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ITS for Safety: Some considerations on effectiveness analysis of new tech for achieving a safer environment

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Abstract: - This paper presents some considerations on the Intelligent Transportation Systems-ITS contributions for a safer environment. The development of new technologies integrating solutions for ITS is only at threshold of great possibilities for the foreseeing future. Aspects related to people, vehicles (cars, trains, ships and others), the environment (roads, railroads, waterways and port terminals) and the interaction between these systems supporting the sustainability are constantly improved. Nevertheless, several solutions to the citizen's daily lives are already available and implemented, but different feelings arise daily among potential users, including conflicts of various kinds. This paper discusses general performance aspects, how to test and confirm the safety of the devices and processes themselves, in order to harmonize the efforts of researchers and manufacturers toward public confidence. As an example, some safety issues of monitoring and control of motor propelled boats circulation in the estuary of the port of Santos, Brazil, are examined.

Key-Words: - Intelligent Transportation Systems, ITS, safety

1 Introduction: ITS, Safety, ITS & Safety

ITS based systems can lead to very important contribution for people safety in many transportation modals such as road, rail, airliners, river and maritime, public and private. As part of integrating basic tools (TI, AT, info telecom, robotics. etc.) ITS based solutions may improve safety, efficiency, comfort aiming to fulfil customers' expectation.

Perception involves the understanding of the scope and related implications, considering not only the approval but also the existence of an open conflict of opposing ideas, forces of individual interests as the opening systems without violating privacy with the collective, aiming to the common security for all involved. Note that ensue complex conceptual and cultural aspects, as [1] consider that "The ITS scenario is complex, so is fundamental involving nontechnical (such as the legal and institutional) issues".

Vehicles equipped with progressive automation systems must be compatible to the legal aspects of each country and international law regulations in order that common integrated traffic suppose that vehicles must have recognition protocols and procedures, regardless of where they circulate.

People begin to realize the effects in their movements and in their lives. Considering this scenery, solutions that are being incorporated into vehicles and tracks requires the interaction of technical and non-technical concepts, in order to support the safety of people and the security of cargoes, vehicles and environment.

As Figueiredo [2] referred, there is subtle gap in Brazil between perception and the references to security. This particular situation follows that Portuguese language has only one word - segurança – that means the broad sense of security. So, in order to address the range of the main concepts - security, insurance, safety – and the way they interrelate in the lives of citizens it is necessary adding the correspondent adjective.

By the cargoes handling field, contributions on ITS to the security are known and implemented, in many port terminals. Since 2008, [3] have presented "a model of secure logistic chain, aiming at integrating the electronic seal, tracking and non-intrusive inspection technologies. Are used as premises the security concepts and standards set forth by many entities worldwide, among them, CSI

(Container Security Initiative), WCO (World Customs Organization) recommendations and the SAFE Ports Act. This model might be applied within the supply chain in order to help in cargo security, by monitoring its inviolability."

By this way, [4] identify as "Information technology and communication can help computerize the operation processes of the terminal, by introducing concepts of monitoring and management, and the introduction of devices that can collect information in real time and thus reduce time and improve quality in services.

These two references are security focused works, although the present paper consider the role of ITS for safety.

Also in the transports, it can be realized that current design of safety strengthens prevention vision, where the prognosis-prevention binomial overrides the previous practice diagnostic-remediation based. That means an important exchange from reactive posture by anticipating problems in a proactive vision, resulting significant improvement for safety management processes. For such reasons, devices and systems are tested thoroughly to reduce the risk of failure in performance on the use of the vehicles.

There is a global mobilization to avoiding of road accidents. This way of thinking and acting is so important that the United Nations declared the period 2011-2020 as the global effort to reduce road accidents. By this way, Brazil held the 2nd Global High - Level Conference on Road Safety, in November 2015 and the conclusions are included on the document namely the "Brasilia Declaration on Road Safety". Following up, on April 15 2016, the UN General Assembly and its Member States adopted a resolution on "Improving global road safety" [5]. The two events main targets are reduce global road traffic deaths and injuries by 50% by 2020 and to provide access to safe, affordable, accessible and sustainable transport systems for all by 2030.

