Comparative Analysis of Several Real-Time Systems for Tracking People and/or Moving Objects using GPS

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Abstract. When we talk about real-time systems for tracking people and/or moving objects using a Global Positioning System (GPS), there are several categories of such systems and the ways in which they work. Some uses additional hardware to extend the functionality of the offered opportunities, some are free, some are too complex and cost too much money. This paper aims to provide a clearer picture of several such systems and to show results from a comparative analysis of some popular systems for tracking people and moving objects that use the GPS, like Navixy, Frotcom GPS Vehicle Tracking & Fleet Management System, FollowMee GPS Tracker, Open GPS Tracking System and our system RadinTechnology GPS Tracking System.

Keywords: Navixy, Frotcom, FollowMee GPS Tracker, Open GPS Tracking System, Radian Technology

1 Introduction

Recent years, we are witnesses of popularization and versatile applications of GPS technologies. Applications range from military, national security and justice system till personal safety and comfort. For example, the criminal justice system in many countries uses GPS based mobile tracking devices in the form of an ankle bracelet, that specific types of offenders are sometimes required to wear [1]; many fleet operators can monitor the driving behavior of employees, parents can monitor their teen drivers [2, 3, 4, 5];there are special systems for tracking people and their body parts [7], for tracking moving objects in surveillance system [8], even stalking [6], etc.

There are a number of hardware devices (sensors, chips, receivers) which provides the functionality of real-time systems for tracking people and/or moving objects. But all of them must have:

- Hardware device (receiver) - which receives signals from a satellite or base stations
- Software that manages the system - receive data from the hardware, store the data, regulate and exchange that data

- Communication network, which enables the exchange of data between different devices in the system

In this paper, we give a comparative analysis of several real-time tracking systems, including Navixy, Frotcom GPS Vehicle Tracking & Fleet Management System, FollowMee GPS Tracker, Open GPS Tracking System and RadinTechnology GPS Tracking System, according to presence of web and mobile application, mobile platform, need of additional hardware, history of movements, update interval, monitoring of vehicle telemetry, prices, existence of free/trial versions, etc.

The motivation for doing this review is that we want to make better GPS tracking system in which we will include all advantages from other analyzed systems and we want to take off all disadvantages.

2 Comparative Analysis

First, we give several key features and disadvantages of examined real-time systems for tracking people and/or moving objects.

2.1 Navixy GPS Tracking System

Navixy [9] is an intelligent and professional system for time and distance based tracking of vehicles and fleet management by using devices that use satellites (GPS or GLONASS) and technologies such as (GSM, WIFI, LBS).It supports over 100+ device models from vendors across the world as GPS tracking devices (GPS trackers). Also, there is a free X-GPS Tracker app which can turn any smart phone or tablet into GPS trackers for people, and X-GPS Monitor for locating different assets. It has a web interface based on pure JavaScript and HTML5 technologies only, and only registered users can watch their vehicles in real time.

The Navixy GPS tracking system has a very good admin panel through which users can manage the data obtained from monitoring devices, to see reports, edit their profiles, manage user accounts, set up billing plans, etc. Other key features of the system Navixy are:

- 24 hours real-time monitoring
- Complete history of movements at all times until a few years ago, through which you can find out when, where, why and length of travel.
- Adjusting certain events to happen in a given circumstance and a number of notices
- Users can be notified via SMS, E-mail or Push notification
- Mobile applications Navixy Tracker and Navixy Viewer through which we can track vehicles and send data independently of the computer
- Monitor vehicle telemetry such as fuel consumption in real-time, engine rpm, speed all that done with the help of additional hardware that is installed in the vehicle
- Remote control of the vehicle using the integrated hardware (starting the engine, engine blocking, heating the vehicle, etc.)
- Interval mode for longer battery life

Fig. 1. View of Navixy GPS tracking system

Disadvantages of the system Navixy are:

- Requires installation of additional expensive hardware
- Expensive monthly payment
- Complex to use and install
- Additional GPS device with GSM card for every vehicle

2.2 Frotcom – GPS Vehicle Tracking & Fleet Management System

Frotcom GPS Vehicle Tracking & Fleet Management System [10]is intelligent and professional vehicle tracking and fleet management system, designed to control drivers, communicating with them and closely monitoring the way of driving.

