GPSTrackP: A Low Cost Vehicle and Driver Management System

Detang Zhong, Jonathon Li, Hong Qiu
Mobile GPS Online
38 Constable Street, Nepean, Ontario, Canada, K2J 3E5
Phone: (613) 823-0926, E-mail: dzhong@mobilegpsonline.com

Abstract

Traditional vehicle and driver management systems can be categorized into two major types: tachograph-based systems and GSM-based systems. Tachograph-based systems monitor vehicle activities with passive or after the event data transfer. These systems are low-cost, but have no spatial perspective or tracking capability. GSM-based systems transmit data real time via cellular networks and can track vehicles with spatial perspective, but they are too expensive for most of the small and medium-sized businesses. With the development of mobile GPS technologies, a third and more desirable category has become available. Systems of this category use advanced GPS technology to combine the low-cost passive data transfer of tachograph-based systems with the tracking capability of GSM-based systems. This paper introduces GPSTrackP, a GPS tracking system of the new category developed by Mobile GPS Online.

Introduction

In today's business environment of escalating costs, effective and efficient utilization of resources is essential if a company or organization is serious in reducing its operating expenses. If the resources are out of sight, it is a critical requirement that the management system should have a capability to track the activities of the resources. Management must be able to differentiate between legitimate and illegitimate or unnecessary activities and trips.

Traditional vehicle and driver management systems can be categorized into two major types of systems: tachograph-based systems and GSM-based systems. Tachograph-based systems monitor vehicle activities with passive or after the event data transfer. These systems are low-cost, but have no spatial perspective or tracking capability. Their benefit is low. GSM-based systems transmit data real time via cellular networks and can track vehicles with spatial perspective, but the costs for real time data communication are too expensive for most of the small and medium-sized businesses. In brief, the availability of management systems can be described as follows:

- Low cost – Low benefit systems (passive data transfer without tracking)
- High cost – High benefit systems (live data transfer with tracking)

With the development of mobile GPS technologies, a third and more desirable category has become available. Based on advanced GPS technology, systems of this category can

not only monitor vehicles with passive or after the event data transfer but also have tracking capabilities with a spatial perspective. These systems can be described as:

- Low Cost – High Benefit (passive data transfer with tracking)

System Overview

For some businesses, such as goods or services delivery companies, real time vehicle and driver tracking and dispatching is not critical. The more critical factor for a successful management is how to increase the productivity and reduce the major operating costs through efficient management of labor, vehicles, and fuel.

To achieve this goal, they need:

- an efficient customer and customer order management system
- an effective and optimized job and route planning system
- a reliable performance tracking and management system
- an effective cost analysis and report system

To meet these requirements, Mobile GPS Online has developed the GPSTrackP system that utilizes:

- advanced GPS positioning and data storage technology to collect all trip data for performance tracking and business cost analysis
- Microsoft MapPoint as a GIS software platform for planning, scheduling, and tracking daily work routes or trips for each vehicle and driver in an efficient and optimal way
- database management technology to manage customers, drivers, vehicles and other resources and business data
- powerful software tools to generate different reports that answers questions like:
    - What are my drivers doing during the day?
    - Are the drivers delivering services or goods to customers on time?
    - How much time do my drivers spend at customers?
    - Are the drivers entering unauthorized zones during working time?
    - Are the company vehicles being abused?
    - How much time and fuel am I losing from idling engines?
    - Are my drivers speeding and where?
    - Are they wasting gas and time in finding roads to customers?
    - Are my drivers running on time throughout their scheduled routes?

- How can I estimate the labor cost more accurately and even get an automatic State Fuel Tax Report?

There are two fundamental principles behind GPSTrackP. The first fundamental principle is that tracking is a pre-requisite for efficient resource utilization and control. If drivers know that management has the capability to observe exactly where they go, how they get there, and how long they stay at customer sites, even if the information becomes available after the event, their attitudes and behaviors will change.

The second principle is that drivers' attitude and behavior can be effectively controlled and influenced with passive (or after the event) data transfer. This highlights the fact that although "tracking" is critical for management purposes, it is a totally different issue to "data communication or transfer". The concept that "tracking" and "live or real-time communication" are synonymous as proposed by the traditional fleet management systems is now no longer valid.

How Does GPSTrackP Work?

GPSTrackP system consists of two parts: GPS data logger units (hardware) and GPSTrackP software. The GPS data logger units are distributed to different vehicles or drivers. The GPSTrackP software is installed on an office PC.

When a driver is doing a service trip, turning on the GPS data logger will record vehicle positions, speeds, moving directions, and time derived from GPS with a predefined time interval. Once the driver finishes the trip, the data recorded in the GPS data logger is downloaded into the PC via the GPSTrackP software. The software displays the details of the completed trip on the map and allows fleet managers to view instant trip reports in the form of Microsoft Word and Excel.

