INTELLIGENT TRANSPORTATION AND TELEMATICS

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***Abstract**: Artificial intelligence (AI) has now become a reality and, in many areas, it is already used, being very secure. Communication with a car now has a variety of different functions, most of which use the cloud. Without data, it's nothing. Vehicle telematics has evolved and allows for a wider range of capabilities including navigation, tracking driver behavior, E-key calling and guidance on efficiency fuel consumption. Opportunity and challenges regarding the development of Intelligent Transport Systems, from the perspective of potential users, require data that must be transformed into accessible information, so that road users can adapt their driving behavior according to weather conditions, traffic jam information and estimates waiting time but also other information to increase the general traffic safety. Information stored on the vehicle's computer or, more likely, on the manufacturer's or service provider's servers, will be transferred from one vehicle to another, as long as the technology is compatible when a user switches their car.*

***Keywords:** telematics; positioning; Intelligent Transport System; Global Navigation Satellite System;*

1. Introduction

Today's vehicles are connected and integrated into our digital lifestyle, more and more. However, in order to make the transport system safer and more efficient, the vehicles must interact directly with each other and with the road infrastructure.

Cooperative Intelligent Transport Systems (C-ITS) will enable road users and traffic managers to use information and coordinate their actions, which are essential for significantly improving road safety and efficiency traffic. [2]

Car manufacturers, technology and telecommunications providers, road user organizations, public transport, and cities and researchers are stakeholders for the implementation of C-ITS in as many countries as possible.

Intelligent Transport Systems (ITS) are a combination of communication technologies and traffic and traffic management systems to improve the safety, efficiency and sustainability of transport networks to reduce traffic congestion and improve driver experiences. Possibilities are endless. [1]

- Road network performance can be monitored and adjusted in real time;
- Data previously collected by expensive physical infrastructure can be provided through new, richer data sources;
- Analysis from historical data can now be done by systems that provide real-time information;
- Road user choices previously influenced only by road signs can be influenced by a wide range of publishing channels, such as personal mobile devices or car navigation systems;

- Road administration services and approaches need to have a clear strategy to bring together systems and services to telephony and telecom operators in the shortest possible time.

2. Intelligent roads

Considering how roads are used today and how they will be affected by the introduction of connected and autonomous vehicles (CAV), transportation agencies must prepare for the future. Imagine if each vehicle has sent a signal when it hit a pit, sending detailed information about road conditions to transport agencies. In the short term, it will provide information that helps to resolve problems immediately. In the long term, this information can help build better roads.

Fig. 1. Portal with sensors and cameras

Fig. 2. Concept of intelligent road
(Source:Korea Expressway Corporation)

Active transport planning and design can reduce the demand for road infrastructure, improve the performance of multimodal networks, increase safety and reduce the cost of building and maintaining traditional car-based roads and will support the development of smart cities.

From conceptual network planning to detailed design and implementation of facilities, the multidisciplinary approach helps to create healthy and sustainable communities through innovative and efficient transport solutions as well as complete road planning and design. The benefits associated with efficient transport networks include:

- Minimizing capital expenses for roads and parking;
- Improve travel efficiency;
- Climate change reduction;
- Supporting the use of public transport;
- Increasing responsibility for the community;
- Improve overall health and promote an active lifestyle.

Through collaboration between transport planning agencies, land use planning and urban design teams, complex projects can be developed to improve access to transit, promote active travel and road safety, generating economic activity. Specialists can develop strategies to change people's behavior to maximize the potential of passenger transport, cycling, pedestrians and a high level of vehicle occupancy.

Integrated and multidisciplinary capabilities allow for successful guidance of active transport projects from concept and planning to detailed design and deployment.

- Planning and design of pedestrian and bicycle facilities;
- Vehicle speed reduction and traffic management solutions;
- Multimodal transport planning;
- Road marking and markings;
- Environmental management;
- Landscape design;
- Risk management evaluation;
- Infrastructure management strategies and tools;
- Road safety.

For road users, ICT (Information and Computers Technology) and ITS technologies are also developing with the active support of data giants, encouraging research on smart communication and connectivity. It is dedicated to the planning and development of sustainable cities that will use ICT systems to build smart infrastructure. This will create more opportunities, because such cities will require significant IT (Information Technology) network infrastructure, plus integration and data management. [3]

3. Smart vehicles

The younger generation of users is more related to smart phones than their cars. In response, car manufacturers are turning to integrate smart phones and tablets into their vehicles.