2 Technology contribution

[6] observes that "Intelligent transportation systems have integrated a broad range of AI-based technologies into both the transportation infrastructure and vehicles themselves. Although the future of ITS is promising, the field is anything but futuristic. Various ITS products and services are already at work throughout the world, significantly improving transportation safety, mobility, and productivity".

As well known, the traffic rules are different around the word, from the left/right position of car driving wheel and main directions passing a myriad of rules and regulations. So, for making these procedures effective, the starting point is an accurate understanding of technical terms and cultural aspects.

For adjusting terminology concerning to systems and equipment designers of on-road motor vehicles, SAE J3016 Standard [7] describes the full range of levels of automation, designating driving modes from 1 a 5, starting from 0 for no automation, when the human driver is absolute for operating e taking the decisions.

The levels 1 to 5 consider the stages of driver assistance (1), partial automation (2), conditional automation (3), high automation (4) and full automation (5).

3 Systems, devices and applications

3.1 On-road motor vehicles

Many new devices and systems emerge every day, resulting from the dynamics of research and manufacturers activities. It is, therefore, a state-of - the-art that should be updated every day. Among them, for the moment, such as: 3D holographic street bumps; comfort zone display for previous identifying of available seats in the train/subway cars arriving in the station; special signs with LEDs in crosswalks, especially in school crossing zones; sensors for previous warning to traffic drivers on cross streets; and so many others.

In the development and application of solutions for motorized vehicles on land routes different equipment are used on board and road-vehicle integration.

ITS solutions integrate traffic controllers with CCTV cameras, sensors for counting, identification and classification, regulating traffic at the toll plazas. They also include fixed and mobile panels to display information and guidance, Bluetooth communication devices, automated guiding traffic in selective way, and so many others. For the supervising control, computerized systems are set to the management of vehicles in service.

As Avenoso [8] observes, "Automated vehicles are already starting to appear on Europe's roads, but regulators are still stuck in the slow lane. It is crucial that we get a much greater understanding of what the real world safety benefits would be, and what new risks would be introduced, before these vehicles are put on sale."

The cooperation university-industry is a fulcrum of many of these innovations, such as [9] relates “the iCAN (intelligent car navigation systems) project is collaboration between academia (the University of Tokyo) and industry (the Toshiba and Yazaki corporations) to pursue intelligent systems and their enabling technologies for near-future intelligent transportation systems”.

3.2 Trains: Interaction between railroad vehicles and permanent way

A traditional solution to the traffic of the rapid trains rail cars trains is those that oppose the rail to the inertial effects when go a curve. Originally this inclination was obtained by progressive uprising of the extern rail of the curve in order to tilt the composition, technic known as “passive tilt." Additionally, is increased the width of the rail gauge, for better insertion and concordance of the bogie rail car.

The variation of these two variables, over-size width and transversal elevation, must to be synchronized and aim to improve comfort and safety conditions for fast compositions users, aligning the traffic cargo load compositions moving at lower speeds and may not have steep slopes to keep stable.

Since 1973, the use of trains equipped with monitoring devices approximation of the curve and action of inclination drive devices is known as "active tilt”.

The track remains both rails with cross-level, yet the train tilts by the action commands sent by sensors of the notable points of the track – tangent-transition spiral, circular, spiral, circular, and spiral-tangent (TS , SC , CS and ST). Thus, travelling the transition from a straight stretch with an infinite radius (tangent), passes through a variable-radius stretch (spiral curve) in order to progressively achieve a finite radius in the circular.

Forces arising are compensated by the inclination of the car from hydraulic system fitted to the bogie, reverting to normal position as reach the straight opposite.

So the performing of the rapid train increases towering to limits of rail-wheels systems and progress are useful on magnetic levitation technology. Despite these tech developments, limitations of capital make the unavailability of diffusion of these technologies and restricts its wide use so trains crashes still are a shame reality.

3.3 Boats: Controls waterway vessels and small boats flow in the estuary.

Figueiredo et al [10] report that ITS can offer better safety conditions in internal circulation of ship in the estuary of Santos port, Brazil, where more than 5 thousand vessels operate per year. But other thousand motor propelled small boats circulate at the space estuary and cause many accidents, by exposing to risky situations. It happens when a small boat comes closer a big ship, subjecting itself and their occupants to the effects of movements of propeller and other influents like climatic conditions and/or tidal variation.

