

★ REPOSIT is a new system integrated or installed into vehicles which is capable of warning the driver through a visual display about imminent collisions with another vehicle. Technical Coordinator of the project, **José I. Herrero Zarzosa**, explains this potentially life saving eSafety technology

In-car Warning System will Make Roads Safer

GMV Sistemas is developing a revolutionary system that will allow drivers to avoid car accidents by getting a visual and acoustic alarm when a vehicle-to-vehicle crash is about to happen. This system works with GPS technology, and it gets its accuracy by exploiting the ability of vehicles to exchange information, thus enabling them to use relative positioning with a sub-metric accuracy that excels the five metres achieved by a standalone receiver.

By knowing the attitude of the vehicle due to its movement along time, the vehicle dimensions and the GPS antenna location, it is possible to compute the minimum distance to a collision with another vehicle. A REPOSIT On-Board Unit (OBU) properly predicts potential collisions and provides a warning to the driver in order to improve his reaction time through a proper Human Machine Interface.

An advantage of the system is that this technology does not need any external infrastructure apart from vehicles having an OBU device inside, and also provides three warning levels, correlated with the danger of collision involved. This means that the driver will perceive different visual and acoustic stimulus similar to a streetlight sensor through usual 'Green/Yellow/Orange/Red' coding colours usage. A 'Green' level implies there is not a risk of collision in the upcoming five seconds, whereas 'Red' means that the collision risk is imminent within the following two seconds. The 'Yellow' and 'Orange' warning levels purpose is to increase the awareness of the driver about the evolution in time of the potential impact danger against nearby vehicles. These levels are user-customisable.

There is an important issue implicitly considered in the system which is the fact that the collision danger is considered 'potentially avoidable or reduced' when detected some seconds in advance. In this sense, vehicles have a surrounding safety domain which is continuously being monitored by the system, looking for potential future intrusions by other vehicles. Additionally, when a critical 'Red' alarm is detected by the system, a propagation algorithm shall disseminate this event to all surrounding vehicles increasing their allowable reaction time.

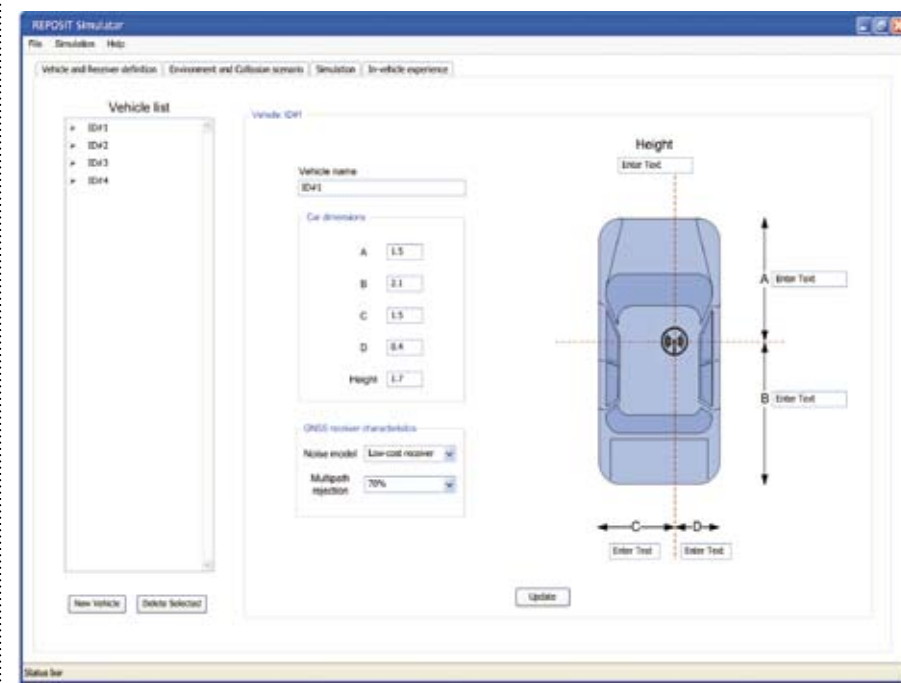
REPOSIT uses a RADAR concept as the recommended way to display alarms within a vehicle, providing a display with coloured vehicles pointing out warnings and showing

graphically the relative distance evolution in time. For regular use the drivers will be shown only the relevant alarms.