A Frotcom tool for GPS tracking and fleet management consists of a GPS receiver and GPRS communication module which is installed in each vehicle. Powered by the vehicle battery, this unit will allow the fleet manager to monitor the movements of the vehicles, where are now, where they were, when they started the journey, how long did not move, etc. The data and monitoring of vehicles can be viewed using a computer with a web browser and internet, and vehicles are displayed on a map.

Modern trucks have built in circuit for transmitting data from the onboard computer called CANBus / J1939. This flow allows external equipment to read some information like level and fuel consumption, the turnover of the engine, the engine temperature, tachograph data etc.

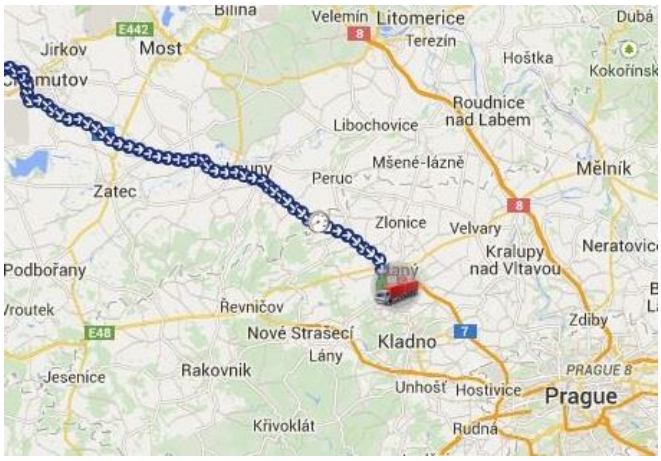

Fig. 2. Frotcom GPS Vehicle Tracking & Fleet Management System

With Frotcom you can track all the vehicles 24 hours a day, with GPS positions and sensor data being received every minute. Additional modules include cost management, integrated navigation module for drivers, two-way text communication, fuel control and automatic driver identification. Data collected by Frotcom from the vehicles is processed, generating rich, simple and useful reports, which can be sent automatically by email. Alarm situations are also immediately detected and can be reported by email and SMS. Frotcom offers also route planning and monitoring, remote tachograph download, workforce management, sensors for open door and temperature and management dashboard for the owners. Disadvantages of Frotcom GPS Vehicle Tracking & Fleet Management System are:

- Requires installation of additional expensive hardware
- The device is dependent on the server side software
- Expensive accessories mounted on the vehicle
- Tracking work only for vehicles
- An expensive monthly subscription
- No mobile application
- No remote control device for mounted device

2.3 FollowMee GPS Tracker

FollowMee GPS Tracker [11] is a real-time system for tracking people and objects using a GPS, and it converts mobile phone or tablet into a GPS tracker. It works in the background and periodically records its location (GPS, WiFi, or cellular triangulation) and sends data to the secured web server for processing.

To monitor tracked devices one can use only web browser and internet. Registration is simple and also is the user interface. Additionally, one can use login token, linked to his account.

There is a free version with limited features, and standard and deluxe versions of the application that is paid and offers additional features. Up to 90-days history is available for paid GPS track app, and only current location for free version.

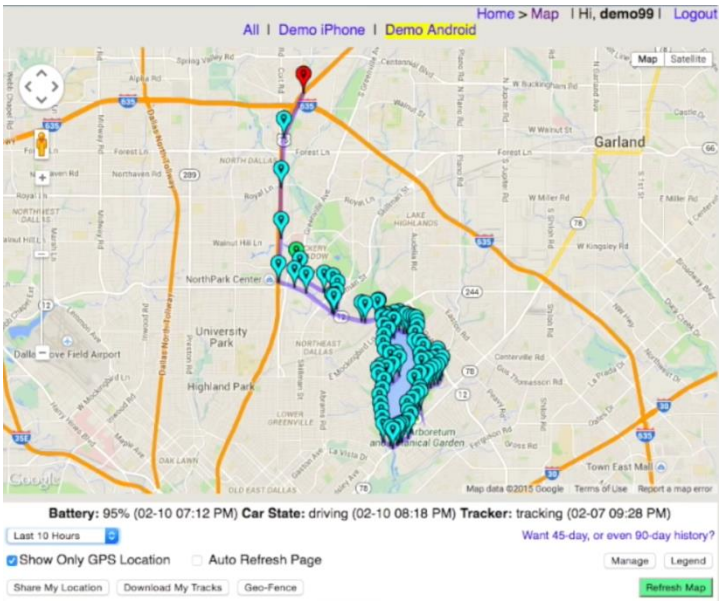

Fig. 3. FollowMee GPS Tracker

Key features of FollowMee GPS Tracker are:

- Monitoring of multiple devices at once
- Mobile application, Works on all major mobile platforms
- All mobile devices are displayed in one place
- Geo–region, receiving notifications when the device enters or exits from someregion, Geo-fencing with user notification by e-mail
- No additional hardware is required, just a phone with a GPS receiver or tablet
- Publication of the tracks through URLs or downloadable KML files, and possibility of embedding the live map in the user web site or Facebook
- Operation of the application even when the device is disabled
- The Android version of this app has a stealth mode, which hides the app icon on the phone screen
- Downloading the tracks in HTML or CSV (Excel) file format.

