

The Integration of GPS Navigator Device with Vehicles Tracking System for Rental Cars Firms

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Abstract — the aim of this research is to integrate the GPS tracking system (tracking device and web-based application) with GPS navigator for rental cars, allowing the user to use various applications to monitor and manage the cars. This is enable the firms and customers to communicate with each other via the GPS navigator. The system should be developed by applying new features in GPS tracking application devices in vehicles. This paper also proposes new features that can be applied to the GPS Navigator. It also shows the benefits that the customers and staff will get from this system.

Keywords: *GPS tracking system, GPS devices, GPRS, Garmin.*

I. INTRODUCTION

The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites (Garmin.com). In 1973 GPS was intended for USA military applications, but in the 1980s, the government made the system available for civilian use. GPS works in any weather conditions, anywhere in the world, 24 hours a day. There are no subscription fees or setup charges to use GPS.

From NASA (2009) : The uses of GPS have extended to include both the commercial and scientific worlds. Commercially, GPS is used as a navigation and positioning tool in airplanes, boats, cars, and for almost all outdoor recreational activities such as hiking, fishing, and kayaking.

GPRS (General Packet Radio Service) is the main method of communication between the tracking unit and the server (Microwave Antenna). GPRS, being a 2.5G 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. (Medagama, Gamage, Wijesinghe, Leelaratna, Karunaratne and Dias , 2008)

GPS tracking system developed that transmit vehicle's data in real time via cellular or satellite networks to a remote computer or data centre (Muruganandham , P.R.Mukesh, 2010). Vehicle tracking system signifies the monitoring and management of vehicle, trucks, etc by using GPS system to get the current location, situation , history and control them. (Mikko Krkkinen, Timo Ala-Risku and Kary Frmling, 2004).

The web based tracking system allows users to securely log in and track their cars in real- time over the Internet. The user sees a moving dot on a map in a web browser .

The system allows users to locate any car at any time of day. Also, it can replay a past trace of the cars history. It can also remotely control the car such as run alarms and locking devices.

A lot of shipment companies in the world use GPS tracking systems in their trucks. It is very important for the fleets, especially when they have big number of trucks and staffs, to manage these huge number of vehicles and people.

However, the biggest challenge in the cars rental companies are car thieves and delay car return. This will cause, lost a lot of money and cars. However, The rental cars firms tried to find the solution to save their cars from these troubles from their clients and staff.

The vehicle tracking system presented in this paper as a system that is designed to track and manage rental cars that are used by the customer, using a GPS tracking technology with GPS navigator.

The system comprises of vehicle GPS tracking devices (Tracking device and GPS navigator), GPRS and a web-based application. Through this system, the company staff will have the facility to monitor the

movement and relevant information of each vehicle. Moreover, to keep in touch with their customers by GPS navigator technology.

The paper highlights how to apply new application in GPS navigator that allows the firm staff and customers to communicate between each other via GPS navigator in the rental cars. Moreover, satisfying customer needs and building high confidence between the firm and customers.

This paper illustrates the integration of multiple technologies to achieve a common goal. It is a case study of an example that shows how such technologies can be synergistically combined to address a real rental cars firm problems. (Medagama, Gamage, Wijesinghe, Leelaratna, Karunaratne and Dias, 2008)

II. GPS TRACKING SYSTEM

GPS device is a small unit that receive signals from satellites and send other signals to antennas (GPRS). This device is a major part of the system and it will be installed into the vehicle which is responsible for capturing the following information for the vehicle such as the Current location of vehicle, Speed of vehicle, Door open/close status, Ignition on/off status, etc. (Muruganandham, P.R.Mukesh, 2010).

This device is also responsible for transmitting this information to the Tracking Server located anywhere in the world. Also, it has to install the unit in a hidden and safe place inside the vehicle (Muruganandham, P.R.Mukesh, 2010).

The information about the vehicle saved in this unit will be sent to antennas by GPRS, and there are many applications (Figure 1 shows one of the application) connected to the internet that can calculate it and put it on the map to integrate with it.



