

LOCATION AND CONTROL OF CARGO AND VEHICLES WITH NEW TECHNOLOGIES

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This paper presents several ideas of effective transport systems technologies, technological solutions in systems for identification objects on the road.

In the article is theoretically shown the coherence of new technologies and new possibilities for location and control of cargo and vehicles with systems of navigation and positioning system. The expansion of Internet connectivity by GSM-GPRS network to transport elements allows using of new possibilities of differential GPS (GNSS) techniques and applications.

Keywords: *cargo, technologies, location, vehicle, control*

1. INTRODUCTION

Rapid development of teleinformatics makes an influence on the development of telematic system. We can distinguish many systems that help to drivers and transport clients.

At present telematic solutions are used in road transport. Transport telematics consists of the following aspects:

- Transmission of information to and from a vehicle (Telecommunication);
- Processing of information (Information Technology);
- Information usage for safe transport and effective usage of already existing technologies' solutions.

Such changeable light boards as navigation systems, the Internet, mobile network are just few examples of telematics usage in road transport.

2. PERFORMANCE PARAMETERS DEFINITION

The first step in addressing the ITS architecture requirements should be the analysis and establishment of performance parameters in telematics applications, in co-operation with the end-users.

The methodology for the definition and measurement of the following individual system parameters is being developed in frame of the ITS architecture:

- Reliability – the ability to perform required function under given conditions for a given time interval.
- Safety – risk analysis, risk classification, risk tolerability matrix, etc.
- Availability – the ability to perform the required function at the initialisation of the intended operation.
- Integrity – the ability to provide timely and valid alerts to the user when a system must not be used for the intended operation.
- Continuity – the ability to perform the required function without non-scheduled interruption during the intended operation.
- Accuracy – the degree of conformance between a platform's true parameter and its estimated value, etc.

Substantial part of the system parameters' analysis is represented by a decomposition of system parameters into individual sub-systems of the telematic chain. Part of the analysis is the establishment

of requirements on individual functions and information linkage so that the whole telematic chain should comply with the above defined system parameters.

The completed decomposition of system parameters will enable the development of methodology for the follow-up analysis of telematic chains according to the various criteria (optimisation of the information transfer between a mobile unit and processing centre, maximum use of the existing information and telecommunication infrastructure, etc).

3. MOBILE LOCATION

Mobile Location is fundamentally characterised by two aspects: mobility and location information.

Mobile Location Services are the services that exploit knowledge about as follows – where a mobile terminal capable of wireless data transfers is located. The end user or another person may carry the terminal, or it may be attached to the object. The wireless data connection is typically based on cellular technologies or wireless. Network-based positioning, satellite positioning or indoor positioning technologies can define the location of the terminal. The most suitable technology depends on an application, the environment and the terminal capabilities. As the mobile location services sector is still in its early phases, the terminology varies and they are also called location based services, location enhanced services and location dependent services.

Typical professional applications include, for instance, fleet and mobile workforce management as well as routing and navigation. Location information is very important in various fields and for various purposes.

4. LOCATION SYSTEM STANDARDS

Now and in the near future we will have the opportunity to use the advanced ITS systems based on the standard Location Systems.

The emergence of road transport means is supported by telematic solutions like:

- Traffic monitoring equipment (sensors, detectors, steering equipment, video detectors), television supervision devices (supervising cameras);
- Systems of satellite navigation (GPS, GLONASS, EGNOS, GALILEO);
- Derivative systems used in navigation;
- Systems of radio communication;
- Geographical data bases (GIS);
- Bases of road data;
- Electronic cards;
- Weather monitoring and measuring systems and other.

The GPS is well known as a global navigation satellite system. The analogous systems are the Russian GLONASS and GALILEO system prepared by European Commission and European Space Agency. GPS is the foundation of the present navigation systems. Actually, the GPS is the only one fully applicable global satellite position determination system in the world.

GALILEO will be Europe's own global navigation satellite system, providing a highly accurate, guaranteed global positioning service under civilian control. It will be inter-operable with GPS and GLONASS, the two other global satellite navigation systems. A user will be able to take a position with the same receiver from any of the satellites in any combination. By offering dual frequencies as a standard, however, GALILEO will deliver real-time positioning accuracy down to the metre range, which is unprecedented for a publicly available system. It will guarantee availability of the service under all but the most extreme circumstances and will inform users within seconds of a failure of any satellite. This will make it suitable for applications where safety is crucial, such as running trains, guiding cars and landing aircraft.

With the help of the GALILEO, SBAS, EGNOS, THALES NAVIGATION, etc. systems with the needed precision objects position may be estimated. It is very important when we have to watch a truck whose position is always changing in the digital map [1].

These systems are the instrumentality to managing land transport in Europe, whether they are by road, rail or inland waterways. They increase both the capacity and the safety of land transport. Not

only airlines but also companies, which operate transport services, need to know where their vehicles are at any times.