Disadvantages of FollowMee GPS Tracker are:

- A small number of options on the server control panel and mobile application
- No remote control
- The tracker app stops after 2 weeks (Windows Phone 8 limitation)
- Limited history of movements

2.4 Open GPS Tracking System

Open GPS Tracking System [12] is the first open source project designed specifically to offer a web based services for the GPS. The services of the system can be used for a fleet of vehicles that can be used to track a group of vehicles, and even mobile phones. The system is designed to be used to monitor a number of vehicles in larger companies but can be used in smaller companies and is highly modular and flexible, and easily expandable.

Open GPS Tracking System supports the collection of data from a large number of GPS trackers and collections of telemetry data from hardware that is connected to the computer of the vehicle.

Based on Open Open GPS Tracking System, a number of commercial systems for tracking vehicles are developed and tailored to the more specific tasks, depending on the requirements of companies. One such system is known as GTS Enterprise [13]which is proprietary.

Fig. 4. Open GPS Tracking System

Key Features of Open GPS Tracking System:

- Customizable web-based interface
- Customizable mapping service, with support for Open Layers/OpenStreetMap, Google Maps, Microsoft Virtual Earth, and Mapstraction
- Customizable reports and customizable geofenced areas
- Use of tracking devices from different manufacturers
- Open GTS system is independent of the operating system
- Open GTS system is i18n compliant and supports easy localization of other languages other than English

Disadvantages of Open GPS Tracking System are:

- No mobile application
- No remote control of devices
- The system is tied only to vehicles powered by a car battery
- Requires installation of additional expensive hardware for each vehicle
- A small number of customizable features on the server panel

2.5 RadinTechnology GPS Tracking System

RadinTechnology GPS Tracking System [14] is a real-time system for monitoring of people and moving objects using the GPS. The system is web-based and on the client side is needed only mobile device with GPS receiver on which is installed a mobile application that replaces expensive hardware and is used for receiving data from base stations and satellites and sending data to the server via the network.

For comfortable working, the RadinTechnology GPS Tracking System uses Google Maps for tracking of the devices. The advantage of the system is that can be powered by portable batteries that are small and have capacity to 20000 mAh, or the device can withstand more than a week without charge and is independent of the battery of the vehicle and can be used everywhere. Easily can be modified and extend with additional functionalities.

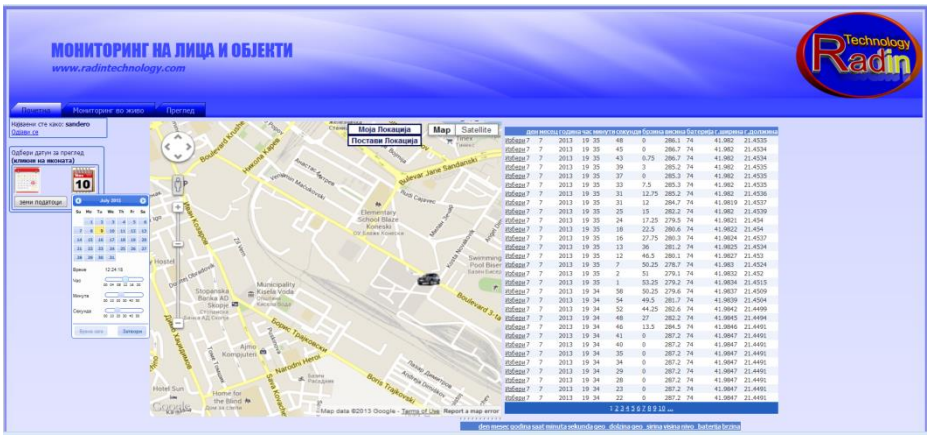

Fig. 5. RadinTechnology GPS Tracking System, the server part

The system has a lot of features, it has options for simulating a passed route between two dates, good reporting services, multiple devices per user account, 24 hour real time tracking of the device and is integrated with Google Cloud Messaging.

