

# Location Tracking Using GPS through Micro-Controller

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**Abstract:** GSM and GPS based vehicle location and tracking system will provide effective, real time vehicle location, mapping and reporting this information value and adds by improving the level of service provided. A GPS-based vehicle tracking system will inform where your vehicle is and where it has been, how long it has been. The system uses geographic position and time information from the Global Positioning Satellites. Vehicle tracking systems are also popular in consumer vehicles as a theft prevention and retrieval device. Police can simply follow the signal emitted by the tracking system and locate the stolen vehicle. When used as a security system, a Vehicle Tracking System may serve as either an addition to or replacement for a traditional Car alarm. Some vehicle tracking systems make it possible to control vehicle remotely, including block doors or engine in case of emergency. The existence of vehicle tracking device that can be used to reduce cost.

**Keywords:** GPS, Micro Controller, GSM

## 1. Problem Statement

**Existing System:** In the previous system security lock and alarm is implemented in a car. If a burglar can break open the lock, then it becomes easy for the burglar to steal the car. And in old security system if the car is stolen then it is out of the owner control. By default user doesn't have any awareness about the current location of the vehicle. The Proposed System: The GPS tracker is attached with the vehicle which has its own identification. This data will be continuously transmitted to the user or the owner of the vehicle through GSM connected through the microcontroller. This GPS will be location the position of vehicle and transmit that data to the microcontroller. If the engine of the vehicle is turned on then it automatically sends location of the vehicle to its owner as a SMS through GSM modem. This will be a much simpler and low cost technique compared to others.

### Objectives

- To study GSM and GPS modules for tracking system.
- To study the skills of designing of PCB and fabricate the same.
- To design and simulate the system that can detect the position of vehicle.
- To test circuit using breadboard and troubleshoot the same.
- To generate a report of overall system.

## 2. Specification

### Specification of Power Supply:

**Voltage and current specifications:** The primary power supply specifications are the voltage and current output parameters. In terms of the voltage, the power supply may be fixed or it may have a variable output. It is necessary to check whether the power supply has a fixed or variable output. If the power supply has a fixed output there will be a small adjustment that can be made and it may be necessary to check that it can be adjusted to the required value if the voltage required is not exactly that quoted on the specification sheet. If the power supply as a variable range

then it is necessary to ensure that it covers the required range. In terms of the current it is necessary to ensure that the power supply will be able to provide the required level of current and have a degree of margin beyond that minimum requirement. When calculating the requirement for the power supply specification for current it is necessary to take account of what is termed the inrush current. This inrush current occurs when an item is turned on and a large surge of current is drawn to charge up capacitors, etc. This inrush current can be several times the ordinary operating current.

**Line regulation:** Power supply specifications detail figures for a parameter entitled "line regulation." It is found that when the line or input voltage changes then a small variation may be seen on the output. The line regulation figure details this change. The specification is normally quoted in millivolts for a given input variation. It may also be expressed or as a percentage of the output voltage and it should typically be a few millivolts (e.g. 5 mV) or around 0.01% of the maximum output voltage for most supplies for a change of line voltage anywhere within the operating range.

**Load regulation:** Another important power supply specification is called the "load regulation." It is found that when a load is added to the output of a power supply the voltage at the terminals can fall slightly. This is obviously not desirable because the output voltage should remain exactly constant in an ideal world. The power supply load variation is normally quoted as a in millivolts variation or as percentage of the maximum output voltage It might typically be a few millivolts (e.g. 5 mV) or 0.01% for a step load change from 0 to 100% load. It is normally quoted for a constant line voltage and at steady temperature.

**Ripple and noise:** The ripple and noise parameters are another important power supply specification. It is possible that noise and other impulses on the power line can be transferred to the output of the circuit that is being powered. In order to minimise this, especially for sensitive circuits it is necessary to ensure that the power lines are as clean as possible. The ripple and noise on the output is combined as a single specification. For linear supplies, ripple frequency is

normally be at twice the line frequency. For switching supplies ripple and spikes will arise from the switching action of the supply. The ripple components are often given as rms figures, but for switching supplies a peak- to-peak measurement is more useful because it shows the extent of the spikes arising from the switching. Most good supplies should offer noise and ripple figures of better than 10 mV rms and for switching supplies figures of 50mV or less should be achievable in many cases, although very high current supplies may have slightly higher values.