(Figure 1 : web based tracking application)

The information includes location, speed, fuel level, engine situation, start driving point, and car situation. Also via this application, the company staff can control the cars, for example, on/off lights, on/off air

conditioning, on/off car engine, on/off security system and others, by sending some codes to the tracker in the car.

A. GPS Tracking System Framework

The GPS tracking system consists of client-server architecture where the web browser is the client and the server functions are shared between a web server, a communication server, a database server and a map server (M. Medagama, D. Gamage, L. Wijesinghe, N. Leelaratna, I. Karunaratne and D. Dias, 2008). The process of web application tracking consists of four parts: a location-aware web system, location determination, location-dependent content query and personalized presentation. The location-aware web system is the underlying infrastructure. It allows the exchange of the location information between the web browser and the web server, and the automatic update of the web pages in the web browser when the location changes (Rui Zhou, 2008).

GPRS (General Packet Radio Service) is the main method of communication between the tracking device and the web server. GPRS, being a 2.5G mobile technology, is available all over the world. 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 kilobyte of data transferred, in comparison to SMS where the cost is per message. (M. Medagama, D. Gamage, L. Wijesinghe, N. Leelaratna, I. Karunaratne and D. Dias, 2008).

The location information collected through the GPS in real time is placed in a central database that is owned by the firm's staff via GPRS antenna. Each user of the system may access this information via the Internet. Figure 2 shows the system framework.



(Figure 2 : GPS tracking system framework)

B. Features of GPS Tracking System:

Some rental car firms offer GPS devices for rent when a customer comes to rent a car by adding charges for it per day. This is beneficial for customers to locate their rental cars, know the location direction and their current location. Moreover, it also helps the rental Car firms to be informed how the customers are using the cars.

This system is also used to prevent theft and retrieve stolen/lost vehicles. The signal sent out by the installed device help the rental car firms to track the vehicle. These tracking systems can be used as an alternative for traditional car alarms or in combination of it. Installing tracking systems can thus bring down the insurance costs for these vehicles by reducing the risk factor (roseindia.net).

Moreover, this system gives benefits to the rental car firms and to their customers such as: (imardainc.com).

- Real-time location of vehicles,
- Historical vehicle reports,
- Security code/pin,
- Trip computer,
- Engine idle and start/stop reporting,
- Real-time tracking alerts and reports after hour vehicle monitoring,
- Create custom Geo-fences and landmarks,
- Historical movement of vehicle,
- Mileage reporting,
- Optional starter disable/enable,
- Notification of doors opening and closing

C. Case Study:

Some fleet firms that applied this tracking system which are the following:

Delhi Transport Corporation is the one of the largest City Road Transport Undertaking in India (DELHI Transportation Corporation case study, 2007). It has a fleet of around 15,000 vehicles carrying on the business of passenger transport in 800 routes from 33 depots all over the state of Delhi with a product mix comprising of City and Inter-city services. After they implemented the tracking system in vehicles and other functions under Automatic Fleet Management System, the benefits they obtained are (DELHI Transportation Corporation case study, 2007) :

- Better bus scheduling.
- Quick replacement in case of breakdown/accident en-route.
- Effective control over the drivers & checking bus-stops skipping.
- Check on over-speeding.

- Basic communication between driver and control room in emergencies.
- Automation of Fleet Operations minimizing human intervention.
- Improved Fleet utilization leading to better services and thereby enhancing commuter satisfaction.

Another car rental Firm is in the United Arab Emirates (UAE) that fitted their cars with high-tech C track GPS/GPRS satellite tracking units to prevent thieves from driving away with the cars.

Thieves in Dubai and Sharjah are increasingly posing as clients who rent a car and then ship the car out of the country, mostly to Russia, North Africa and Eastern Europe. This prompted car rental firms to integrate vehicle with GPS tracking system to protect their business and save themselves time and money. Al Mumtaz Rent-a-Car in Dubai gives their vehicles some level of safety and it can monitor their vehicle all the time. (digicore.com case study, 2007).

