanded over time to include first circuit switched data transport, then packet data transport via GPRS (General Packet Radio Services). Packet data transmission speeds were later increased via EDGE (Enhanced Data rates for GSM Evolution) referred as EGPRS. The GSM standard is more improved after the development of third generation (3G) UMTS standard developed by the 3GPP.

A GSM 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.

A GSM modem exposes an interface that allows applications such as NowSMS to send and receive messages over the modem interface. The set of sending/receiving SMS messages, as defined in the ETSI GSM 07.05 and 3GPP TS 27.005 specifications.

A GSM modem could also be a standard GSM mobile phone with the appropriate cable and software driver to connect to a serial port or USB port on your computer. Any phone that supports the “extended AT command set” for sending/receiving SMS messages, as defined in ETSI GSM 07.05 and/or 3GPP TS 27.005, can be supported by the Now SMS & MMS Gateway. Note that not all mobile phones support this modem interface.

GSM uses General Packet Radio Service (GPRS) for data transmissions like browsing the web. The most commonly deployed GPRS ciphers were publicly broken in 2011, and the evidence indicates that they were once again intentionally left weak by the mobile industry designers.

GSM is a cellular network, which means that cell phones connect to it by searching for cells in the immediate vicinity. There are five different cell sizes in a GSM network—macro, micro, pico, femto and umbrella cells. The coverage area of each cell varies according to the implementation environment.

1. Macro cells can be regarded as cells where the base station antenna is installed on a mast or a building above average roof top level.
2. Micro cells are cells whose antenna height is under average roof top level; they are typically used in urban areas.
3. Picocells are small cells whose coverage diameter is a few dozen metres; they are mainly used indoors.
4. Femtocells are cells designed for use in residential or small business environments and connect to the service provider's network via a broadband internet connection.
5. Umbrella cells are used to cover shadowed regions of smaller cells and fill in gaps in coverage between those cells.

Cell horizontal radius varies depending on antenna height, antenna gain and propagation conditions from a couple of hundred metres to several tens of kilometres. The longest distance the GSM specification supports in practical use is 35 kilometres (22 mi).

#### GSM carrier frequencies bands

GSM networks operate in a number of different carrier frequency ranges (separated into GSM frequency ranges for 2G and UMTS frequency bands for 3G), with most 2G GSM networks operating in the 900 MHz or 1800 MHz bands.

Where these bands were already allocated, the 850 MHz and 1900 MHz bands were used instead (for example in Canada and the United States).

In rare cases the 400 and 450 MHz frequency bands are assigned in some countries because they were previously used for first-generation systems.

Most 3G networks in Europe operate in the 2100 MHz frequency band.

. The channel data rate for all 8 channels is 270.833 kbit/s, and the frame duration is 4.615 ms.

The transmission power in the handset is limited to a maximum of 2 watts in GSM850/900 and 1 watt in GSM1800/1900.