**Stability with time:** It is found that the output voltage of a power supply may change a small amount over a period of time. Although the amounts of change are normally small, they may be important in some applications. As a result figures for the voltage output stability with time are sometimes quoted within the overall power supply specifications. For the stability specification, the output voltage of the power supply will be measured over a period of time under constant load and input voltage and the voltage drift measured. Typically, this will be a few millivolts (e.g. five to ten) over a period of ten hours.

**Temperature stability:** The output voltage from any power supply will also change slightly as the ambient operating temperature changes. Again this can be important for some circuits that might be voltage dependent. As a result, figures are often given in the power supply specifications. The parameter is measured as a percentage or absolute voltage change per degree C. Typically, this might be in the region of 0.02% / degree C or 2 mV / degree C.

**Power supply specifications:** Although the power supply specifications mentioned above are generally the most widely used, others may also appear, and these may be important for some more specialised applications. In general, it is possible to interpret them, at least in general terms, and gain a good idea of the required operation of the power supply.

#### Specification of each block in the project:

The following lists of hardware are required for this system.

**GSM module-**GSM abbreviates global system for mobile communication; this is a second generation (2G) mobile network. This is widely used in all over the world for mobile communication. This GSM device consists of sim slot in which a sim slot in which a sim can be inserted which has a unique number is used for contact. This GSM device consists a unique number called imei number and this is different for each and every hardware kit. In our project the device is used for transmitting data. The data from GPS is transmitted to given mobile through this GSM itself.

**GPS module-** GPS abbreviates global positioning system and this is used to detect the latitude and longitude of the particular position and it also shows the exact time. It detects these values anywhere on the earth. In our project it plays main role and it is the main source of the latitude and longitude of the vehicle to know its exact location, or even for theft tracking of the vehicle. This gadget gets the coordinates from the satellite for each and every second. This device is the main component of vehicle tracking

project.

**Microcontroller ATMEGA328p-** The high-performance Microchip picoPower 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while- write capabilities, 1024B 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, a 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.

**Crystal oscillator -**The 16 MHz Crystal Oscillator module is designed to handle off- chip crystals that have a frequency of 4ñ16 MHz. The crystal oscillator's output is fed to the System PLL as the input reference. The oscillator design generates low frequency and phase jitter, which is recommended for USB operation. Specifications: 16MHz, Total capacitor load is 22 pF.

Power supply- +5V, -5V

Reset button

We have used softwares such as:

Multisim 12.0

Proteus 8.6

Arduino IDE

Eagle PCB

### 3. Proposed Methodology

**The Proposed System:** The GPS tracker is attached with the vehicle which has its own identification. This data will be continuously transmitted to the user or the owner of the vehicle through GSM connected through the microcontroller. This GPS will be location the position of vehicle and transmit that data to the microcontroller. If the engine of the vehicle is turned on then it automatically sends location of the vehicle to its owner as a SMS through GSM modem. This will be a much simpler and low cost technique compared to others.

#### Block Diagram Explanation:

When the burglar tries to steal the vehicle, the microcontroller senses the change in the database of the vehicle. GPS tracker is used to locate the current position of the vehicle, then it sends the link of the location to GSM module via controller. Then through GPS module the current location of the vehicle is been send to the user / owner through GSM module to which the owner's cellphone number is provided. In this way the user gets aware of the vehicle been chased away and he gets the exact location of the vehicle so he could track the vehicle too. Therefore this is a better and a secure way where the owner can track his vehicle wherever it may be present.

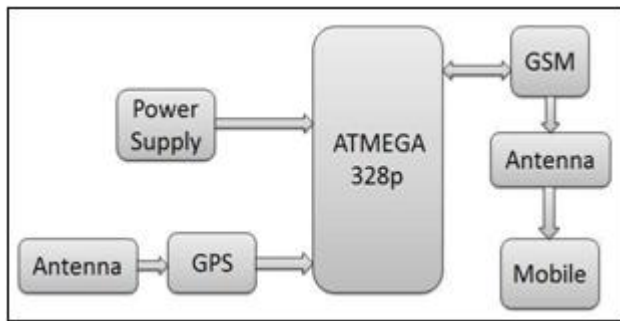


Figure: Block diagram of vehicle location tracking

#### 4. Design and Implementation

Design of power supply

Design Calculation of power supply:

Component List :

Step down transformer

Voltage regulator

Capacitors

Diodes

Voltage regulator: As we require a 5V we need LM7805

Voltage Regulator IC.