Adding such technologies gives drivers the opportunity to stay in touch with their digital world on Twitter, Facebook and SMS while using their cars. This has significant implications for road safety because drivers are already in difficulty by using mobile phones while driving. However, there are advanced driver assistance systems (ADAS) and vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) systems that are quickly emerging to solve this problem.

As shown in the picture below, the intelligent machine is more a personal assistant than a vehicle. This will eventually help the driver make decisions, find social and business opportunities, and keep both the driver and connected passengers where everything communicates continuously altogether in real time.

Fig. 3. Intelligent car (Source: Cisco IBSG, 2010)

As shown in the picture below, the car of the future will likely change the vision and business model of the automotive industry. This leads to linking a range of services, media and media systems to the car brand product.

This vision for a car or a "portable personality" truck that has enough artificial intelligence to drive almost alone may seem futuristic but relies on technologies that already exist.

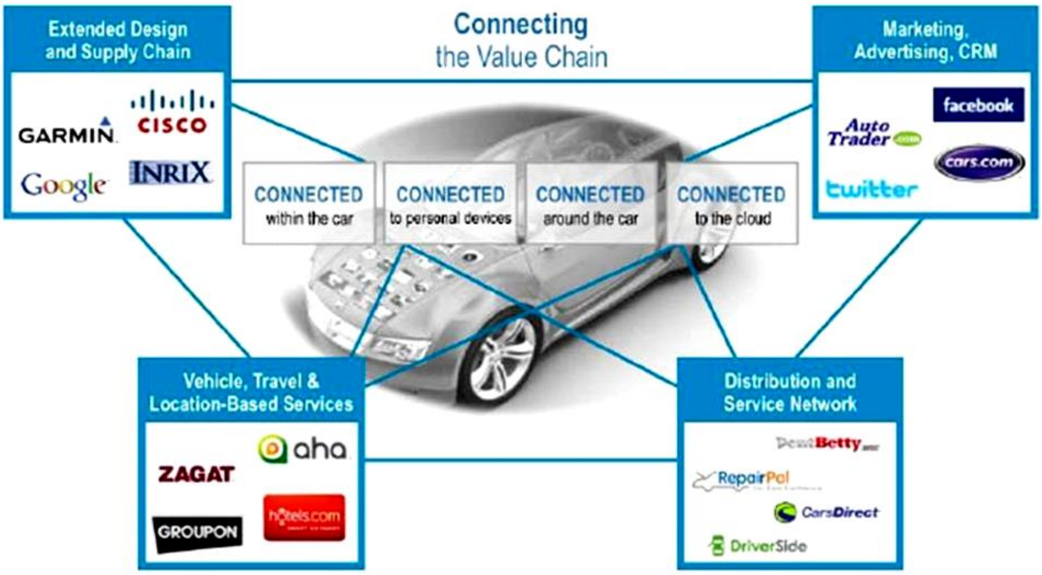

Fig. 4. Car with personality (Source: Cisco IBSG Automotive, 2011)

Some technology experts foresee a future where the omnipresent connectivity concept will see everything, from computers to coffee mugs, talking to each other and exchanging data. This will require an investment in smart infrastructure to allow us to keep pace with the globally connected digital world.

4. Geo-information support for intelligent transport

Traffic congestion, fuel costs, reduced air quality and infrastructure spending are just a few of the transport issues that directly affect users every day and everywhere.

Many viewers see this as an opportunity to implement digital technology to improve the transport network. As a result, a number of companies are making huge investments to create a "smarter" transport system that uses Connected and Autonomous Vehicles (CAV).

The question is - while we are in a hurry to digitize and electrify the transport system, how will we manage road data and addresses, and especially data sharing and communication?

The most popular road data application is for localization. You may want to know where you are at a time or to get to a place, or simply share your current location and activity with others on social media. [4]

Another major use of mapping data is routing or navigation. Today, GPS and communication technology easily enables a variety of transport applications that can be handy. These applications not only provide users with a route, but also step-by-step directions to reach their comfortable destination. These applications require current and accurate geospatial data. For example, when using a car navigation system, road and address data need continuous updates or its performance can be compromised - driving routes or inaccurate destinations, and travel times are longer. Many people rely on the smartphone to make sure they have the most up-to-date routing data. However, although smart phones offer real-time routes on the map, they can use a significant amount of data.

When we talk about transport, we cannot ignore traffic congestion. Certain applications have exploited this obstruction, allowing users to report congestion, so others can avoid those clogged roads by alternative ways.

