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GPS, GPRS, GIS FOR Tracking System

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Abstract: **This paper proposes and implements a low cost object tracking system using GPS and GPRS and GIS. The system allows a user to view the present and the past positions recorded of a target object on Google Map through the internet. The key features of the system are an open-source GIS platform, HTTP protocol, A web application is developed using PHP, JavaScript, Ajax and MySQL with the Google Map embedded and a communications server, a web-server, a database server, and a map server. The Monitoring Centre displays the above information on Google Map by means of Internet and sends commands to all the subsystems. The real time availability of all exact locations and speeds of the vehicles enables the system to encompass very clear traffic information**

***Keywords*: GPRS, GPS, GIS, HTTP**

1. INTRODUCTION

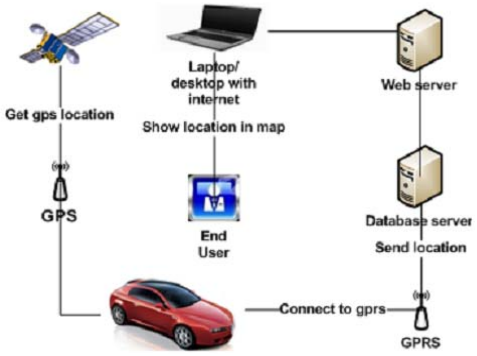
A good number of tracking systems had so far been developed with a wide range of tracking facilities. But the operation cost of most of these systems is higher which prevents from widespread use. On the other hand, the rate of car theft, asset theft, child kidnapping in many countries are increasing at a higher rate. GPRS (General Packet Radio Service) is chosen as the main method of communication between the tracking unit and the server.

GPRS, being mobile technology, is ubiquitously available in the country. It is also ideally suitable for data transfer over an always on-line connection between a central location and mobile devices. The cost is per 1(KB) of data transferred, in comparison to SMS where the cost is per message. The paper illustrates the integration of multiple technologies to achieve a common goal.

Global Positioning System (GPS) is a system composed of a network of 24 satellites of the United States, The satellites periodically emit radio signal of short pulses to GPS receivers .A GPS receiver receives the signal from at least three satellites to calculate distance and uses a triangulation technique to compute its two-dimension (latitude and longitude) position or at least four satellites to compute its three-dimension (latitude, longitude, and altitude) position. Once a location is computed, it can calculate an average speed and direction of travelling. Therefore, GPS is a technology for giving device its position.

2. SYSTEM OVERVIEW

The system has two parts – the tracking device, the database server, a map server and platform is selected for the map server. The system uses GPRS as the main method of communication between the units need a system to track and server. The device is attached with the moving object and gets the position from GPS satellite in real-time. It then sends the position information with the International Mobile Equipment Identity (IMEI) number as its own identity to the server .The data is checked for validity and the valid data is saved into the database. When a user wants to track the device, she/he logs into the service provider's website and gets the live position of the device on Google Map.



3. SYSTEM DESIGN

3.1. HARDWARE SPECIFICATION

Figure 1 shows the work flow of the hardware.

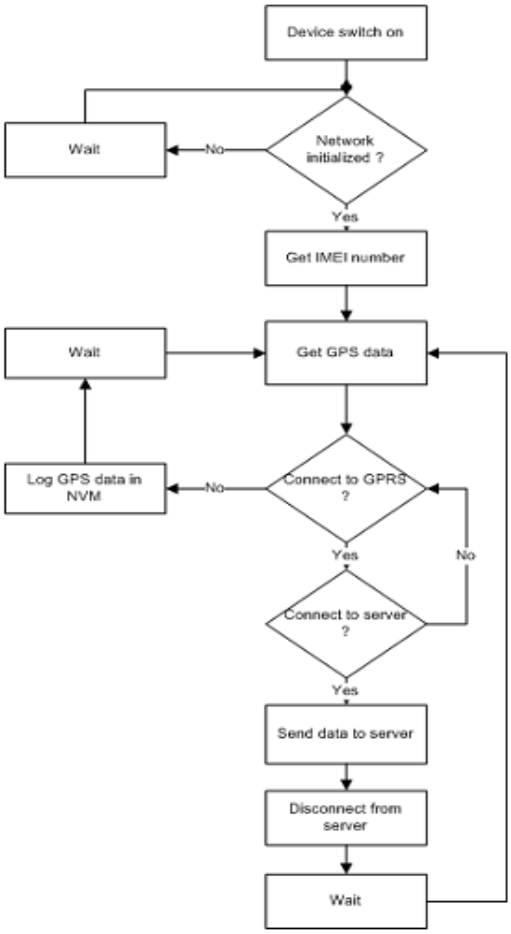


Figure1. Hardware flowchart of the system

The tracking unit collects the location information via the GPS, formats this information into a system-specific packet format and sends it to the server via GPRS. If GPRS is unavailable at any time, time-stamped data packets are stored in a temporary storage unit to be uploaded when GPRS becomes available again. Thus, the movement information of a vehicle is not lost even in the event of a communications failure.