As a powerful business management system, GPSTrackP can record all business-related data such as information on customers, services requests, drivers, vehicles, GPS data logger units, and trips.

As an efficient job or route planner, fleet managers can use GPSTrackP to plan and optimize the daily working route for each vehicle or driver according to customer services requests and their geographic distributions in a specific region. The planned route can be printed out or emailed to the driver for reference. If the driver is equipped with Mobile GPS Online's NavStar navigation system, the planned route file can be loaded directly into the system and used for real time navigation. In this case, the driver will have no difficulty in following the manager's plan.

Data Capture and Communication

GPSTrackP uses TripTracer (Figure 1) as its GPS data logger. The cost-effective data logger has the following outstanding advantages:

- As a two-in-one product, it can be both used as a GPS receiver and a recorder.
- As a GPS receiver, TripTracer can be used for navigation software such as NavStar while recording the GPS data.
- As a trip recorder, TripTracer does not require a PC in the vehicle to capture along the route travel data such as directions, speed, duration of stops, and positions.
- It can store over 2,400 hours (100 days) of recorded data in 1-minute sample interval.
- The recorded GPS data can be easily downloaded to a PC through a USB port.
- It is small in size, portable, and very easy to use.

Fig. 1: TripTracer GPS Data Logger

Fig. 2: GD30-L GPS Data Logger

Other similar compatible products are also available. Such an example is the GPS data logger GD30-L (Figure 2). It uses memory card technology for the storage of a large amount of GPS tracking data. It allows recording of hours, days, weeks, months or even years of GPS positions. The memory card's size and parameter settings can define the length of the time for recorded data, and MMC cards are available in 16MB, 32MB, 64MB and 128MB capacities.

The recording interval can be set from 1 second to 30 minutes by setting the DIP switches on the unit. No PC attachment is necessary for configuration. The same set of switches configure the NMEA GPS sentences that should be recorded, with available options for $GPGGA, $GPGLL, $GPGSA, $GPGSV and $GPVTG. The recorded GPS data can easily be transferred to a PC using widely available MMC memory card adapters.

Trip Profile and Map View

GPSTrackP allows the user to define areas and strategic zones as well as to set various rules and conditions on them. Based on the defined areas, zones, and rules, the primary data can then be manipulated and processed to provide the user with a very powerful management tool.

To identify different driver activities, GPSTrackP uses different markers in different colors, for example:

Arrows: show vehicle position and travel direction

Squares: show customer stops
Triangles: show unauthorized stops
Circles: show a deviation from a pre-defined rule or condition

The preplanned route is marked in green color. Figure 3 shows an example of a selected trip profile.

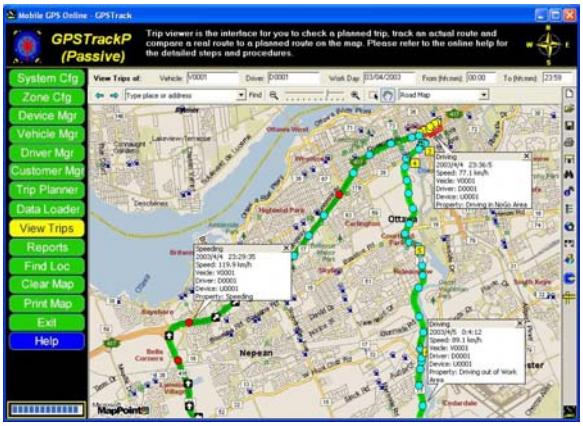

Fig. 3: An map view example of a selected trip profile

To check the property of a tracking point, the user can click on the marker. Then a detailed log record appears in a balloon text box as shown in Figure 3.

Data Analysis and Reports

GPSTrackP has a powerful and advanced reporting structure. It can provide the user with a wide variety of standard reports, ranging from violation management to detailed information on the activities of vehicles and drivers (see Table 1 for a complete list). Quality graphs and reports are automatically generated in the form of Microsoft Word and Excel. Reports can also be customized to reflect cost, productivity, efficiency or other business data.

