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Virtual GPS Based Tracking System

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ABSTRACT

This paper proposed design and implementation of trucks tracking system using GPS based on semantic web for vehicle tracking in real time. In-vehicle unit and a tracking server is used. The information is transmitted to tracking server using GSM/GPRS modem on GSM network by using SMS or using direct TCP/IP connection with tracking server through GPRS. The received SMS contain longitude and latitude that are used to locate the vehicle on the Google maps. Tracking server also has GSM/GPRS modem that receives vehicle location information via GSM network and stores this information in database. It has been explored that most of the GPS based tracking systems are user friendly, cost effective, reliable and can be easily validated through different experiments and simulations which means that tracking system will send notifications periodically to the main station about the current position of the vehicle . Moreover those tracking notifications (GPS) will be stored in the database for future revising or generating required reports.. The tracking system will be better for cars, trucks, trailers, railways, containers and boats that can be traced using GPS vehicle tracking.

Keywords:

Heavy Vehicle Tracking System, Transportation, GPS, Semantic Web

I. INTRODUCTION

Global System for Mobile Communication (GSM) and Global Positioning System (GPS) based vehicle location and tracking system provided effective, real time vehicle location, mapping and reporting this information value and add by improving this level of service provided.

The vehicle tracking system is an electronic device that tracks the vehicle's location. Most of the tracking systems use the Global Positioning System GPS module to locate vehicles position. Many systems also combine communication components such as satellite transmitters to communicate the vehicle's location to the remote user. Google maps are used to view vehicles' location. The design of the tracking system has been divided into three parts: basic design, intermediate design and advanced design.

A GPS-GPRS based tracking system gives all the specifications about the location of a vehicle. The system utilizes geographic position and time information from the Global Positioning Satellites . This system is built based on embedded system, used for tracking and positioning of any vehicle by using Global Positioning System (GPS) and Global system for mobile communication (GSM). This design will continuously watch a moving Vehicle and report the status of the Vehicle on demand.

The market for GPS vehicle tracking systems is considered as one of the fastest growing markets for GPS applications. There are many levels of sophistication, but what all systems have in common is a GPS receiver and software to put the tracking results on a map. The differences in mapping programs are huge and it is very difficult to judge in advance how well these software solutions will perform.

In today's fast moving life GPS based tracking system has great importance in everyone's life where loved ones, vehicles, mobile phones and other devices can be located with a touch of a button. With the evolution in processing power, and information fed into the memory, for example, points of interest, road guides, topographic data, and many more, GPS

receivers have the ability to change the location, speed, and time data into a helpful display design. GPS information might likewise be fed to a website for real-time location mapping .

Google Maps is a web mapping service developed by Google. It offers satellite imagery, street maps, 360° panoramic views of streets (Street View), real-time traffic conditions (Google Traffic), and route planning for traveling by foot, car, bicycle (in beta), or public transportation. Like many other Google web applications, Google Maps uses JavaScript extensively .

Each of these 3,000- to 4,000-pound solar-powered satellites circles the globe at about 12,000 miles (19,300 km), making two complete rotations every day. The orbits are arranged so that at any time, anywhere on Earth, there are at least four satellites "visible" in the sky.

II. RELATED WORKS

In this paper, we have proposed a novel method of vehicle tracking and locking systems used to track the theft vehicle by using GPS and GSM technology. This system puts into the sleeping mode vehicle handled by the owner or authorized persons; otherwise goes to active mode. The mode of operations changed by persons or remotely. When the theft identified, the responsible people send SMS to the micro controller, then issue the control signals to stop the engine motor. After that all the doors locked. To open the doors or to restart the engine authorized person needs to enter the passwords. In this method, easily track the vehicle place and door is locked.