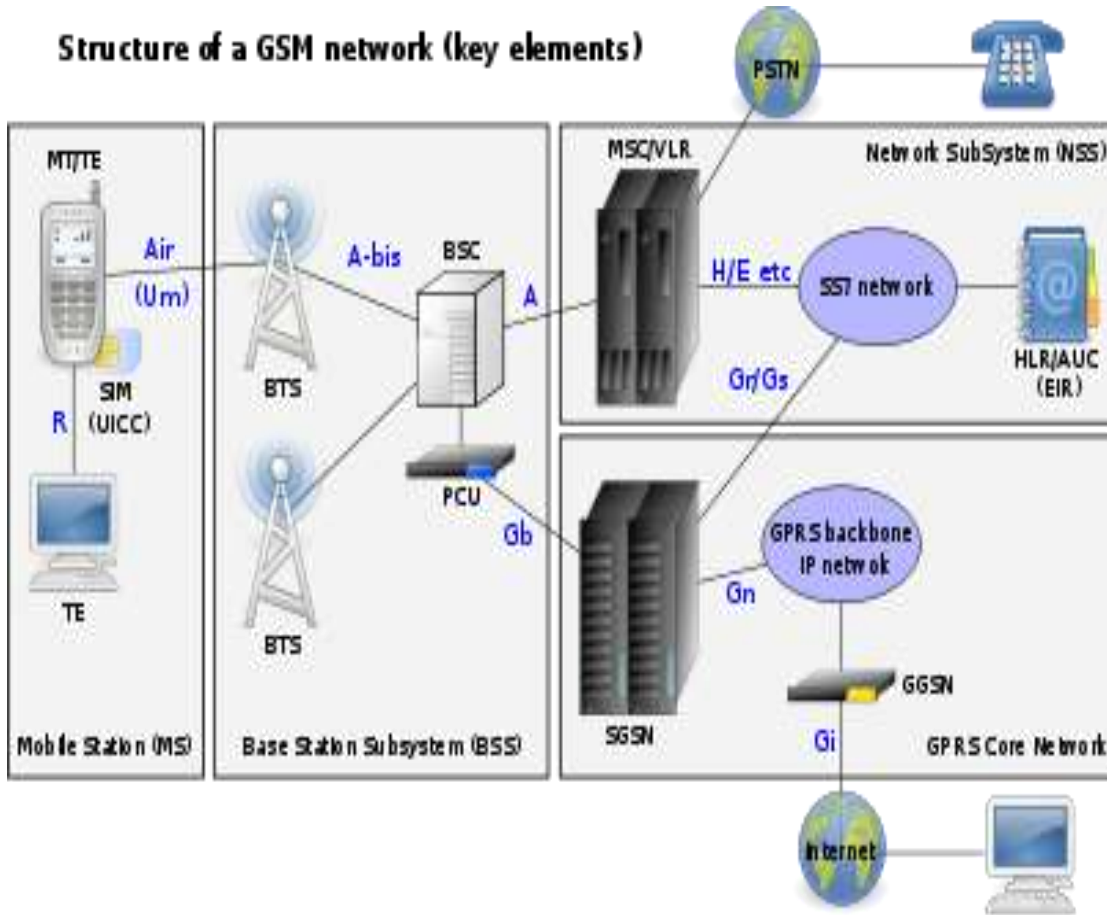
The modulation used in GSM is Gaussian minimum-shift keying (GMSK), a kind of continuous-phase frequency shift keying. In GMSK, the signal to be modulated onto the carrier is first smoothed with a Gaussian low-pass filter prior to being fed to a frequency modulator, which greatly reduces the interference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

#### VOICE CODECS

GSM has used a variety of voice codecs to squeeze 3.1 kHz audio into between 6.5 and 13 kbit/s. Originally, two codecs, named after the types of data channel they were allocated were used, called Half Rate (6.5 kbit/s) and Full Rate (13 kbit/s)..

**NETWORK STRUCTURE**

**Structure of a GSM network (key elements)**



The network is structured into a number of discrete sections:

- 1.The Base Station Subsystem (the base stations and their controllers).
- 2.The Network and Switching Subsystem (the part of the network most similar to a fixed network). This is sometimes also just called the core network.
- 3.The GPRS Core Network (the optional part which allows packet based Internet connections).
- 4.The Operations support system (OSS) for maintenance of the network.

**SUBSCRIBER IDENTITY MODULE (SIM)**

One of the key features of GSM is the Subscriber Identity Module, commonly known as a **SIM card**. The SIM is a detachable smart card containing the user's subscription information and phone book. This allows the user to retain his or her information after switching handsets. Alternatively, the user can also change operators while retaining the handset simply by changing the SIM. Some operators will block this by allowing the phone to use only a single SIM, or only a SIM issued by them; this practice is known as SIM locking.

## GSM SERVICE SECURITY

GSM was designed with a moderate level of service security. Communications between the subscriber and the base station can be encrypted.

The development of UMTS introduces an optional Universal Subscriber Identity Module (USIM), that uses a longer authentication key to give greater security, as well as mutually authenticating the network and the user, whereas GSM only authenticates the user to the network (and not vice versa).

## OPERATION



This system involves different units, which have specific work to make a smart vehicle security system.