The system is cost-effective, as it saves time and money in the recovering of stolen vehicles. According to Diamond Lease, they can also monitor the movement of all their vehicles and can thus establish whether a vehicle is being misused. The GPS tracking device can keep track of the car's engine condition by recording harsh braking, speeding and even the removal of any of the car's parts, thus saving us more money (digicore.com case study, 2007).

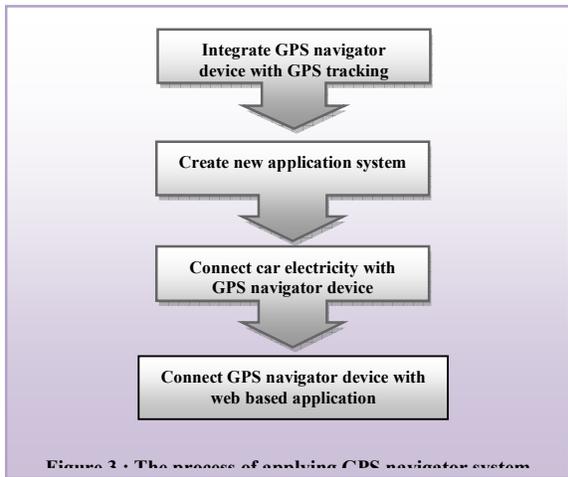
In Saudi Arabia from rental cars report there is have more than 300 cars and their experience more than 25 years in this field. Moreover, they have more than 10 branches in East of Saudi Arabia. However, during this time the rental cars faced many troubles from either customers or employees such as car lost, personal car use from the staff and delays. From these problems the rental cars lose money, lose cars, low service quality, and short cars use period.

On the other hand, after they installed the tracking system into the rental cars they save almost all of their money, time and cars. Moreover, The firm got improvement of their services quality and maintained the cars quality for a longer period.

III. PROPOSED METHOD AND RECOMMENDATION

This paper shows that this system is easy to apply, very important to manage , save and control the cars . In this section, the paper will proposed some helpful and useful features in the GPS system.

There are some new features recommended to be implement in the system that will save Firm time, money, and manage their cars safely which are as following (Figure 3):



1) Integrate GPS navigator device with GPS tracking system

This device usually work as a guide for travelers to show them where they are , where they want to go , maps , roads, shops and other useful information .

The integration framework is between GPS navigator device and GPS tracking system.



(Figure 4: framework for Garmin and GPS tracking devices)

2) Create new application system that can link customers with rental car company via GPS tracking device. This system will contain new menus that provide new services for customers in addition to its main function as guidance. The proposed new menu can help the customers to contact with staff for any help such as lost directions, lost key or any other assistants as shown in figure 5.



(Figure 5: Proposed new menu in GPS nav. Application)

GPS navigator device must be installed in the cars because it will link with the GPS tracking device.

3) connect car electricity with GPS navigator device that controls the cars, so that nobody can drive the car without logging in using the specific username and password. When the customer wants to drive the car after he/she has signed the contract , he/she has to enter the name that is in the contract and the contract number as shown in figure 6 and figure 7.

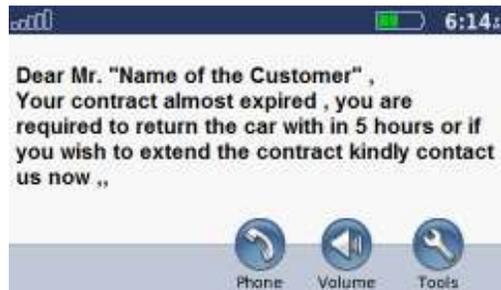


(Figure 6: field for entering customer name)

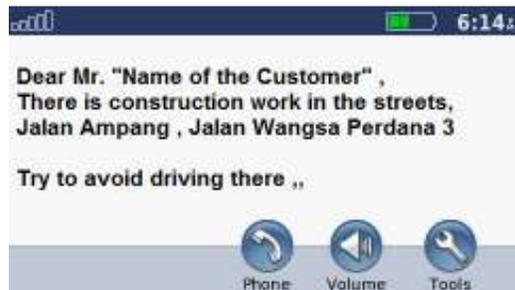


(Figure 7: field for entering contract number)

4) connect GPS navigator device with web based application through GPS tracking device that can send messages from the company to the customer, such as, reminders of expiry date of contract, last promotions, and other useful information (as shown in figure 8 & 9) .