As well as improving safety, world satellite navigation and positioning systems are an invaluable aid to managing transport operations. Managers will be able to know exactly when a consignment has been held up and its exact location. This will also improve customer services as clients can be notified of delays and the reason for them and when necessary breakdown crews can be sent out immediately.

5. DOCUMENTS AND MOVING OBJECTS TRACKING SYSTEM

Documents and Moving Objects Tracking System is supplemented by possibilities to control not only cargo documents movements, but also present cargo carrier physical movements, using tracing possibilities, supplied by Global Positioning System (GPS) and Geographical Information Systems (GIS). In addition, several communication channels are used (GSM, Radio Channels or Satellite).

Moving Object Tracking System consists of two main components (Fig.1):

1. Objects Tracing Subsystem;
2. Tracking Communication Subsystem [4].

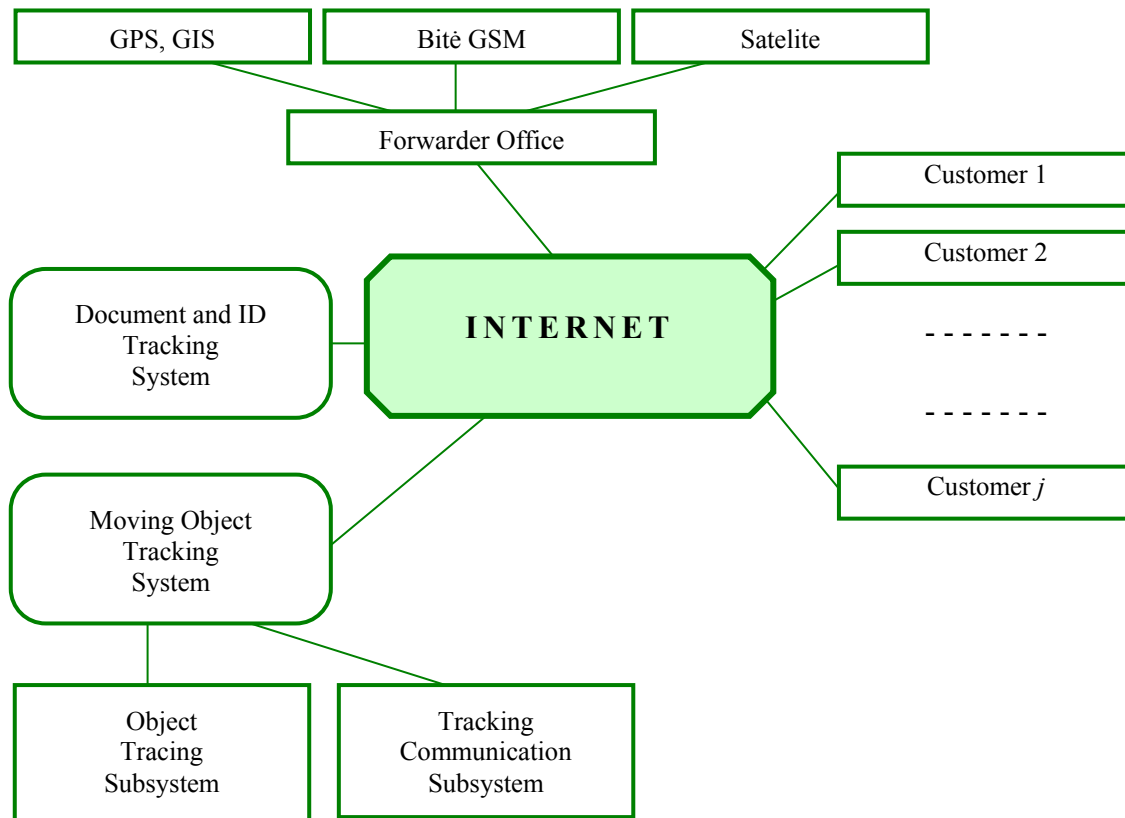


Figure 1. Documents and Moving Objects Tracking System

Object Tracing Subsystem serves for driver of a truck to know his transport movement route. There are two constituent parts in the heart of tracing subsystem: GIS module and GPS engine module.

GIS module stores area chart image, which is shown by driver request on the monitor in the cabin. GPS engine ensures truck coordinates calculation by getting signals from GPS satellites. As a result on the display screen we can observe truck movement area chart. This kind of tracing or navigation system should be presented as a part of equipment in any car.

Tracking Communication Subsystem is created of different communication channels, which ensure on-line transmission of information about truck and freight movements to Moving Object Tracking System. In this case satellite communication channels are used.

Tracking Communication Subsystem is presented in Figure 2.

As a result, Operator of the Moving Objects Tracking System at central office can see and control several cargo movement routes.

There are the following benefits for using of this system:

- Transport driver's working quality control (whether he does not spend more than allowed time on a parking and whether fuel consumption corresponds to reported route);
- Cargo movement forecasting (client is able to get ready for cargo receiving);
- Route corrections possibilities (if there are delays on one part of a route, it is possible to change object movement direction);
- Movement safety rising (it is possible to identify a driver, block vehicles engine; it is possible to press alert button in case of unlawful interference).

