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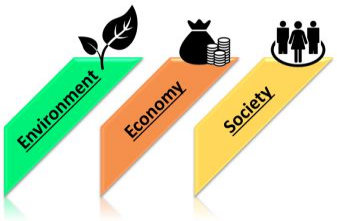
Space for Sustainability Award

Special Mention of the Jury	2016 Edition



Traffic Eyes from Above

"Traffic Eyes from Above" aims to bring benefits from space to ground to facilitate a safe driving way when visibility conditions are precarious, offering traffic awareness of other vehicles in the vicinity on a display interface of the navigation system, and to reduce the number of vehicle incidents and accidents. With help of this project it is desired to increase the road safety and reliability when using this transport method, increase the driving self-confidence, reduce the number of road accidents, avoid traffic jams, and decrease carbon dioxide emissions over a zone.

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Traffic Eyes from Above

Proposal submitted for the 'Space Sustainable Award 2016'
by Cristian Lazar

1. Introduction

The 'Traffic Eyes from Above' is a proposal that aims to support the space sustainable development on Earth and to bring many benefits to the society, environment and economy.

Since automobiles are still the most common mode of transportation in Europe and worldwide, it is desired to increase the road safety and reliability when using this transport method, increase the driving self-confidence, reduce the number of road accidents, avoid traffic jams, and decrease carbon dioxide emissions over a zone.

According to the National Safety Council, buses, trains, and airlines have much lower death rates than automobiles when the risk is expressed as passenger deaths per mile of travel.

In 2000, the passenger death rate in automobiles was 0.80 per 100 million passenger-miles. The rates for buses, trains, and airlines were 0.05, 0.03, and 0.02, respectively.

The National Transportation Safety Board (2006) reports 1.3 deaths per hundred million vehicle miles for travel by car, and 1.7 deaths per hundred million vehicle miles for travel by air. In Europe, the most risky method of transportation is on the road due to higher rates of fatalities and injuries compared to air or rail transportation. Based on EU Transport Commission statistical pocketbook ed. 2013 the road fatalities reached a number of 30,268 while the rail fatalities was 38 and air fatalities reached 6. In 2015, the total road fatalities reported in Europe reached 84,589 based on WHO Global Status Report on Road Safety.

As it can be observed many people did not made it home or they were involved in serious injuries.

2. Description of the idea

The automotive navigation system implemented onboard vehicles, or the GPS navigation devices and smartphone software/applications are very helpful to facilitate the driving. In present almost every car is manufactured with an onboard navigation system and in the future is desired to have all the vehicles equipped with navigation system. More functions and abilities of the navigation systems will be a must in the near future.

One important function of the navigation system is to have displayed on the map a real-time interface positioning indicator of the near-area vehicles in order to see their presence approaching or moving away from us.

2.1 Benefits behind this idea:

The driving reasons of implementing such an interface on a navigation system map is to:

- ✓ Help to improve daily life and road transportation system
- ✓ Increase the driving reliability and safety
- ✓ See traffic in other directions: Decrease the number of automobile accidents due to unreliable or risky overtaking (while the approaching car is not clearly visible due to driving circumstances or weather conditions with low visibility (dense fog, heavy rainstorm, etc), and even avoid crashing with another car from behind that is already engaged in an overtaking and is not visible in the mirror due to the mirror blind spot).
- ✓ Help in critical or emergency situations. For instance: if the vehicle unexpectedly stops working while in desert and you need help or rescue and nobody is around, this navigation application will have an alarm "button" that triggers a blinking signal on every other similar device in the close area, so that other drivers can see your emergency signal.
- ✓ Traffic jam avoidance. Especially in overpopulated areas traffic jams can easily form. Therefore with help of the real-time interface of this navigation application the agglomeration will be visible on the display. In addition, this functionality could automatically notify the navigation system and offer route alternatives to the user. This way the traffic jam will be avoided and would help to be dissipated.
- ✓ Awareness in low-visibility intersections or street junctions due to no field of vision of other vehicles. Thus, another vehicles will be visible on the navigation map if they are not visible due to a curve which restricts the field of vision. With this functionality the street intersection mirrors will not be needed anymore or just to double check the situation.
- ✓ Involve multiple business-field opportunities and cooperation with multi-national stakeholders (companies and industries such as Google Maps, automobile manufacturers, software developers, Galileo GNSS for European cooperation and space data usage, satellite data receivers, ground stations, etc)
- ✓ High-accuracy data (information about speed, time and distance traveled by other vehicles). Real-time data will be assured with software development which calculates the next position of a vehicle.

In the figure above, it can be seen a prototype navigation system map with the *green* arrows which indicates the other moving vehicles in the near area, and the *red* arrow which indicates the request-for-aid alarm situation of a car. The *blue* arrow depicts the personal vehicle location and direction.

