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GPS Vehicle Tracking System

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Abstract: *This Project presents an automotive localization system using GPS and GSM-SMS services. The system permits localization of the automobile and transmitting the position to the owner on his mobile phone as a short message (SMS) at his request.*

The system can be interconnected with the car alarm system and alert the owner on his mobile phone. This tracking system is composed of a GPS receiver, Microcontroller and a GSM Modem. GPS Receiver gets the location information from satellites in the form of latitude and longitude. The Microcontroller processes this information and this processed information is sent to the user/owner using GSM modem. The presented application is a low cost solution for automobile position and status, very useful in case of car theft situations, for monitoring adolescent drivers by their parents as well as in car tracking system applications. The proposed solution can be used in other types of application, where the information needed is requested rarely and at irregular period of time (when requested).

Keywords: *Global Positioning System, Performance, Vehicle tracking, Real-time systems, Android App.*

1. INTRODUCTION

1.1. Motivation

The motivation for GPS Tracking System is the desire for advanced features in an inexpensive receiver. Currently, all OEM GPS receivers i.e., the single GPS receiver boards with no case, display, etc, proprietary firmware which makes certain assumptions on the system dynamics or application which may not be appropriate.

Currently there is no single system that integrates all tracking and tracing of any movable objects, there are applications but all of them are separate so to integrating all of them was the source of motivation for our team.

1.2. Need of GPS

You may think that you only need a GPS tracking device to get you from point A to point B if you are unsure of where you are driving, but did you know that there are many other tracking systems that you may have a use for?

GPS tracking systems are used to track anyone and anything these days. Technology has rapidly advanced in the past few years and it has become very easy for the average person to use a tracking system. If you have a vehicle, then you will want to place a GPS tracking system under your dash or in your glove compartment. This way, if your car ever gets stolen, you will be able to locate it within seconds. If you have a small child, you will want to have a tracking system in place in case they get lost or wander. Every second counts with a lost or abducted child, so a tracking device is imperative to avoid a possible disastrous and heartbreaking outcome.

If you have valuable items in your home like jewelry, or electronics you will want a GPS tracking system in case they are ever stolen. There are also various tracking systems that can locate items inside buildings and parking garages. If you have a teenager, you will want to use a GPS tracking system to make sure that they are driving responsibly and they are going where they told you they were going. If you suspect your spouse or significant other of cheating, a good tracking system will be able to confirm or absolve your suspicions [2][5].

2. SYSTEM ARCHITECTURE AND WORKING

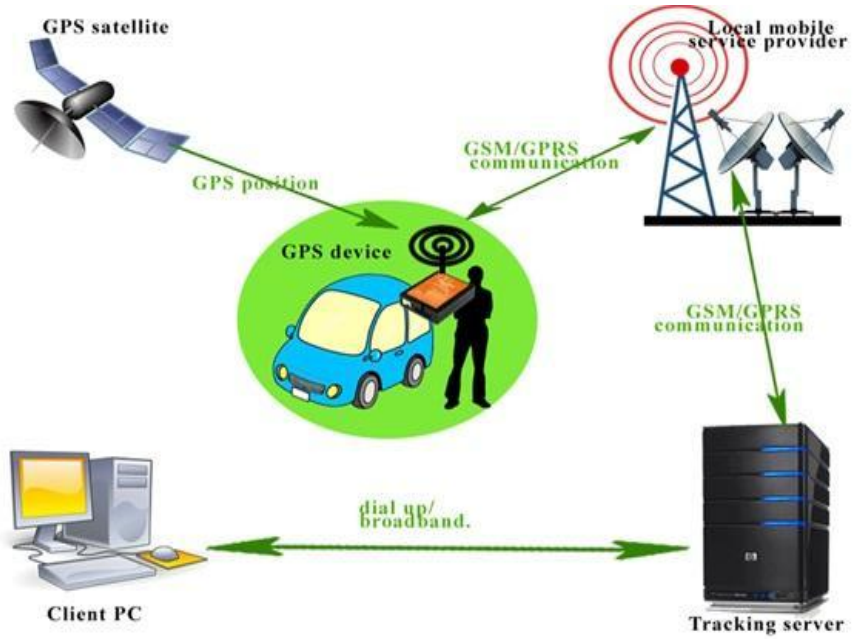

Fig1. *Architecture of GPS Tracking System*

2.1. Working

The GPS satellite gives the exact position of the device which is situated in the Car. This device is in turn which is connected to the local GSM service provider via a GSM network as it has SIM card present in it thus the GPS parameters which the device has are send to the tracking server which has a Static IP address via a GPRS network.

The tracking server consists of a Socket listener application running in the back-ground which listens at a particular port. The GPS parameters received by the port listener are given to the Parser and converter for proper conversions and this data is stored in the database. These values from the database are fetched and are manipulated to get the reports in proper format. [1]

3. ALGORITHM ANALYSIS FOR GPS VEHICLE TRACKING SYSTEM

The algorithm used for GPS location latching is based on 3 time lock GPS status. So it has three for loops present.