When owner wants to monitor/track their cars, they send a predefined message to this smart vehicle security system then after receiving a msg, gps find the location and transmit this info in term of geographical distance (longitude latitude) to the gsm module. This gsm module send this data to the owner. Now using this google maps they can estimate the location of vehicle.

The solution includes hardware, software and a complete set of procedures in numerous languages, based on the long and extensive experience of Starcom.

The full cellular (GSM/ CDMA) and location (GPS) system solution allows worldwide real-time tracking via web based user friendly application, that can be easily implemented anywhere around the world, in any language (includes certifications from all the leading standards).

Other applications include monitoring driving behavior, such as an employer of an employee, or a parent with a teen driver.

Some vehicle tracking systems integrate several security systems, for example by sending an automatic alert to a phone or email if an alarm is triggered or the vehicle is moved without authorization, or when it leaves or enters a geofence.

## PROGRAM AND CODING

```
#include<reg52.h>
#include<lcd.h>
#include<ser.h>
#include <string.h>
#include<stdio.h>
sbit sw=P3^2;
sbit relay=P1^0;
sbit mot=P1^1;
void gps();
```

```
void gsm(unsigned char *str);
void gsm_call();
void gsm_read();
void del();
unsigned char d,dat[60],daat[15];
bit run=0,run1=0;
void main()
{
  lcd_init();
  lcd_str("OK");
  ser_init_gsm();//initialise ser comm with gsm modem
  ser_str("AT+CMGF=1\r");//cmd for msg format (1=text mode)
  MSDelay(500);
  ser_str("AT+CPMS=\"SM\r");//cmd for preferred msg storage(SM=sim memory)
  MSDelay(500);
  ser_str("AT+CMGD=1\r");//cmd for msg delete 1st msg
  relay=0;
  MSDelay(500);while (RI){RI=0;MSDelay(500);}

while(1)
  {
    lcd_cmd(0x01);
    lcd_str("Waiting.....");
    if(run || run1)
      {
        lcd_cmd(0x01);
        if(run){lcd_str("SENDING LOCATION");run=0;}
        relay=1;
        ser_init_gps();
        for(d=0;d<200;d++)del();
        gps();
        for(d=0;d<200;d++)del();
        relay=0;
      }

gsm("9040643401");

for(d=0;d<200;d++)del();
  RI=0;
  lcd_cmd(0x01);
  lcd_str("Message sent");
  if(run1)
    {
      lcd_str("calling");
      gsm_call();
      run1=0;
    }
}
```



```
//while
    if(dat[14]=='A')
    {
        lcd_init();
        lcd_str("      ");
        lcd_cmd(0x80);
        lcd_str("LAT:");lcd_dat(dat[16]);lcd_dat(dat[17]);lcd_dat(223);lcd_dat(dat[18]);lcd_dat(dat[19]);lcd_d
at(dat[20]);lcd_dat(dat[21]);lcd_dat(dat[22]);lcd_str("min");
        lcd_cmd(0xc0);
        lcd_str("      ");lcd_cmd(0xc0);
        lcd_str("LOG:");lcd_dat(dat[29]);lcd_dat(dat[30]);lcd_dat(223);lcd_dat(dat[31]);lcd_dat(dat[32]);lcd_d
at(dat[33]);lcd_dat(dat[34]);lcd_dat(dat[35]);lcd_str("min");
    }
    else if(dat[14]=='V')
    {
        lcd_cmd(0x80);
        lcd_str("NO SIGNAL ");
    }
}
void gsm(unsigned char *strr)
{
    ser_init_gsm();
    ser_str("AT+CMGS=\"");
    ser_str(strr);
    ser_str("\r");
    MSDelay(10);
    if (run1)
    ser_str("I am in danger. Plz cal me.My position is at ");
    ser_str("LAT:");
    ser_dat(dat[16]);
    ser_dat(dat[17]);
    ser_dat(223);
    ser_dat(dat[18]);
    ser_dat(dat[19]);
    ser_dat(dat[20]);
    ser_dat(dat[21]);
    ser_dat(dat[22]);
    ser_str("min\r");
    ser_str("LOG:");

    ser_dat(dat[29]);
    ser_dat(dat[30]);
    ser_dat(223);
    ser_dat(dat[31]);
    ser_dat(dat[32]);
    ser_dat(dat[33]);
```

```
ser_dat(dat[34]);
ser_dat(dat[35]);
ser_str("min\n\r");
ser_str("rpm");

ser_dat(0x1a);
MSDelay(1000);
RI=0;
ser_str("AT+CMGS=\"7873927750\r");
MSDelay(10);
if (run1)
ser_str("I am in danger. Plz cal me. My position is at ");
ser_str("LAT:");
ser_dat(dat[16]);
ser_dat(dat[17]);
ser_dat(223);
ser_dat(dat[18]);
ser_dat(dat[19]);
ser_dat(dat[20]);
ser_dat(dat[21]);
ser_dat(dat[22]);
ser_str("min\n\r");
ser_str("LOG:");
ser_dat(dat[29]);
ser_dat(dat[30]);
ser_dat(223);
ser_dat(dat[31]);
ser_dat(dat[32]);
ser_dat(dat[33]);
ser_dat(dat[34]);
ser_dat(dat[35]);
ser_str("min\n\r");
ser_str("rpm");
ser_dat(0x1a);
MSDelay(1000);
RI=0;

}
void del()
{
unsigned int j;
for (j=0;j<5000;j++);
}

void gsm_call()
{
ser_init_gsm();
```

```
lcd_cmd(0x01);
lcd_str("Calling...");
ser_str("ATD+919040643401;");//cmd for msg send
ser_str("");
ser_str("\n\r");
MSDelay(1000);
RI=0;
}
void gsm_read()
{
unsigned char i=0;
lcd_cmd(0x01);
lcd_str("READING.....");
ser_str("AT+CMGR=1\r");
while(SBUF!='#'){while(RI==0);RI=0;}//dat[i++]=SBUF;}
for(i=0;daat[i-1]!='#';i++)
    {while(RI==0);RI=0;daat[i]=SBUF;}
ser_str("AT+CMGD=1\r");
lcd_cmd(0x01);
lcd_str(daat);
if(strstr(daat,"STATUS"))
    run=1;
else if (strstr(daat,"START"))
    {mot=1;lcd_cmd(0x01);lcd_str("Motor Started");}
else if (strstr(daat,"STOP"))
    {mot=0;lcd_cmd(0x01);lcd_str("Motor Stopped");}
lcd_cmd(0xc0);
lcd_str("RECEIVED");
MSDelay(1000);
RI=0;
}
```

