INCREASING TRANSPORT EFFICIENCY BY USING WIRELESS TRANSMISSIONS

RNDr. Daniela Šusteková, PhD., Mgr. Lýdia Kontrová, PhD., RNDr. Marek Ďurica, PhD.
The Faculty of Operation and Economics of Transport, University of Žilina, Slovak Republic
sustek@fpedas.uniza.sk

Abstract: The main subject of this article is description of an actual two realizations of the connection between trucks and centre using GPS and GPRS and WI-FI technologies in Slovak companies. There are described advantages of the freight cars connection using wireless technologies, as advanced trends of wireless technologies using in the road transportation. There are described basic concept of wireless technologies GPS and GPRS and possibilities of using these nets in a road transport for Fleet tracking and realization of the connection between trucks and centre using WI-FI technologies.

Keywords: GPS, GPRS, Fleet tracking, WI-FI, server, mail server, dispetcher, freight cars.

1. Introduction

Improving quality using information technologies is currently one of the factors in improving the efficiency and competitiveness of transport companies. Comprehensive quality monitoring as an integral part of business performance is essential for successful management of transport companies. Information technologies is an accurate and appropriate tool for this purpose, providing online information on costs, consumption, performance and other process quality characteristics.

Appropriate deployment these technologies enables optimizing and simplifying traffic management, reducing costs, increasing revenue and profit, and speeding up the implementation of all activities needed in the area.

I describe in this article realizations in companies, that use technologies GPS, GPRS, WI-FI, computer nets and others to improve effectivity, reliability and competitiveness transportation in these companies.

2. Basic concept of wireless technologies GPS and GPRS

A GPS (Global Positioning System) receiver calculates its position by precisely timing the signals sent by the GPS satellites high above the Earth. Each satellite continually transmits messages containing the time the message was sent, precise orbital information (the ephemeris), and the general system health and rough orbits of all GPS satellites (the almanac). The receiver measures the transit time of each message and computes the distance to each satellite. Geometric trilateration is used to combine these distances with the location of the satellites to determine the receiver’s position. The position is displayed, perhaps with a moving map display or latitude and longitude; elevation information may be included. Many GPS units also show derived information such as direction and speed, calculated from position changes. It is using a several satellites formation on the middle earth orbit. It is able to afford data about the position independently of the weather 24 hours daily. [1]

Usage of GPS is very wide, for example in a road transport (Figure 1), in both military and civilian aircraft or for the tourist apparatus. In Slovakia it is often used as a monitoring and navigational device in a road transport. GPS device is a passive long measuring system, so GPS device is only receiver it does not transmit any data. GPS receives signals from different satellites it can see on the sky with navigational message including satellite path parameters and other useful information for position determination and the system status monitoring.

3. Fleet tracking using GPS and GPRS in transportation

Many transport companies successfully use GPS fleet tracking what brings them enormous advantages not only for the large but also for the small businesses (Figure 2).

The most important advantages of using GPS fleet tracking:

- Maximize Vehicle Utilization – devices are used in the most effective way
- Helps in customer satisfaction - by ensuring their safety and by the assets and inventory management.
- Ensure Vehicle Safety
- Resource Optimization
- Route Optimization
- Speed detection

General packet radio service (GPRS) is a packet oriented mobile data service available to users of the 2G cellular communication systems global system for mobile communications (GSM), as well as in the 3G systems. In the 2G systems, GPRS provides data rates of 56-114 Kbit/s. [3]

GPRS data transfer is typically charged per megabyte of traffic transferred, while data communication via traditional circuit switching is billed per minute of connection time, independent of whether the user actually is using the capacity or is in an idle state. GPRS is a best-effort packet switched service, as opposed to circuit switching, where a certain quality of service (QoS) is guaranteed during the connection for non-mobile users.

Fig 1. GPS,GPRS Communication in public transportation
Fuel Monitoring

Real Time Monitoring

In the next part, I will show realization of fleet tracking in any Slovak company using GPS and GPRS.

Fig 2. GPS and GPRS communication in a freight transportation

4. Fleet tracking by realization of the connection between trucks and centre using GPS and GPRS in Slovak transport company

Following text describes computer network realization in the company providing transport and logistics [Figure 3]. Using of GPS and GPRS technologies to connect transport devices with the whole company’s computer network enabled simplification of transport management, namely domestic freight traffic and international truck transport along with a strong cost cutting and increasing of income and profit.

Fig 3. GPS and GPRS in the out-plant freight-transport

4.1 Computer network is created:

Central part is made from LAN network with components:

- Dispatching computer
- Computers in workrooms
- Computers on the economy section
- Communication server

Freight cars with a board-computer with a GPS receiver and GPRS terminal

4.2 Functionality of single workplaces

Board-computer in a vehicle’s cabin scans a vehicle position using GSM and according to the data the computer is filling daily record of driver’s performance. Driver inputs expenses into the computer that he has during a working day. All data from the board-computer are sent to the central computer using GPRS and then to the dispatcher where they are executed and evaluated. [4]

According to information from centre where requests for transport are gathered, the dispatcher sends commands to drivers.