3.2. SOFTWARE SPECIFICATION

The main software components of the system are the socket communication server, the web server work and the GIS map server. It will then listen to any incoming connections when a client (a remote tracking device) connects, the server will authenticate and acknowledge the client .T he web application will retrieve the data from the database server and do preprocessing for further operations as requested by the user. To develop this software PHP5, JavaScript and Ajax scripting language was used. A PHP file named dgl.php is responsible for accepting data which is sent by the device via GPRS using POST method of the HTTP protocol. This data consists of IMEI number of the device, Latitude, Longitude. IMEI number is used to authenticate the device.

The Spherical law of cosines is used to find out the name of the device's location. Spherical law of cosines

d = R*acos(cos(lat1).cos(lat2).cos(lng2−lng1)+sin(lat1).sin (lat2))

d is the distance between two coordinates (lat1,lng2) and (lat2, lng2)

Four attributes as given in Table 1

Table1

ID	Name	Latitude	Longitude
1	Banani	23.3456554	90.9825973
2	Gulshan-1	23.3456546	90.9825934
3	Gulshan-2	23.3456590	90.9825926
4	Mohakhali	23.3456525	90.9825979

After receiving a new position, dgl.php the nearest location name of the newly received position is found.

"**SELECT** name, (3959 * acos(cos(radians('lat1)) * cos(radians(lat2)) * cos(radians(lng2)– radians('lng1')) + sin(radians('lat1')) * sin(radians(lat2)))) AS distance

FROM geocode

HAVING distance < 5

ORDER BY distance LIMIT 0, 1"

This query returns the name of the location which has the shortest distance with the new position.

4. GEOGRAPHIC SPATIAL INFORMATION

The Geographic-data module deals with all spatial information in the system and we can see the current situation device. The main information components are Locations, Geofences, Routes and Tours. Geo-fences are circular areas defined around a Location. The GPS location of the center of the circle and the radius define a Geo-fence. A Route comprises of two or more Locations described above. When a vehicle needs to be reserved for a particular trip, the system operator creates the Tour by combining parts of the pre-defined Routes. For example when the vehicle needs to travel from Colombo to Horana . A Tour may be defined by joining the Colombo-Katubedda segment from the Colombo-Galle Route, the Katubedda-Piliyandala Route and the Piliyandala-Horana segment from the ColomboHorana Route.

This is done through a graphical user interface including digital maps. For example, a mouse click on a particular city can be used to retrieve its coordinates. While the vehicle is on tour, the system tracks its position in real-time and is able to detect if it deviates from the defined tour. Along with the location information, the tracking device also sends other relevant data such as speed, time, and power level to the communication server. This information is also stored in the database. In the tracking module these data will be displayed

along with the vehicle number which is being tracked. Vehicle which is being tracked is displayed as a point on the map. The browser refreshes the map every eight seconds, so that the vehicle's movement can be tracked.

In this system user can check the history of tracking with Google map. According below image

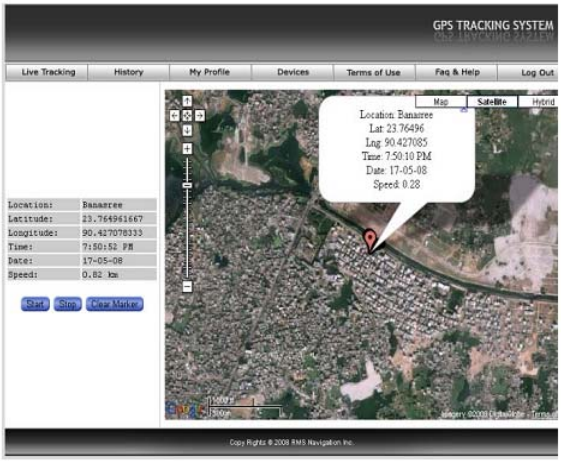


Figure2. Shows the live position of the tracking device (a)

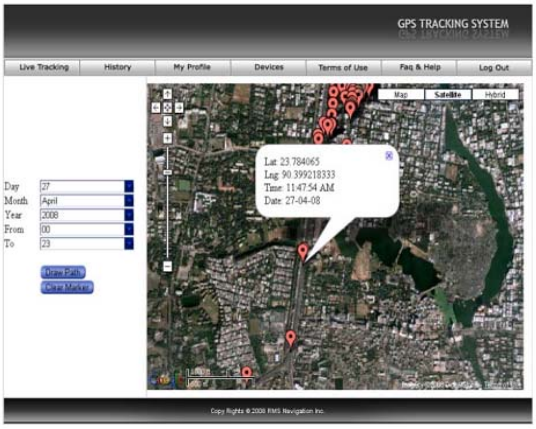


Figure3. Shows the live position of the tracking device (b)

CONCLUSION

5. CONCLUSIONS

This paper presents the development of a fleet tracking system using GIS technologies, the GPS and GPRS. The system displays the location of moving vehicles with an error less than 50m in real time on the Map.It is expected that the full implementation of the proposed system would ultimately replace the traditional and costly SMS based tracking systems

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