Fig. 5. Traffic jam in Bucharest

One of the most important players in traffic reports generated by users for routing is Waze, the world's largest community-based traffic and navigation application. Waze allows other drivers to automatically share traffic and road traffic information in real time to avoid congestion, saving time and fuel on daily journeys.

Fig. 6. Waze connectivity

Many important government applications use this road and address data daily. These include police, firefighters, ambulances, urban planning, environmental assessments, public transport, cycling routes and tickets. While it is well known that data collected and used by the government is not perfect, they are sufficiently precise for the applications for which they are used. [5]

Experience has shown that aggregating transport data at all levels to produce a road network with the only authority using telematics technologies is quite feasible and efficient. Although it may not be possible to create a geospatial database and a geospatial address, it is very possible to make a very accurate database that is constantly updated.

In-vehicle applications containing road and address data are time and money savings for users, based on the most accurate and reliable data. This requires a single, current and complete roadblock and current address database.

While still under development, Autonomous and Connected Vehicles (CAV) need map data to find the best route from location A to location B, plus to stay on the road. However, the level of accuracy of the spatial data required for CAVs is much higher than for navigation systems or current government requirements. Like Waze, these CAVs will share map and real-time traffic data through communications links, and many of the sensor data will be geocoded on map data. These high-definition CAV maps will be very accurate and will correct existing map data to support self-contained and safe driving.

In order to allow for an uninterrupted transition in the new era of CAVs, we must ask ourselves: are accurate our road maps and addresses, reliable and effective to facilitate computerized management and ensure complete safety? The key is to make sure that, as new roads are built, lanes are closed, traffic is blocked or open new bridges, road information and address are collected and communicated to all vehicles (including you) in real time.

Two opportunities have emerged in recent years that can make a significant advance towards traffic management:

- have matured two types of technology: radio frequency identification, known as RFID (Radio Frequency IDentification) and shape traffic environment GIS (Geographic Information Systems);
- the carbon pollution issue has become stringent, which has the effect of increasing the acceptability of a decision to introduce carbon dioxide taxation within urban communities, leading to the passage of road freight transport to intermodal freight transport.

A geospatial solution is not a simple map, a map that GIS involves much more than an "engine" data processing with spatial characteristics. Once the visual border is exceeded, the GIS map becomes a remarkable collection of alphanumeric data (attributes) and geographic data (positioning elements) that are usually the result of workflows made by staff from different functional compartments of an institution.

The power of a GIS is the complexity of the database that is attached to the digital plan; the map is the visible part of the system, its quality being given not only by the precision of the drawing, but also by the database that the map has in the back. The more complex the database, the higher the quality of the queries answers, and the map gets smarter, because the end goal is to allow a user to find complete answers to problems raised in a given area.

GIS systems are not simple components of an integrated IT system, but turn into true data integration platforms that, even if they come from specialized subsystems, share the spatial feature.

GIS systems have evolved from "technology islands", which were addressed to a small group of specialized users, to inter-departmental and inter-institutional solutions and platforms that allow the analysis of already existing alphanumeric information from a new perspective: geographic location.

The implementation of the geospatial solution must reflect an integrated approach to information and should proceed from a detailed analysis of the data flows, objects to be managed within the geospatial solution, the attributes and origin of the information from these attributes, as well as the "actors" who will interact with these data and the rights they have in relation to each object and attribute.

5. Conclusions

The Internet of Things is a term that refers to the totality of physical objects, vehicles, buildings or other types of objects incorporating electronic systems, software, sensors and actuators that are connected to the Internet and which are thus capable of collecting and exchanging data between them.

There is a growing perception of a future in which vehicles are increasingly connected and interconnected, and GPS tracking services with increasingly sophisticated GNSS (Global Navigation Satellite System) are becoming more and more common and will evolve to meet new needs of users.

Traffic will not be a problem, since more than half of the vehicles in circulation will be autonomous. Vehicles will know exactly what and how to bypass congested routes or to avoid any traffic problems due to adverse weather conditions. In these circumstances, drivers will not be stressed, will not be constantly alert and state of tension, only oversee data related to race, data provided in real-time systems in the vehicle, possibly can read a book or watch a movie on mobile devices. Most of the time, they will not have to intervene.

The transformation process has already started in the transport industry once products such as GPS tracking systems or digital tachographs with the possibility of downloading remote data are already good practice standards. That while mobile devices with increasing power of computing are becoming more affordable, smart sensors and cameras consume fewer resources, mobile internet bandwidth widening is more accessible, so these technologies can be used on a wider scale. That translates into more data that can be transmitted in real time fleet managers, so that they can make decisions better and better to reduce operating costs.

6. References

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