The system proposed on the paper ITS to Monitor Small Vessels Movements within Port Area - A Study at Santos Estuary could offer a solution for this situation but was not yet implemented. The image 1 presents the information flow chart.

Figure 1: Flow Chart of system control
Ref.: Figueiredo et Al, Wseas CSCC 2014.

The access to Santos Port includes a ferry crossing, where 9 big ferries crosses each 5 minutes the 500m width of estuary channel, transporting about 8 million vehicles per year from the estuary banks. So this traffic combined with so many kinds of boats, passenger boats ships, tugs, ferries, supply boats, water tanks, sludge boats, yacht and sport boats browses in a complex that has taken some lives in crashes.

Despite the respect of Marine Authority guidelines and international navigating rules is mandatory, some people do not even comply with the regulation. In the same way, facing the current control and enforcement difficulties, attacks still occurs with pirate threatening fishermen and facilities to the bank of the estuary of Santos.

The installation of a VTMIS is in the way, under the Santos Port Authority responsibility, system able to control the traffic of ships. If directed to control the movement of vessels can also support to the authorities to combat actions criminals.

4 Considerations

The design of automated driving vehicles complexity requires special attention facing the perspective of use by million people around the world. The new situation establishes a long term learning facing brand new users and situation, requiring testing the equipment and training people until avoiding unexpected and disastrous results.

Automated driverless cars tests nowadays had suffered about two dozen small collisions, usually due to several human errors. In recent collision between one vehicle that collided with a bus, the event entails the improvement of the control software. The autonomous vehicle deviated from an obstacle and went to the side track when it was hit by a bus. As the speed was limited - 3.2 km / h of the automated car and 24 km / h the bus - the damage was small.

The experience of industrial automation is very important, taking account that procedures are usually very careful and meticulous, so production accidents are proportionally very rare. Here is referred to the occurrence of a car factory where a robot caused the death of a worker who was unduly inside the production cell of assembly line.

If it occurred with trained and experiment personal what could be done with the ordinary people that will use this transportation systems? Hence these innovations must consider the need of proving safety and their efficacy. Despite new technologies are continuously been developed, until these advances became effective in useful application it requires a larger time lapse, for many reasons, some very complexes by its dependence on human idiosyncrasy.

People have their own acceptance, so it is not possible treat as a *takt time* to assimilate and use things that require their understanding and ability to use them. So there is not any kind of *digital hortator* that could make this happen in a shorter time.

4.1 Prospects to the future

Take, for example, the use of self-guided vehicles in transporting people, object of recent research conducted by IEEE [11] to discuss user behavior. Participants of IEEE roundtable that took place at the University of Southern California on August 2015 where asked to let their kids walk alone in an experimental driverless car. “The survey polled members of the IEEE Intelligent Transportation Systems society, as well as IEEE’s social media communities notably experts attending the congress, that consider driverless vehicle technology as an area that needed further growth”. The issue is still complex, so the correspondent release was entitled “You Can Take Me, but not My Kids”.

In a new context, innovations can subliminally bring new risks, and, as Figueiredo et al (12) observe, negative effects like job reduction, as verified in the industries, ports and other activities.

5 Conclusion

ITS can act significantly in expediting technological solutions for the various process steps. However, major problems pass through macro planning view of human activities, either by streamlining the cities, with the nucleation centers with residential areas, supporting business and shopping centers, education, health, leisure and entertainment, productive, in order to reduce the pressure lengthy trips in congested traffic areas.

The issue of safety can get significant results by traditional intervention as reducing speed on expressways, as seen in the avenues on river bank at São Paulo city, where the reduction of the upper speed limit from 60 to 50km/h, has direct relation to a reduction of 18.5% of accidents 71% deaths and 14% in injured.

This is not a strictly cause and effect rule, as it can be find on road traffic, where the prevention and control measures of new tech for ITS can result in reducing accidents which, however, may become more lethal, with increasing numbers of victims.

By the way, many unprotected sites and could be better preserve users but lack of funds and investment limit the access and use of these new technologies.

Cultural aspects of the people are imposed by the user's resistance to accepting certain promising innovations, such as the driver alcohol consumption indicator that releases the motor start up, and was not widely adopted. Some people many times prefer to drive against the law in a risky attitude. The choice based on free will factor continues to influencing people's own and other lives.

So ITS development has a long and challenging way to be travelled.

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