The system has mobile applications for Symbian, Android and one hybrid application for all other mobile platforms.

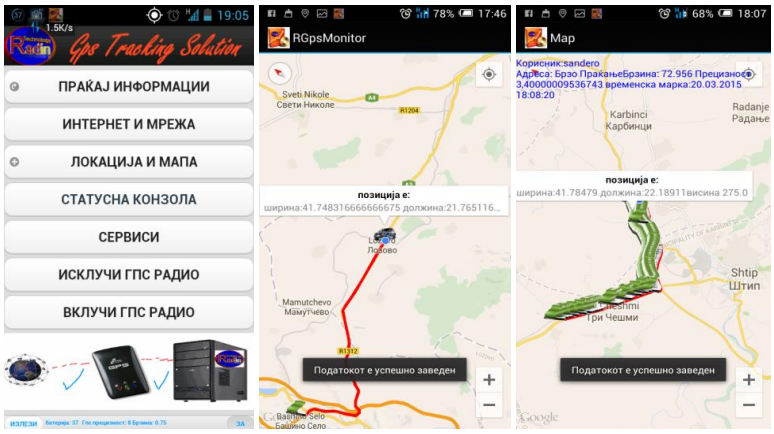

Fig. 6. View of RGPS Monitor mobile application

Key Features of RadinTechnology GPS Tracking System are:

- 24 hours real time monitoring , Web-based interface, customizable reports
- Complete history of movements at all times until a few years ago, through which you can find out when, where, why and length of travel.
- Users can be notified via SMS, E-mail or Push notification
- Intelligent background services of mobile applications
- Mobile applications RGPS Monitor Tracker and RGPS Tracker through which we can track vehicles and send data independently of the computer
- Remote control of tracking devices via SMS or push notifications
- Local database independent from server
- Remote database synchronization
- Export data to KML or TXT for future analysis in another map solution
- Simulation of passed route and length of passed route
- Optimized battery consumption of mobile applications
- Free notification sending to tracking devices directly from a web control panel
- Can operate independently(offline), and later sync
- Choice of various operation modes and data sending

Disadvantages of RadinTechnology GPS Tracking System are:

- No external navigation support
- The system has not been adjusted and tested to monitor vehicle telemetry such as fuel consumption in real time, the engine speed using the additional hardware which is built into the vehicle

2.6 Summary

The following table shows the results of the comparative analysis of the previous systems for tracking people and/or moving objects using GPS.

Table 1. Results of the comparative analysis

Features	Navixy	Frotcom	FollowMee	Open GTS	RTGTS
Tracking	Vehicles, people	Vehicles	People, objects	Vehicles, mob. phones	Vehicles, people, objects
Multiple devices at once	√	√	√	√	√
Trial/free version	30 days	x	√	√	
Web interface	√	√	√	√	√
Registration	√	√	√	√	√
Mobile application	√	x	√	x	√
Mobile platform	Android iOS	x	all	x	all
Additional hardware	√	√	x	√	x
Monitor of vehicle telemetry	√	√	x	√	x
Remote control	√	x	x	x	√
History of movements	all	√	up to 90 days	√	all
Update interval	Real time	1 min	>=30 min	Real time	Real time
Price	$99.99 - $299.99/month	√	up to $10 per device, one time	x	5$ per device, 50$ per company monthly up to 100 devices
User notification	SMS, E-mail Push	SMS, E-mail	E-mail	SMS, E-mail	SMS, E-mail Push
Reports	√	√	√	√	√
GPS precision/accuracy/speed	It depends from GPS receiver	It depends from GPS receiver	It depends from GPS receiver	It depends from GPS receiver	It depends from GPS receiver

3 Conclusion

There are a number of systems for monitoring people and/or moving objects. Some use additional expensive hardware, some are too complex, some are free but with limited functionality. The analyzed systems are one of the best existing systems for tracking people and moving objects

using Global Positioning System (GPS) that appeared on the market, without the last one, which is our recently developed product.

Depending of needs and price all systems have their advantages and drawbacks. If you need a complex system that works with external navigation and cost and complexity of installation is not important and is intended to monitor the vehicle and not the people then you can decide for systems like Frotcom or Navixy.

If you want a quick, simple and cheaper way to monitor not only the vehicles, but also people and moving objects, then it is advisable to choose a system like RadinTechnology GTS system.

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