#### Results:

- 1.Input :#STATUS# ,OUTPUT: LAT:2017.67 MIN  
LOG:8549.97 MIN
- 2.INPUT: #STOP# ,OUTPUT: STOP MOTOR
3. INPUT: #START# ,OUTPUT: START MOTOR

4.If press the emergency key then two messages(I am in danger.plz call me.my position is at LAT:2017.67 LOG:8549.97 MIN) will sent to the owners or nearer police station.A automatic call wii also generate to the first owner.

#### BENIFITS

- Information on fleet location
- Vehicle Fuel consumption and any pilferage's
- Increase daily trips and minimizes costs

- Maximizes dispatch and transport desk efficiency
- Increase operational efficiency and reliability
- Record the distance traveled by the vehicles
- Instantly communicate via Voice and SMS
- Provide efficient service with improved response times
- Maximize vehicle efficiency
- Improved routing, service operations

Other scenarios in which this technology is employed include:

**Stolen vehicle recovery:** Both consumer and commercial vehicles can be outfitted with RF or GPS units to allow police to do tracking and recovery.

**Fleet management:** When managing a fleet of vehicles, knowing the real-time location of all drivers allows management to meet customer needs more efficiently. Whether it is delivery, service or other multi-vehicle enterprises and drivers now only need a mobile phone with telephony or Internet connection to be inexpensively tracked by and dispatched efficiently.

**Asset tracking:** Companies needing to track valuable assets for insurance or other monitoring purposes can now plot the real-time asset location on a map and closely monitor movement and operating status.