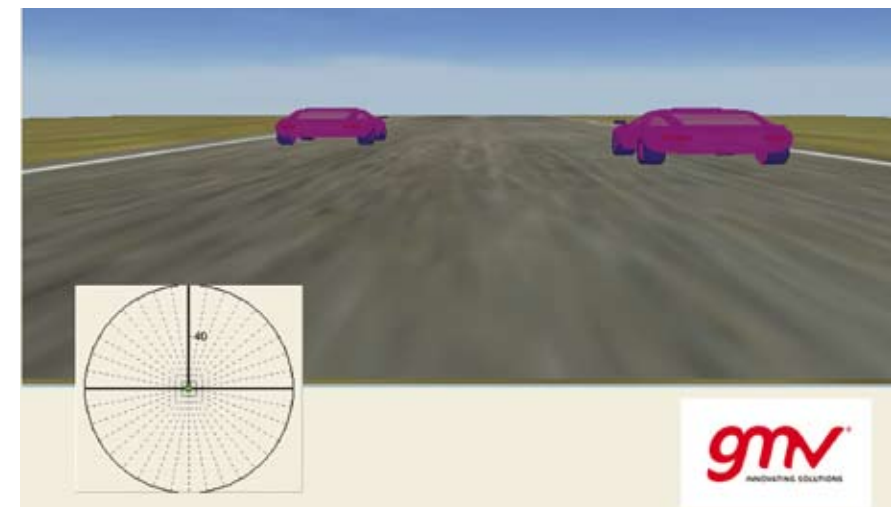
Intensive testing

To assess the performance of the system in different collision scenarios with a very high confidence level, GMV has coordinated the development of a simulator. This initiative is partially funded by the European Commission within 6FP-Call 4 and all the results are updated periodically in the project website (www.ist-reposit.org).

Simulation environments of interest under study are focused on rural and sub-urban eSafety cases, where vehicle's velocities are typically higher and



REPOSIT simulator screenshot: Configuring vehicle local parameters



REPOSIT simulator screenshot: view in-vehicle - A RADAR plot is shown in dashboard.

therefore so are the related hazards. Rural cases can be identified as those with a very low density of obstacles for V2V (Vehicle-to-Vehicle) communications and GPS reception, whereas sub-urban cases are analysed in a worst case basis considering the masking effect of buildings or forest. Regarding collision detection and applications among vehicles, the REPOSIT simulator is able to partially assess the following scenarios:

Longitudinal and intersectional cases, in most different configurations with/without collisions

Velocity control and follow-up: For stop & go applications, it can help to foresee traffic jams/slow traffic 500m ahead

Safety at intersections & Complex scenarios: It can detect approaching traffic and provide a warning of local danger in a range from 300m up to 500m in advance. In night scenarios it can provide a representation of all vehicles equipped with OBUs

REPOSIT as an Identification System: All REPOSIT vehicles are identified with a digital ID plate. For urban cases this can be used to monitor black-spots, to make a dynamic management of traffic lights based on the traffic density in order to minimise transit times and keep public transportation on schedule. With a memory module, OBU can be used as a black-box that can store the relevant information for reconstructing an accident - useful to police and insurance companies for liability purposes

Platooning: OBU can compute the distance to the leading vehicle if it is also equipped with REPOSIT. Actuators would be also needed for a complete automatic

manoeuvring

For most ADAS applications: like PACC (Predictive Adaptive Cruise Control) and collision warning in highway intersections

Facing the Future

REPOSIT system is the first serious effort that addresses and uses GPS technology for collision warning detection among vehicles without any further infrastructure requirements. The results show that longitudinal and transversal collisions at medium/high velocities are properly detected due to the benefits of relative GPS computations, and it is also seen that the number of potential applications of the system is high enough to be considered of interest by the car industry in the near future. The latest challenge is affordability. So GMV is also letting the door open to an externally installed version of REPOSIT to allow a quicker penetration at a competitive price. However, this is only part of the ultimate solution, as collisions may also imply not only vehicles with a REPOSIT unit inside, but also, other obstacles like bikes, people crossing roads, and adverse environments like urban-canyons. The REPOSIT system remains open to be integrated in a cooperative way with the existing sensors of a vehicle and to share additional V2V information, to make safer, cleaner, more efficient roads. Car manufacturers are also encouraged to promote an eSafety standard interface for externally installed devices that would allow the use of existing vehicle sensors by eSafety installed systems. Those new systems would benefit from an increased service level and a shorter time to market free of additional cost for the car maker.★

At a Glance

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The project is coordinated by GMV Sistemas PTM S.A.

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Technical coordinator of European projects
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Technical coordinator of European projects, within GMV's Navigation Engineering and Applications division, his field of expertise focuses on GPS solutions for low cost systems and high level topographic applications for pedestrian, road and maritime turn-key applications.