A GPS receiver's job is to locate four or more of these satellites, figure out the distance to each, and use this information to deduce its own location. This operation is based on a simple mathematical principle called trilateration :-

In order to make the simple calculation of the location, then, the GPS receiver has to know two things:

1) The location of at least three satellites above you

2) The distance between you and each of those satellites

Our system decomposition allows each of the subsystems to be reusable by a wide variety of sensor network applications. The network management and debugging services are useful for deploying other sensor. We demonstrate a working system that not only monitors sensory data but also tracks and controls a higher tier system to accomplish a cooperative task in real time. The system assumes very little processing and communication requirements on the sensor. Logs of Tracking Server and Pointing out current location of vehicle. For vehicle tracking in real time, in-vehicle unit and a tracking server is used. The information is transmitted to Tracking server using GSM/GPRS modem on GSM network by using SMS or using direct TCP/IP connection with Tracking server through GPRS. Tracking server also has GSM/GPRS modem that receives vehicle location information via GSM network and stores this information in database.

In this research paper , quality assurance standards considered which are followed by different techniques used in systems in the surveyed papers. Upon quality standards these techniques are adopted to achieve Quality in their processes. Mainly in our survey all the techniques and methodologies used to provide secure, robust and low cost systems for the owners to satisfy their needs for tracking through GPS and GPRS of GSM network. Most of the systems used GSM network for the sending messages as it is the cheapest way to send SMS as compared to other modes of communication. Along with GSM technique, systems used web services to facilitate their users with the help of interactive web pages. Some systems follow the quality standards to improve their work with the growing need of security and accuracy in the services but some are unable to compete with them in this quality standard. Now days, achieving quality is very important to compete with others in this growing technological world to uphold your work in international market and to fulfill the customer requirements. For future work, more services could be added to the mobile application, make it more fast and accurate, and also the graphical user interface could be improved in these systems to make it more interactive for the users.

The vehicle tracking system presented in this paper can be used for positioning and navigating the vehicle with an accuracy of 10 m. The positioning is

done in the form of latitude and longitude along with the exact location of the place, by making use of Google maps. The system tracks the location of a particular vehicle on the user's request and responds to the user via SMS. The received SMS contains longitude and latitude that is used to locate the vehicle on the Google maps. The vehicle tracking system allows a user to: remotely switch ON the vehicle's ignition system, remotely switch OFF the vehicle's ignition system, remotely lock the doors of the vehicle, remotely unlock the doors of the vehicle, and remotely track a vehicle's location. Some changes were made in which most notable change was alteration of the tracking methodology (i.e. Access to 32 channels of satellites instead of 3). The vehicle tracking system was built successfully. However, the vehicle tracking system could be made more robust by using more accurate GPS unit.

III. SYSTEM REQUIREMENTS

overall system functionality comes from interaction between the system components which are:

- GPS receiver tool
- Web application and purpose designed database
- VB.Net
- SQL Server
- Flash (Google Maps)

A. Functional Requirements

Functional requirements capture the intended behavior of the system. This behavior may be expressed as services, tasks or functions which the system is required to perform. Descript the activity and services a system must provide. Inputs, outputs, processes, stored data o There will be two types of users: Drivers – Manager o Manager should be able to view Maps o Manager should be able to track Trucks and Drivers o Manager can manage all trucks to access GPS signals history and received data

B. Features of the GPS Tracking System :-

Generally all of the GPS Tracking System has some of the common features that are listed below :-

♣ GSM/Gprs Module - It is used to send the location to the user online. In some case, if the user wants the location through the internet then this module is very useful. By the help of the GSM/GPRS module, we can send data real time. It can be seen on the internet enabled any device as a PC, mobile phone, PDA etc.

♣ Track Playback - Animates your driver's daily driven route so that you can follow every move. The track animation line is color coded to indicate the speed your driver was traveling during his route.

♣ Idle Time Report - Gives you an accurate report detailing when your driver was stopped and has left the engine running on the vehicle. This report was designed with input from our existing customers who were concerned about high fuel bills.

♣ Track Detail - Provides you with a split screen view when reviewing your driver's route. Stop and transit times, as well as speed information, are displayed in the bottom pane. You can easily toggle between stops by clicking the stop number on the track detail pane.

C. VISUAL BASIC.NET

VB.Net will be used as the main language in this paper, because it is building a system that needs screens and tables to store in the database. The system as programming will be divided in two parts, the first part which will be installed on the PC's inside the trucks, that part works as a receiver for the GPS signals and send data when requested from the second part of the software which is the administration. The administration will receive the signal and see it on the map, and if any location may be reflected by that signal, the system will give that on map.