**Field service management:** Companies with a field service workforce for services such as repair or maintenance, must be able to plan field workers' time, schedule subsequent customer visits and be able to operate these departments efficiently. Vehicle tracking allows companies to quickly locate a field engineer and dispatch the closest one to meet a new customer request or provide site arrival information.

**Field sales:** Mobile sales professionals can access real-time locations. For example, in unfamiliar areas, they can locate themselves as well as customers and prospects,

get driving directions and add nearby last-minute appointments to itineraries. Benefits include increased productivity, reduced driving time and increased time spent with customers and prospects.

**Trailer tracking:** Haulage and Logistics companies often operate lorries with detachable load carrying units. The part of the vehicle that drives the load is known as the cab and the load carrying unit is known as the trailer. There are different types of trailer used for different applications, e.g., flat bed, refrigerated, curtain sider, box container.

**Surveillance:** A tracker may be placed on a vehicle to follow the vehicle's movements.

**Transit tracking:** This is the temporary tracking of assets or cargoes from one point to another. Users will ensure that the assets do not stop on route or do a U-Turn in order to ensure the security of the assets.

Industries not traditionally known to use vehicle tracking systems (logistics and transportation industries are the ones that have traditionally incorporated vehicle tracking system into their operations) have started to use it in creative ways to improve their processes or businesses.

Vehicle tracking systems have also been used in food delivery

Starcom System designed for tracking vehicle fleets, equipment, people, containers, and merchandise. Starcom develops, manufactures, and establishes a combined cellular/GPS tracking systems for fleet management, protecting the vehicle and driver, and locating equipment and people.

## ECONOMIC CONSIDERATIONS

Smart Vehicle security systems are also popular in consumer vehicles as a theft prevention and retrieval device. Police can simply follow the signal emitted by the tracking system and locate the stolen vehicle. This makes it possible to control the vehicle remotely to start or stop the vehicle engine, in case of an emergency, the vehicle driver has an option to call and send messages to their owners or nearer police station. The existence of a vehicle tracking device then can be used to reduce the insurance cost, because the loss-risk of the vehicle drops significantly.

An smart security vehicle system would involve extensive technology in areas where the U.S. has a lead such as computers, networks, software, and aircraft-type systems. If the U.S. took a lead role in developing vehicle automation technology and associated standards, procedures, techniques, and regulations it could be expected to lead the world in vehicle automation in a manner similar to the experience with aviation.

A smart vehicle security system can come at price ranges from ₹ 1000 to ₹3000.

## FUTURE SCOPE

Vehicle tracking systems are an integrated part of the "layered approach" to vehicle protection, recommended by the National Insurance Crime Bureau (NICB) to prevent motor vehicle theft.

The hospitality industry has caught on to this technology to improve customer service. For example, a luxury hotel in Singapore has installed vehicle tracking systems in their limousines to ensure they can welcome their VIPs when they reach the hotel.

The American Public Transportation Association estimated that, at the end of 2015, about all transit buses in the United States were already using a GPS-based vehicle tracking system to trigger automated stop announcements.

In the future, this system can be used as an accident proof system, and one step forward

Ford Motor Company demoed a crash warning system that utilizes Wi-Fi technology to detect potential collisions and then notify the driver with a series of beeping noises and flashing red lights.

While some cars are installed with radar systems that can sense a troubling situation directly ahead, the smart car system goes a step further by pinpointing an incoming hazard in all directions and more than 900 feet away, thanks to multi-directional Wi-Fi signals that send out a car's location, cruising speed and brake status.

Ford Technical Expert Farid Ahmed-Zaid and Joe Stinnett showed us some of the moves. First, Forward Collision Warning: "Keep an eye on the vehicle ahead. We're going to drive towards it. Hang on!" says Stinnett as we race toward an Explorer that has just slammed on its brakes.

Wi-Fi has already sensed the third car as a slower moving object, and begins warning us even before the second car swerves away.

Peter Appel, an administrator of the Research and Innovative Technology Administration at the U.S. Department of Transportation, told the Washington Post in an article that the technology can potentially save "a lot of lives."

The article cited a report by the National Highway Traffic Safety Administration suggesting that the system can save lives in roughly "80 percent of reported crashes that do not involve drunk drivers."