7805 IC Rating:

Input voltage range 7V- 35V

Current rating  $I_c = 1A$

Output voltage range  $V_{Max}=5.2V$ ,  $V_{Min}=4.8V$

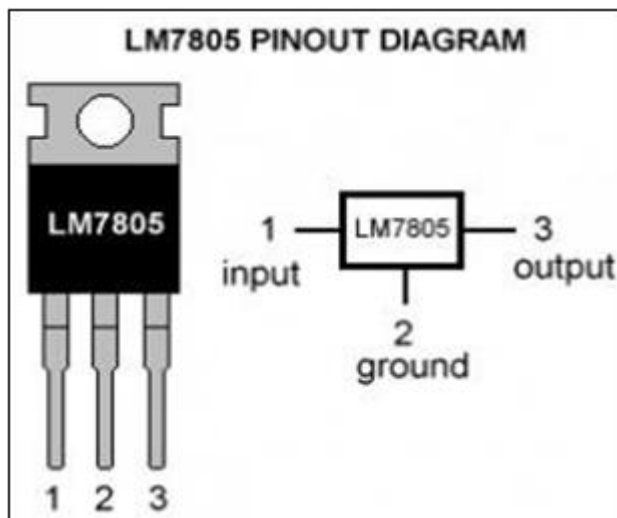


Figure: LM7805 – Pin Diagram

Transformer : Selecting a suitable transformer is of great importance. The current rating and the secondary voltage of the transformer is a crucial factor. Any transformer which supplies secondary peak voltage up to 35V can be used but as the voltage increases size of the transformer and power dissipation across regulator increases.

The current rating of the transformer depends upon the current required for the load to be driven.

The input voltage to the 7805 IC should be at least 2V greater than the required 2V output, therefore it requires an input voltage at least close to 7V.

So, chose a 6-0-6 transformer with current rating 500mA

(Since  $6 \times \sqrt{2} = 8.4V$ ).

Rectifying circuit: The best is using a full wave rectifier

Its advantage is DC saturation is less as in both cycle diodes conduct.

Higher Transformer Utilization Factor (TUF).

1N4007 diodes are used as its is capable of withstanding a higher reverse voltage of 1000v whereas 1N4001 is 50V

Capacitors: Knowledge of Ripple factor is essential while designing the values of capacitors. It is given by  $Y=1/(4\sqrt{3}fRC)$  (as the capacitor filter is used)

$f$ = frequency of AC ( 50 Hz)

$R$ =resistance calculated by  $R= V/I_c$  where  $V$ = secondary voltage of transformer  $V=6\sqrt{2}=8.4$

$R=8.45/500mA=16.9\Omega$  standard  $18\Omega$  chosen  $C$ = filtering capacitance

We have to determine this capacitance for filtering

$Y=V_{ac-rms}/V_{dc}$   $V_{ac-rms} = V_r/2\sqrt{3}$   $V_{dc} = V_{Max}-(V_r/2)$   $V_r = V_{Max} - V_{Min}$

$V_r = 5.2-4.8 = 0.4V$

$V_{ac-rms} = .3464V$

$V_{dc} = 5V$

$Y=0.06928$

Hence the capacitor value is found out by substituting the ripple factor in  $Y=1/(4\sqrt{3}fRC)$  Thus,  $C= 2314 \mu F$  and standard  $2200\mu F$  is chosen. Datasheet of 7805 prescribes to use a  $0.01\mu F$  capacitor at the output side to avoid transient changes in the voltages due to changes in load and a  $0.33\mu F$  at the input side of regulator to avoid ripples if the filtering is far away from regulator.

#### Power Supply Testing:

Digital Multimeter is used to test the power supply. Here we have attached the respective current and voltage ratings of the 5V power supply designed.

#### Description:

Eagle PCB software was used to design the Printed Circuit Board (PCB). First we designed our circuit in the schematic view in Eagle PCB software placing all the necessary components. Connections of all these components were done in the software itself. Then we converted the schematic file into Board file which converted the design into PCB. We have designed and manufactured a single layer PCB for our project.

#### 5. Results

##### Simulation Software tool Introduction

Proteus: The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing circuit boards. The Proteus Design Suite is a Windows application for schematic capture, simulation, and PCB (Printed Circuit Board) layout design. It can be purchased in many configurations, depending on the size of designs being produced and the requirements for

microcontroller simulation. All PCB Design products include an autorouter and basic mixed mode SPICE simulation capabilities.