C. SQL SERVER

In this paper, an SQL Server is used to store data, data about trucks, about drivers, about GPS locations which are taken and must be stored for future reference. Moreover, the maps and locations are stored; also required locations must be stored to be tested periodically. Since the researcher needs a huge storage of data, for example the database will store the GPS records for tracks for several months or maybe years. That directed us to use the most useful and powerful database: SQL Server.

D. FLASH (GOOGLE MAPS)

Flash from Google maps is used to implement Maps for example, if certain important location in one place the map will be show in flash the track to that position, a moving red track that will be obvious and clear. Flash is making a prominent presence into the web world these days. Flash is the best medium to put animated and interactive movies onto websites to catch eyes instantly.

E. GSM/GPS MODULE

Quad-Band SIM908 module is used which combines GPS technology for satellite navigation with worldwide known technology GSM. This module is configured to connect to navigation satellite and get GPS location at predetermined intervals and send this information to web application through GPRS service provided by GSM.

IV. DRAW FLOW DIAGRAM (DFD) CONTEXT DIAGRAM

That diagram summarizes the data flowing inside the proposed system that shows the two types of users:

The current design is an embedded application. It is continuously monitor a moving vehicle and report the status of vehicle on demand. For doing an Arduino is interfaced serially to a GSM modem and GPS receiver. A GSM modem is used to send latitude and longitude of the vehicle from a remote place. The GPS modem gives the data i.e., the latitude and longitude indicating the position of the vehicle. The GPS modem gives many parameters as the output, but only the National Marine Electronics Association NMEA data coming out is read and displayed on to the LCD. The same data is sent to the mobile at the other end from the place of the vehicle's position is demanded. An EEPROM is used to store the data received by GPS receiver.

A. DFD LEVEL 0

That diagram describes and explains in detail the processes that are performed inside the system. There will be sequence of processes each of them reflects one of the authorities for each user. Each process has certain number to define. Also, the data stores which reflect the data tables in the proposed system (in Figure 4)

ER DIAGRAM (ENTITY RELATIONSHIP DIAGRAM)

That diagram shows the main entities in the software and links entity relationship diagram between them. There will be seven entities and all are connected to each other through primary key in each table. Those tables will store data to generate reports also (in Figure5).

C. DATABASE DESIGN

Normalized database tables use results in reduction in cost as the redundancy is avoided as much as possible. Repetition when occurs exhausts the server and database engines by checking similar data existing in a number of different tables. Using the standardized set procedures and distributing database functionality into set of stored procedures reduce the needed code amount and syntax lines of code used.

Case study:-

♣ 108 emergency ambulance service:- In India, many of the states have launched the Emergency Management and Research Institute's (EMRI) 108 emergency ambulance service in the state. Gujarat, TamilNadu, Goa, Karnataka, Andhra Pradesh, Uttarakhand, Chennai, Rajasthan and Assam are some of them states which provide the 108 Emergency service. The ambulances would also be equipped with GIS and GPS systems, which would help locate the geographical position of emergency scene and help the nearest ambulance reach the site in the shortest possible time. The case before the GPS system was not equipped with the ambulances was very different. The manager of the ambulances could not decide which of ambulances to send at the accident site. It might be possible that the manager can order the ambulance to reach at the accident site which is not very near to the site. And there might be a free ambulance near to the accident site. So the manager's decision was wrong. And it is not tolerable.So they have decided to equip GPS reciever with the ambulances so that the manager can get the location of every ambulances and decide which is nearer to the site.So this is the most advantageous and can save life of thousands

♣ 911 service through IP or VOIP:- There are many systems for providing 911 services to cellular phones. But these systems are not designed to work in Internet Protocol ("IP") or voice over IP ("VoIP") systems. These systems do not have any way to match a location or address to an IP address because an IP address does not have a physical address or telephone number associated with it. Accordingly, there is a need for an IP based 911.

V. DESIGN SEMANTIC WEB TRUCKS TRACKING SYSTEM

The Semantic Web is a web that is able to describe things in a way that computers can understand. In ontology technology classes and their instances are used to describe domain concept specific resources, data properties and object properties are used to describe characteristics of resources and relationships between them . A challenge for the Semantic web is enabling information interoperability between related but heterogeneous ontology .