The algorithm is:

Check No. of Satellites Visible = n

If (N>3) then get the lat and long

It checks this condition 3 times for getting confirms lock. So the time complexity of this algorithm is

O(n^3).

The space complexity of this project depends on the data client wants to store in database. More the duration of data more is the space complexity.

4. SYSTEM SPECIFICATIONS

4.1. Hardware Interfaces

- Client PC with Internet Connection.
- Server with Static IP.
- AVL (Advance Vehicle Locator) Device.
- GSM SIM Card with GPRS activated.

4.2. Software Interfaces

- FM1100 Configurator (for configuration of AVL)
- Microsoft Visual Studio10.
- .Net framework 3.0/greater.

4.3. Communication Interfaces

Internet is the only communication interface for our system.

4.4. Non-functional Requirements

4.4.1. Performance Requirements

System should take minimum time for report generation. The system performance must not act by the number of vehicles present. The web pages should not take much time to load the pages.

4.4.2. Security Requirements

System should not grant authentication to any unauthorized person. The system should not be vulnerable to the security attacks. Information related to Admin password should be con denial.

4.5. Equations

Our goal is to divide some data D (e.g., the safe combination) into pieces D1, D2…,Dn in such a way that:

The Knowledge of any k or more Di pieces makes D easily computable, Undetermined (in the sense that all its possible values are equally likely).

This scheme is called (k, n) threshold scheme. If k=n then all participants are required to reconstruct the secret original data.

The essential idea of GPS Lock scheme is that 2 points are sufficient to define a line, 3 points are sufficient to define a parabola, 4 points to define a cubic curve and so forth. That is, it takes K points to define a polynomial of degreee^{K-1} . Suppose we want to use $a^{(K,n)}$ threshold scheme to share our secret S, without loss of generality assumed to be an element in a finite field. Choose random K-1 coefficients a1,. . . ,a_{k-1} in F, and $let^{a0=s}$. Build the polynomial f(x)=a_0 + a_1X + a_2X^2 + a_3X^3 +….+ $a_{k-1}X^{k-1}$. Let us construct any n points out of it, for instance $set^{i-1,\dots,n}$ to $retrieve^{(i,f(i))}$. Every participant is given a point (a pair of input to the polynomial and output). Given any subset of k these pairs, we can find the coefficients of the polynomial using interpolation and the secret is the constant $term^{a0}$.[3]

4.6. GPS Lock

We divide our secret into pieces by picking a random degree polynomial

Q(x)=a_0 + a_1X + a_2X^2 + a_3X^3 +….+ $a_{k-1}X^{k-1}$

in which

a_0=s,s_1=q(1), s_2=q(2),…, s_n=q(n) and represent each share as a point(x_i=q(x_i)= y_i)

Example:

The following example illustrates the basic idea. Note, however, that calculations in the example are done using integer arithmetic rather than using finite field arithmetic. Therefore the example below does not provide perfect secrecy, and is not a true example of GPS Lock.[4]

4.7. Preparation

Suppose that our secret is $1234^{(s=1234)}$.We wish to divide the secret into 6

$parts^{(n=6)}$ where any subset of 3 $parts^{(k=3)}$ is sufficient to reconstruct the secret. At random we

obtain 2 numbers: 166, 94. a_1=166; $a_2 = 94$

Our polynomial to produce secret shares (points) is therefore:

F(x)=1234+166x+94x^2

4.8. Reconstruction

In order to reconstruct the secret any 3 points will be enough.

Let us consider

($x_{0,}y_{0,}$)=(2,1942); ($x_{1,}y_1$)=(4,3402) ; ($x_{2,}y_2$) =(5,4414)

We will compute Lagrange basis polynomials

$$L0=\frac{x-x1}{x0-x1}\times\frac{x-x2}{x0-x2} = \frac{x-4}{2-4}\times\frac{x-5}{2-5} = \frac{1}{6}x^2 - \frac{3}{2}x + \frac{10}{3}$$

$$L1= \frac{x-x0}{x1-x0}\times\frac{x-x2}{x1-x2} = \frac{x-2}{4-2}\times\frac{x-5}{4-5} = \frac{1}{2}x^2 - \frac{7}{2}x - 5$$

$$L2= \frac{x-x0}{x2-x0}\times\frac{x-x1}{x2-x1} = \frac{x-2}{5-2}\times\frac{x-4}{5-4} = \frac{1}{3}x^2 - 2x - \frac{8}{3}$$

Therefore

F(x)=$\sum_{j=0}^{2} y_j \cdot l_j$ (x)

The secrete sharing and reconstruction algorithms are NP type. Because we can get & verify the solution set.

As it creates n shares by making n iterations & retrieves original data within k iterations then, the time could be measured in polynomial representations. Hence, problem comes under P type.

5. CONCLUSION

GPS and GSM integration for vehicle and other objects tracking can be very helpful instead of using GPS network alone. This system can be further extended for multiple applications as follows

- Anti-theft system for cars and bikes.
- Managing of public transports likes buses and trains.
- Tracking of valuable assets.
- Fleet Management of cars.
- As a vehicle management software for transport companies

And many more similar applications thus, this system can prove to be very helpful in future.

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