2.2 Implementation

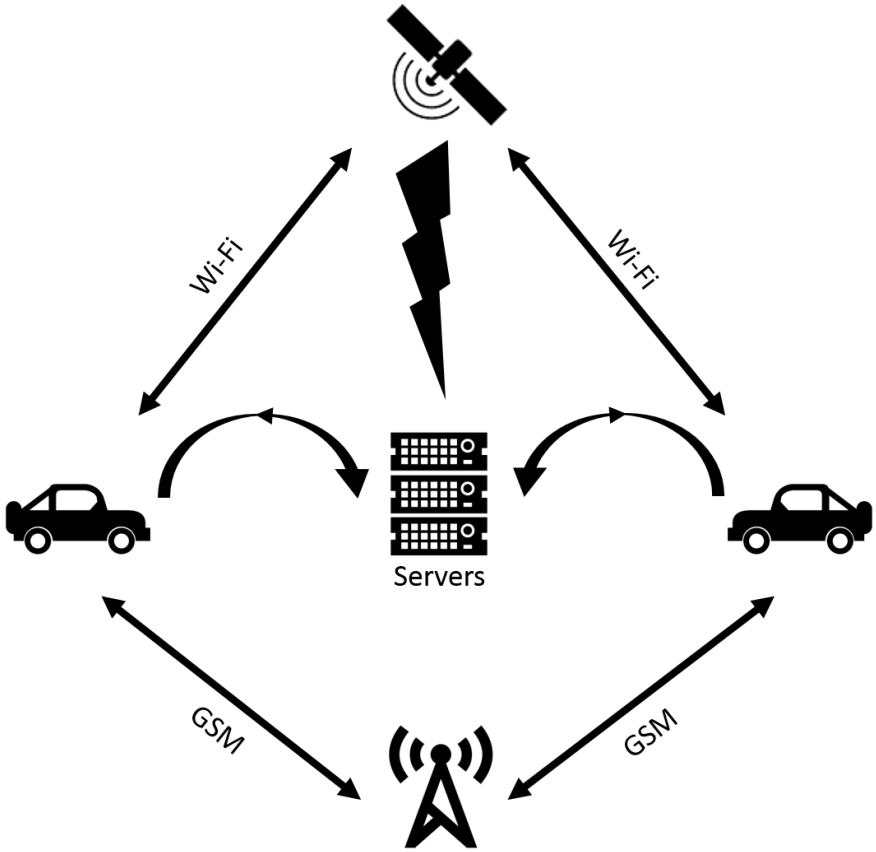
The "Traffic Eyes from Above" display interface with the location of the vicinity cars can be beneficial and added value for implementation in different case scenarios according to the stakeholder's business line:

- ✓ Mobile phones (for providers) via GSM
- ✓ Application (software) development – transmitting (TX) and receiving (RX) the signal
- ✓ GPS Navigation devices (TomTom, Garmin, Magellan, etc)
- ✓ Automobile manufacturer – for car navigation system
- ✓ Possible Extension: using "OneWeb" satellite constellation architecture instead of GSM

2.3 Communication layer

The data transmission can be done in two optimal possible ways:

- ✓ Mobile GSM / Mobile Data
  - Data transmission: Mobile → Server → Mobile (via GSM)
  - via smartphone Application
  - ease of implementation, but reduced coverage
- ✓ "One Web" Wi-Fi
  - Data transmission: Mobile → Server → Satellite → Server → Mobile (via Wi-Fi)
  - Worldwide usage
  - Better coverage (even in desserts, mountains) than GSM



In the figure above are presented the two possible cases of data transmission via Mobile GSM or Wi-Fi. These two communication types offers more advantages than using other method, for instance via radar signal. To transmit and receive data with radar would require higher energy, usage of antenna, RX/TX hardware. These factors would increase the vehicle total mass and would occupy a certain volume of the vehicle for the equipment.

2.4 Other beneficial Server services could be used for:

- ✓ Data Mining
  - How many cars are passing from a location to another each day (traffic density). Using the system of presented idea no manual traffic counting would be required
  - Less time spent in traffic jam
  - The server could keep securely the track of the average speed of vehicles per area
  - Possibility to check the overspeed limitation violation
  - Possible business collaboration with car insurance companies to provide better insurance rates to reasonable drivers by using the proof from the "Traffic eyes from above" system (after one year statistics for instance).
- ✓ Electric cars
  - The software can predict when the car batteries will run out of energy and search for the closest charging center in a specific region on the route

- The software will keep track of other car's discharging rate in the area, and if there are many cars waiting to charge their batteries at one charging station, it will anticipate a better charging place in the area since in the future there will exist more charging stations.

✓ Autonomous cars

- The application software could offer the positioning information about the personal car and find optimal routes (avoid traffic jam)
- The autonomous cars using this navigation interface will decrease the risk of potential accidents

The advantage of using "OneWeb" satellite constellation would be a worldwide startup business collaboration opportunity with Airbus Defence & Space and Google. "OneWeb" will offer Wi-Fi data connection on ground with wide coverage from a constellation of 900 satellites used to provide global internet coverage.

3. Conclusion

The future navigation systems for automobiles will be more complex and will offer more features. Therefore it has to become interconnected between other navigation systems and not operate only individually. This way the reliability of driving in safety conditions on the road will increase exponentially.

The 'Traffic Eyes from Above' plans to support both the space sustainable development and daily life on Earth in traffic with special impact on our Environment, Economy, and Society.