Table 1: List of Reports

Report	Description
Customer Details	Report detailed customer information such as address, contact information, etc.
Customer Invoice	Issue an invoice for all services done for a selected customer up to a given date.
Customer Service Details	List all services requested by a customer during a given time period.
Customer Visits (Times	Report all customer visits done by a driver during a given

at customers)	time period and list the stopped times at each customer.
Driver Activity (Time distribution)	List a driver's driving, stopping, and idling time on a business trip.
Driver Details	Report driver classification, authorized vehicle, license number, home address, contact information, etc.
Driver Last Download	Report the last download time of GPS tracking data for each driver.
Driver Rating	Enumerate the number of time when preset rules are broken so as to allow the manager to establish driver performance and to scientifically distribute bonuses/incentives where applicable.
Driver Stops	List all stops that are longer than a specified time length so as to allow the user to identify unauthorized stops.
Driving Time and Distances	Report the time and mileage traveled and categorizes them into work and after hours.
Violation Details	List the violation of rules by vehicles/drivers during a given time period.
Violations Summary	List the vehicles/drivers that have deviated from the rules and conditions with comparable statistic numbers.
Graphical Time Scale	Identify graphically the trip in terms of all the driving and idling time and violations specific to a driver.
Graphic Speed Profile	Display graphically the vehicle's speed changes over time
Missing Data	Check for any gaps in the tracking data to assist in establishing missing data.
System Configurations and Status	Report system setup parameters and options, such as rules, work time schedules, holidays, current customer count, driver count, vehicle count, and track device count.
Tracking Data Details	List all activities (driving on road, stops and visits at customers) of a driver during a given time period.
Tracking Device Details	Record all tracking device information registered in the system.
Vehicle Details	Record vehicle classification and drivers who are authorized to use the vehicles.

Power and Benefit of GPSTrackP

GPSTrackP has emerged as a new generation vehicle and driver management product. Its power lies in the fact that

- advanced GPS technology is applied and packaged to "shatter" the price barrier of traditional GSM vehicle and driver management systems
- the user is supplied with accurate and comprehensive vehicle and driver information to have total control of vehicles and drivers
- effective vehicle and driver monitoring is possible without the need for costly and complex "real –time" communications
- the investment is secure as the product does not rely on the product supplier or any other third party after purchase
- there is no need to install sensitive and complex equipment in the vehicle

Companies that use GPSTrackP can enjoy the following benefits:

- better tracking of your vehicles and drivers on the road
- easier management of drivers, vehicles, and customers
- higher customer satisfaction resulting from detailed reports on service stops and deliveries
- better customer dispute resolution as a result of irrefutable data
- immediate reduction in fuel, maintenance, and insurance costs by controlling drivers' activities, including speed and zones
- more sales from more productive vehicles and drivers
- quicker response to improve business efficiency

At the same time, employees of the companies that use GPSTrackP can have their share of benefits:

- better protection against false customer accusations of late deliveries or arrival to scheduled spots
- no need to record mileage and customer call logs
- no fear of being accused of after-hour vehicle usage by employers even if the drivers bring company vehicles back home
- better employee bonuses translated from increased corporate savings
- increased driver safety

Case Study of Cost Saving

Suppose that a goods delivery company with 10 vehicles is located in Canada. The following tables show how much the company can save monthly, annually and over five years by introducing the GPSTrackP system.

Table 2: Cost Savings Calculation

Monthly Fuel Savings (unauthorized or wasted kilometers)		
Number of vehicles	10	Savings Experienced:
Average Monthly Driving Kilometers per Vehicle	1500	Transport: 5% - 30%
Fuel Cost per Liter	$0.69	Services: 10% - 30%
Consumption – Kilometers per Liter		Municipal: 5% - 30%
Consumption – Liters per 100 Kilometers	15	
Expected Savings (%)	15%	
Gross Monthly Savings:		$232.88
Monthly Fuel Savings (driving behaviors)		
Monthly Vehicle Maintenance Costs	$100	Savings Experienced:
Expected Savings (%)	20%	General: 20%
Gross Monthly Savings:		$200.00
Monthly Savings in Lost Productivity (unauthorized or wasted kilometers)		
Average Driving Time per Kilometer (Minutes)	1.8	
Labor Cost per Month per Driver	$3000.00	
Working Days per Month per Driver	21.25	
Working Hours per Day per Driver	8	
Gross Monthly Savings:		$1191.18
Savings Summary		
Total Monthly Savings:	$1624.06	
Total Annual Savings:	$19488.68	
Savings over 5 Years:	$97443.39	
Total Cost of the System		

Table 2 shows clearly that the cost saving with GPSTrackP is significant and immediate.

Conclusion

GPSTrackP has combined the low cost passive data transfer of the traditional tachograph-based systems with the tracking capability of GSM-based systems through applying the advanced GPS technology. It is really a low-cost but powerful GPS passive tracking system for vehicle and driver management. It uses passive GPS data loggers to collect tracking data, and then display, analyze, and report the tracking data through a powerful software tool. The key advantages of GPSTrackP are low investment, low cost (no monthly or ongoing cost) and powerful tools for increasing productivity and reducing operating cost.