1. The Semantic Web trucks tracking system is a system designed using a combination of several modern information and communications technologies. The system comprises of Trucks tracking devices, a central server system and a web-based application. The web based system enables user to browse location track on map through developed web application embed Google Map and interact with database server for vehicles track details.

The trucks tracking system is shown in Figure 8. System contains a GPS, and GSM modem and overall system reside into a truck. A tracking system will provide effective real time vehicle location reporting. Tracking system will inform where your truck is and where it has been, how longer it has been there. The GPS receiver of truck terminal receives and resolves the navigation message broadcasted by GPS position satellites, computes the longitude and latitude of truck coordinates, transforms it into the GSM message form by GSM communication controller, and sends the message to monitoring center via the GSM network.

Figure 8: The Trucks Tracking System Overview

The location is acquisitioned from satellite using GPS receiver location coordination sent through GPRS, the GSM network will pass the information to the destination server as XML packet. The clients can browse track on electronic map using purpose designed web application on website.

VI. RESULT AND DISCUSSION

In this paper, GSM module used to send and receive message from another GSM number. If the owner of the vehicle wants to know their vehicle location, they have to send find message firstly. At that time, GSM module was working to send back to the owner mobile phone number. In this thesis, GPS module also contains so that message contains the location of their vehicle latitude and longitude. If the owner wants to see on Google map, it shows the location of their vehicle. Therefore, the user easily knows their vehicle location when the vehicle was stolen.

Accuracy of the system is highly dependent on the GPS device and the coordinates received from GPSsatellite while reliability and usability depend on the reliability of the mobile communications network. Here we list the main screens as follows:

The objective of the paper is to build an additional feature to the present security system that will warn the owner of the vehicle by sending SMS when there has been an intrusion into the vehicle. To provide a solution to avoid car stolen in the lower cost than advance security car system

The signals will be received by the station through the connection with the same server, since we will implement the tracking system as software. Google Maps provide zoom and moving tools which ease zooming in and out and navigation on map.

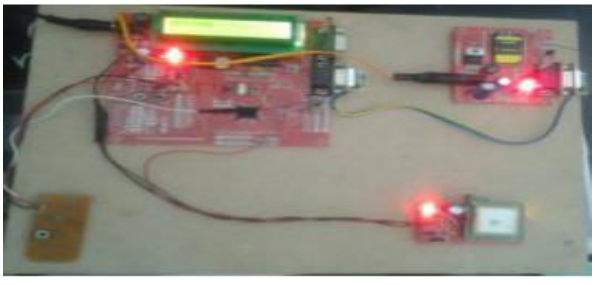

Figure 12: Heavy Vehicle Tracking Kit

VII. CONCLUSION

Tracking system is nowadays the most important system for the person, they want their car security in efficient hands this is the main reason. So the vehicle tracking system are getting popular day by day not only in metropolitan areas but also in small cities. This system is completely integrated and it becomes possible to the user to track their car very easily at any time and from anywhere.

Accuracy of the system is highly dependent on the GPS device and the coordinates received from GPS satellite while reliability and usability depend on the reliability of the mobile communications network.

As a result, it may be able to lower overhead business costs. The semantic web is designed to be user friendly, interactive, secure, and reliable. This paper includes various features like ingenuity, simplicity of design and ease of implementation .This system is reliable any very secure. 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. GSM module used in this paper to send and receive SMS.