Documents and ID tracking system is such a cargo tracking system, where movements of documents and identification numbers are controlled using total routes database.

If we know Tracking Number, which is printed on cargo documents, then using Internet it is possible to follow cargo movements among UPS hubs.

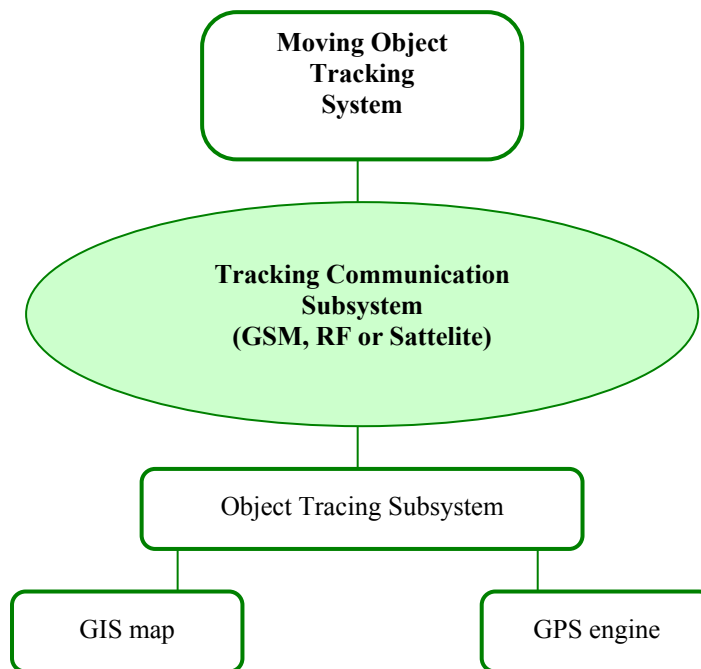


Figure 2. Moving Object Tracking System

Tracking and location systems play an important role in transportation of dangerous loads because dangerous loads bring big danger for the environment and the society.

6. SOFTWARE APPLICATION

The catalogue of telematic system has the client-server structure. All data are stored in separate place (computer) named the server. Access to its data is possible by a client applications installed on the user's computer. Clients are connected via, for instance, a local area network (LAN) or wide area network (WAN) [5]. The solution gives many advantages for future users. The central bank of data (server) gives certainly that all users have an access to the same updated data. Any change of the infrastructure telematic system may be input to the catalogue system directly by the service that change made. It causes that the update data will be available for all users soon after updated. Access to the server's data is restricting depending on the service need. It protects against free access to the data for the unprivileged persons.

The local database contains all necessary information about the saved telematic systems, their items, remarks, etc. The digital map server stores a graphic representation of spatial locations a system's item may be found. The external databases module allows users to access to an external temporary databases to improve the knowledge about the telematic system. The graphic user interface combines all data that comes from different module into the one comprehensible view easy to interpret by user. The map scanner allows to the preparation of external maps to use with the system. The last module is responsible for the analysis-loaded data from the server as an answer to user's question. Other function the last module has is the reporting. It is the one of main functions of a catalogue program. Particular parts of the software are presented in Figure 3.

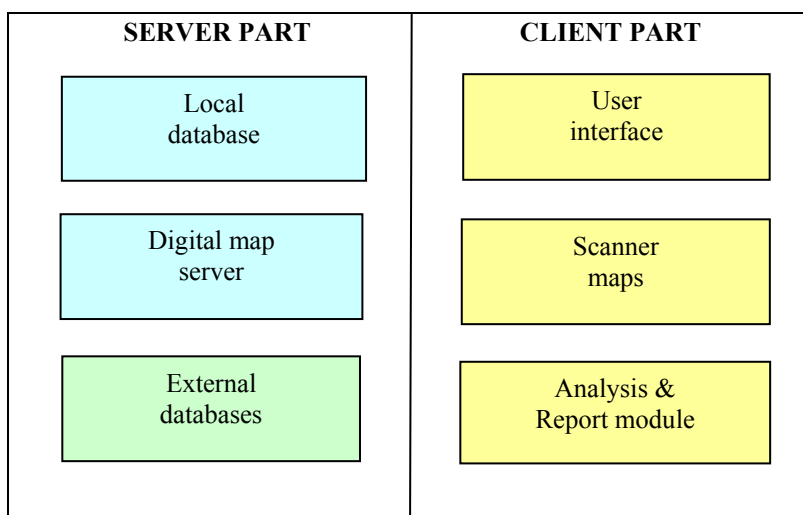


Figure 3. Main parts and modules of the catalogue of telematic systems

7. CONCLUSIONS

1. It is important to use decisions of transport mobility in the transportation of road transport.
2. Concerning safety improvement, world satellite navigation and positioning systems are as an invaluable aid to managing transport operations.
3. It is necessary to use vehicle and loads tracking on their trips in the forwarder of road transport.
4. Tracking and location systems play an important role in transportation of dangerous loads.

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