Data from board-computer are used by dispatcher for:

- Monitoring of the vehicle status, monitoring of driver’s output
- On the economic section for:
  - Preparing of invoices, monitoring of the expenses

4.3 Advantages of the freight cars connection using GPS and GPRS

Described realisation simplifies transport management, namely domestic freight traffic and international truck transport along with a strong cost cutting and increasing of income and profit. More precisely there can be specified following advantages. [5]

- Localization of vehicles
- Optimization of driver’s work
- Electronic daily record of vehicle/driver
- Automatic processing of the driver’s output
- List of lines
- Consumption checking
- Cost saving
- Simple and quick assembly without check on vehicle
- Minimizing manual manipulation
- Access into the system 24 hours daily anywhere in the world

5. Basic concept of wireless technology 802.11 WI-FI and BlueTooth

WI-FI nets are standardized by IEEE 802. committee as the rule 802.11. These nets operate in an unlicensed frequency range 2.4 and 5 GHz and they reach speed about 56 Mbit/s. Individual user does not need permission of a local offices when he uses WI-FI nets. In our country the permission is given by the telecommunication office as a Common permission, it is not paid, but it is necessary to respect the specific conditions.

It allows creating a computer network LAN without cables and in this way to decrease the costs of building or expanding the net.

Wireless connections WI-FI are profitable in those areas where it is not possible to use cables – for example in the exteriors or historical buildings, in places where repositioning of the computer configuration is very often or for the companies, which need to connect computers on different locations (for example transport systems).

Bluetooth technologies are an open wireless protocol for exchanging data over short distances from fixed and mobile
devices, creating personal area networks (PANs). It was originally conceived as a wireless alternative to RS232 data cables. It can connect several devices, overcoming problems of synchronization. Bluetooth and Wi-Fi have many applications in today’s offices, homes, and on the move: setting up networks, printing, or transferring presentations and files from PDAs to computers. Both are versions of unlicensed wireless technology [2].

In nowadays is WI-FI technology used in every transport devices for many reasons. Very important is on-board WI-FI, that helps to improve the commuters’ travel experience, optimize public transport planning and increase public transport ridership for a more environmental-friendly society.

6. WI-FI technologies realized in a road transport in Slovak transport company

Following text and figure 4 describes computer network realization in the Slovak company providing transport, forwarding and storing. To connect moving trucks with computers in the branches and overall computer network it was necessary to use wireless nets Wi-Fi.

![Computer network for company providing transport, forwarding and storing.](image)

**Fig 4.** Computer network for company providing transport, forwarding and storing.

6.1 The computer network is created:

**Central part**, it is made from LAN network with components:

- **Servers:**
  - Web server
  - Windows Server
  - SQL Server
  - Mail server

- **Stations (Windows) with functions:**
  - Company accountancy
  - Stock holding
  - Invoicing
  - Bank connection

**Branches where are:**

- **Central computer**
  - includes radio WI-FI adapter for receiving data from trucks

- **Trucks** – including
  - PDA computers (with bar code reader,
    - Stock holding programme,
    - fiscal module,
    - printer connected by Bluetooh).

6.2 The description of the storage and removal process:

Employees during stock loading are reading product bar code, by using WI-FI radio adapter they are sending data into the central PC and after the process is finished (truck is full with desired stocks) the car leaves the area.

Truck drivers deliver stocks to customers, given stocks are scanned by terminal and the invoice or cash account is printed (scanning terminal as well as printer are situated in the truck cabin). After the car unloading truck drivers print out bill of delivery and record potential order into the PDA.

Usually the terminal has following functions:

- Issue of the bill of delivery
- Issue of the invoice
- Cash sale and registration in a fiscal module, actually all the store system for the car as a store
- Registering of orders
- Registering of customer requests for example request for new assortment

After the truck returns to the branches, car PDA connects with central computer and sends all information about made supply, invoices, orders and cash sales. In a central computer it is possible to see the cash desk status – cash money, made invoices and bills of delivery that should be invoiced consequently. After data computing data sent into the Centre.

6.3 Advantages of wireless connections uses for firms and companies that are using means of transport:

- possibility to change supply according to the actual request of the customer and stocks availability in the car
- possibility of the cash sale, if the customer has low payment discipline
- branches does not deal with entry, only with the issuance, the entry of more branches can be done by headquarters
- In the headquarters it is possible to optimize the orders according to current status of the stocks on the branches and according to obtained orders

7. Conclusion

It is necessary for each organization to connect computers into computer network in all objects independently on the fact whether these objects are static in some areas or are moving out of the main building. In such cases it is inevitable to use radio communication medium. This in very lucrative financial conditions can connect computers placed in trucks with the computers in the central LAN and it allows keeping updated status of the company databases immediately after the change of the stock reserves [4].
REFERENCES