Perhaps the toughest hurdle is the complex task of getting the major automakers to talk to each other first in order to hash out a universal standard for how such a system would work. One major incentive is the relative low cost of implementing the technology. It is estimated that adopting the system would cost manufacturers an extra 100 dollars per vehicle.

## SCOPE IN INDIA

Smart Vehicle security system has never been easier throughout India. GPS based this Systems combines the power of GPS with our State of the Art Geographic Information System (GIS), provides the ability to track and monitor the vehicles of the companies and individuals alike. With our Web Based GIS you can monitor your whole fleet from any computer and from anywhere in the world and at time instantly. Installing it offers protection of vehicles from theft and also the ability monitor the current location to keep clients informed of delivery status of goods.

Many businesses across India are using our tracking system and experience:

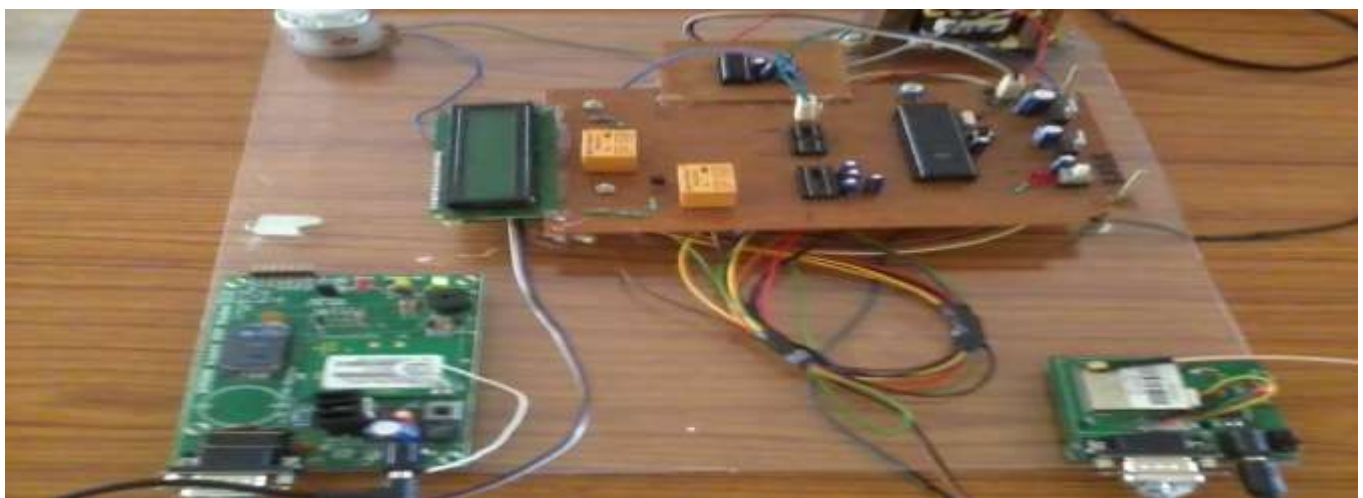
- Better utilization of fleet
- Elimination of unnecessary third-party hire
- Lower fuel costs
- More accurate positional information of vehicle
- Elimination of unauthorized vehicle use
- Safer driving techniques

With our new enhanced models, we continue our commitment to provide customers with the most effective way to save money and increase productivity every day. Our most popular benefits include Ease of Use, Single Screen Tracking, On demand Google Mapping, Panoramic Reporting and the list goes on.

This system with new enhanced technology can be used in various applications including School Bus tracking and Taxi Tracking. This system can give you specific information about the vehicle's current location within few seconds. It informs you about the vehicle's speed (you will be alerted if there is any speed violation) and about the various stops the vehicle makes. Very ideal for buse, it can provide real time information through SMS even to general public. Installing it in the School buses, the parents can query the location of their ward's buses through SMS. Geographic Information System (GIS)maps can be custom made for certain category of vehicles to make the Vehicle Tracking more effective and efficient.

## PICTURE OVERVIEW

### IN OFF CONDITION





IN ON/WORKING CONDITION

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