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APPENDIX

- Source Code
- Showing locations on Google maps

```
ImportsSystem.Text

Public Class Form1

Private Sub btnMapLatLong_Click(ByVal sender AsSystem.Object, ByVal e AsSystem.EventArgs) Handles btnMapLatLong.Click

    Label3.Text = "START TRACING"

    Timer1.Enabled = True

  End Sub

Private Sub Form1_FormClosed(ByVal sender As Object, ByVal e AsSystem.Windows.Forms.FormClosedEventArgs) Handles Me.FormClosedMainMenu.MapsGPSToolStripMenuItem.Enabled = True

  End Sub

Private Sub Form1_Load(ByVal sender AsSystem.Object, ByVale AsSystem.EventArgs) Handles MyBase.Load

Load_Active_Sim()

End Sub


SubLoad_Active_Sim()

#include <TinyGPS++.h>
#include <SoftwareSerial.h>
#include<LiquidCrystal.h>
LiquidCrystallcd(13, 12, 11, 10, 9, 8);

static constintRXPin=4, TXPin=3;
static const uint32_t GPSBaud=9600;
// The TinyGPS++ object
TinyGPSPlusgps;
inttemp=0,i;
// The serial connection to the GPS device
SoftwareSerialss(RXPin, TXPin);
String stringVal="";
void setup(){
Serial.begin(9600);
ss.begin(GPSBaud);
lcd.begin(16,2);
pinMode(13,OUTPUT);
digitalWrite(13,LOW);
lcd.print("Vehicle Tracking");
```

```
lcd.setCursor(0,1);
lcd.print("    System      ");
delay(2000);
gsm_init();
lcd.clear();
Serial.println("AT+CNMI=2,2,0,0,0");
lcd.print("GPS Initializing");
lcd.setCursor(0,1);
lcd.print("  No GPS Range  ");
delay(2000);
lcd.clear();
lcd.print("GPS Range Found");
lcd.setCursor(0,1);
lcd.print("GPS is Ready");
delay(2000);
lcd.clear();
lcd.print("System Ready");
temp=0;
}

void loop()
{
serialEvent();

while(temp)
{
while(ss.available()>0)
{
gps.encode(ss.read());
if(gps.location.isUpdated())
{
temp=0;
digitalWrite(13,HIGH);
tracking();
}
if(!temp)
        break;
}
}
digitalWrite(13,LOW);
}
void serialEvent()
{
while(Serial.available()>0)
{
if(Serial.find("Track Vehicle"))
{
```

```
temp=1;
      break;
}
else
{
temp=0;
}
}
}
void gsm_init()
{
lcd.clear();
lcd.print("Finding Module..");
booleanat_flag=1;
while(at_flag)
{
Serial.println("AT");
delay(1);
while(Serial.available()>0)
{
if(Serial.find("OK"))
at_flag=0;
}

delay(1000);
}
lcd.clear();
lcd.print("Module Connected..");
delay(1000);
lcd.clear();
lcd.print("Disabling ECHO");
booleanecho_flag=1;
while(echo_flag)
{
Serial.println("ATE0");
while(Serial.available()>0)
{
if(Serial.find("OK"))
echo_flag=0;
}
delay(1000);
}
lcd.clear();
lcd.print("Echo OFF");
delay(1000);
lcd.clear();
lcd.print("Finding Network..");
```

```
booleannet_flag=1;
while(net_flag)
{
Serial.println("AT+CPIN?");
while(Serial.available()>0)
{
if(Serial.find("+CPIN: READY"))
net_flag=0;
}
delay(1000);
}
lcd.clear();
lcd.print("Network Found..");

delay(1000);
lcd.clear();
}
void init_sms()
{
Serial.println("AT+CMGF=1");
delay(400);
Serial.println("AT+CMGS=\"8825737586\"");   // use your 10 digit cell no. here
delay(400);
}
void send_data(String message)
{
Serial.print(message);
delay(200);
}
void send_sms()
{
Serial.write(26);
}
void lcd_status()
{
lcd.clear();
lcd.print("Message Sent");
delay(2000);
lcd.clear();
lcd.print("System Ready");
return;
}
void tracking()
{
init_sms();
send_data("Vehicle Tracking Alert:");
Serial.println(" ");
```

```
send_data("Your Vehicle Current Location is:");
Serial.println(" ");
Serial.print("Latitude: ");
Serial.print(gps.location.lat(), 6);
Serial.print("\n Longitude: ");
Serial.println(gps.location.lng(), 6);

  // https://www.google.com/maps/@8.2630696,77.3022699,14z
Serial.print("https://www.google.com/maps/@");
Serial.print(gps.location.lat(), 6);
Serial.print(',');
Serial.print(gps.location.lng(), 6);
Serial.print(",14z");
send_sms();
delay(2000);
lcd_status();
}
```