(Figure 8: one of the proposed reminder messages from the firm to their customer)



(Figure 9: one of the proposed notice messages from the firm to their customer)

IV. CONCLUSION

In conclusion, This paper presents the development of a Rental cars tracking system using GPS & GPRS technologies. It is a typical example of how the advantages may be forced for the efficient and effective managing of rental cars firm. However, after implementation of this proposed system may give benefits for the rental cars firm customers such as built in road maps, Route capability Touch screen access, monitor fuel consumption, vehicle maintenance alerts, route guidance, Speed limit display, last promotions from the firm, warning reminders, renewal car rental contract, keep contact with the rental cars firm. Moreover, this system show that the customers will connected with the rental cars firm in whole day via GPS navigator device with full protection of the rental cars firms from any violations from the customers.

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REFERENCES

- [1] B.H. Rudall, C.J.H. Mann (2008), "The Challenges of Tracking And Protecting Data", *Kybernetes*, vol. 37 no. 3/4, pp. 543-549.
- [2] Barnes, Scornavacca, Innes (2006), "Understanding wireless field force automation in trade services", *Industrial Management & Data Systems* Vol. 106 No. 2, pp. 172-181.
- [3] Craig A. Scott (1994), "Improved GPS Positioning for Motor Vehicles Through Map, Matching", University of

Technology, Sydney, Presented at ION-94, Salt Palace Convention Center, Salt Lake City.

- [4] Crowley (1998), "Virtual logistics: transport in the marketspace", *International Journal of Physical Distribution & Logistics Management*, Vol. 28 No. 7, pp. 547-574.
- [5] DELHI Transportation Corporation case study (2007), http://www.emcltd.com/case_studies/transportation/GPS_System_Case_Study_DTC.pdf
- [6] General Information Document of GPS-based Fleet Management and Tracking Systems (2008), Exaterra Inc., Ottawa, Canada: Canadian company based in Ottawa.
- [7] Hariharan, Krumm, Horvitz (2005), "Web-Enhanced GPS", School of Information and Computer Sciences, University of California, Irvine, USA.
- [8] <http://gpstrackit.com/gps-tracking-products/garmin-integration>
- [9] <http://scign.jpl.nasa.gov/learn/gps1.htm>
- [10] <http://www.digicore.com/>, (UAE Press Release August, 2007)
- [11] <http://www.imardainc.com/smartrack-vehicle-tracking-system>
- [12] <http://www.roseindia.net/technology/vehicle-tracking/VehicleTrackingSystems.shtml>
- [13] <http://www8.garmin.com/aboutGPS>
- [14] M. Medagama, D. Gamage, L. Wijesinghe, N. Leelaratne, I. Karunaratne and D. Dias (2008), GIS/GPS/GPRS and Web based Framework for Vehicle Fleet Tracking, *ENGINEER*, No. 05, pp. 28-33.
- [15] Mikko Ka'rkka'inen, Timo Ala-Risku, Kary Fra'mling (2004), "Efficient tracking for short-term multi-company networks", *International Journal of Physical Distribution & Logistics Management* Vol. 34 No. 7, pp. 545-564
- [16] Muruganandham, P.R. Mukesh (2010), "Real Time Web based Vehicle Tracking using GPS", *World Academy of Science, Engineering and Technology* 61 2010.
- [17] Robert W. Bogue (2004), "New on-vehicle performance and emission monitoring system", *Sensor Review*, Volume 24, No. 4, pp. 358-360
- [18] Roger Clarke (2001), "Person location and person tracking (Technologies, risks and policy implications)", *Information Technology & People*, Vol. 14 No. 2, pp. 206-231.
- [19] Rui Zhou (2008), "Enable web-based tracking and guiding by integrating location-awareness with the world wide web", *Campus-Wide Information Systems* Vol. 25 No. 5, pp. 311-328