Schematic Capture - Schematic capture in the Proteus Design Suite is used for both the simulation of designs and as the design phase of a PCB layout project. It is therefore a core component and is included with all product configurations.

Microcontroller Simulation - The microcontroller simulation in Proteus works by applying either a hex file or a debug file to the microcontroller part on the schematic. It is then co-simulated along with any analog and digital electronics connected to it. This enables its use in a broad spectrum of project prototyping in areas such as motor control, [2][3] temperature control [4][5] and user interface design. [6] It also finds use in the general hobbyist community [7][8] and, since no hardware is required, is convenient to use as a training [9][10] or teaching tool. [11][12] Support is available for co-simulation of:

Microchip Technologies PIC10, PIC12,

PIC16, PIC18, PIC24, dsPIC33 Microcontrollers.

Atmel AVR (and Arduino), 8051 and ARM Cortex-M3

Microcontrollers

NXP 8051, ARM7, ARM Cortex-M0 and ARM Cortex-M3

Microcontrollers.

Texas Instruments MSP430, PICCOLO DSP and ARM

Cortex-M3 Microcontrollers.

Parallax Basic Stamp, Freescale HC11, 8086

Microcontrollers.

### PCB Design

The PCB Layout module is automatically given connectivity information in the form of a netlist from the schematic capture module. It applies this information, together with the user specified design rules and various design automation tools, to assist with error free board design. PCB's of up to 16 copper layers can be produced with design size limited by product configuration.

Eagle PCB: EAGLE is a scriptable electronic design automation (EDA) application with schematic capture, printed circuit board (PCB) layout, auto-router and computer-aided manufacturing (CAM) features. EAGLE stands for Easily Applicable Graphical Layout Editor. Features:

EAGLE contains a schematic editor, for designing circuit diagrams. Schematics are stored in files with .SCH extension, parts are defined in device libraries with .LBR extension. Parts can be placed on many sheets and connected together through ports.

The PCB layout editor stores board files with the extension .BRD. It allows back-annotation to the schematic and auto-routing to automatically connect traces based on the connections defined in the schematic.

EAGLE saves Gerber and PostScript layout files as well as Excellon and Sieb & Meyer drill files. These are standard file formats accepted by PCB fabrication companies, but given EAGLE's typical user base of small design firms and hobbyists, many PCB fabricators and assembly shops also accept EAGLE board files (with extension .BRD) directly to

export optimized production files and pick-and-place data themselves.

EAGLE provides a multi-window graphical user interface and menu system for editing, project management and to customize the interface and design parameters. The system can be controlled via mouse, keyboard hotkeys or by entering specific commands at an embedded command line. Multiple repeating commands can be combined into script files (with file extension .SCR). It is also possible to explore design files utilizing an EAGLE-specific object-oriented programming language (with extension .ULP).

## 6. Conclusion

Vehicle tracking system is becoming increasingly important in large cities and it is more secured than other systems. Now a day's vehicle thefting is rapidly increasing, with this we can have a good control in it. Since, now a days the cost of the vehicles are increasing they will not step back to afford it. This setup can be made more interactive by adding a display to show some basic information about the vehicle and also add emergency numbers which can be used in case of emergency. Upgrading this setup is very easy which makes it open to future requirements without the need of rebuilding everything from scratch, which also makes it more efficient.

### Innovativeness & Usefulness

Vehicle tracking systems are also popular in consumer vehicles as a theft prevention and retrieval device.

Police can simply follow the signal emitted by the tracking system and locate the stolen vehicle.

When used as a security system, a Vehicle Tracking System may serve as either an addition to or replacement for a traditional Car alarm.

Some vehicle tracking systems make it possible to control vehicle remotely, including block doors or engine in case of emergency.

The existence of vehicle tracking device then can be used to reduce the insurance cost.

### Bill of Materials

S No.	Components	Quantity Required	Price (In Rupees)
1	ATMEGA328p IC	1	90
2	GPS	1	940
3	GSM	1	850
4	Crystal oscillator 12MHz	1	20
5	Resistors	4	8
6	Capacitors	2	10
7	PCB	1	60
8	LM7805	1	8
9	Diodes	4	8
10	LEDs	1	2
11	Button	1	4
12	Transformer	1	150
13	Board	1	50

TOTAL- Rs 2200/-

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