Will cars soon be able to ‘talk’ to each other?

Every year, thousands of people die on the roads across Europe. For this reason, several research establishments are currently developing programmes to facilitate travel and make it safer, while reducing traffic impact on the environment. One of the paths explored is to develop inter-vehicular communication so that road safety or weather condition alert messages can be forwarded by wifi from vehicle to vehicle. The European Union recently allocated a specific radio-frequency band for such future applications.

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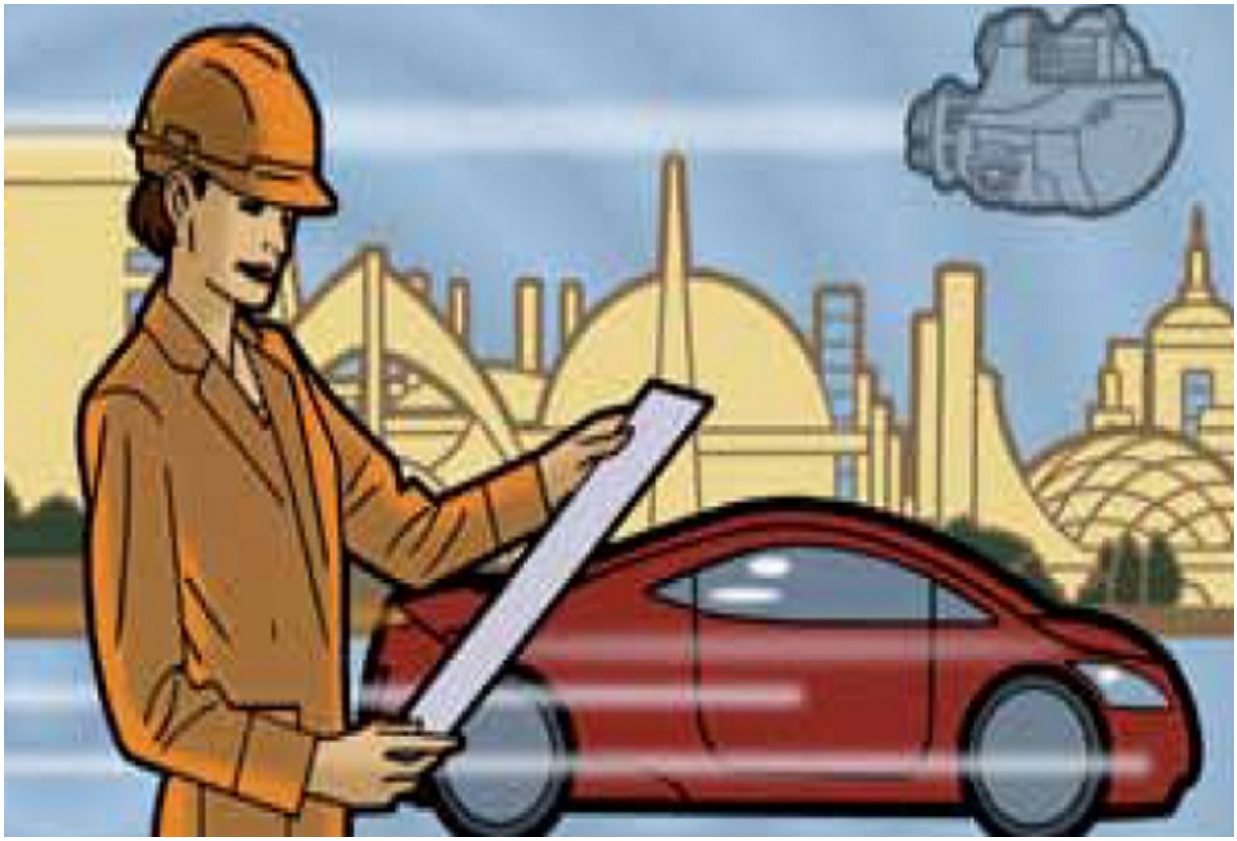
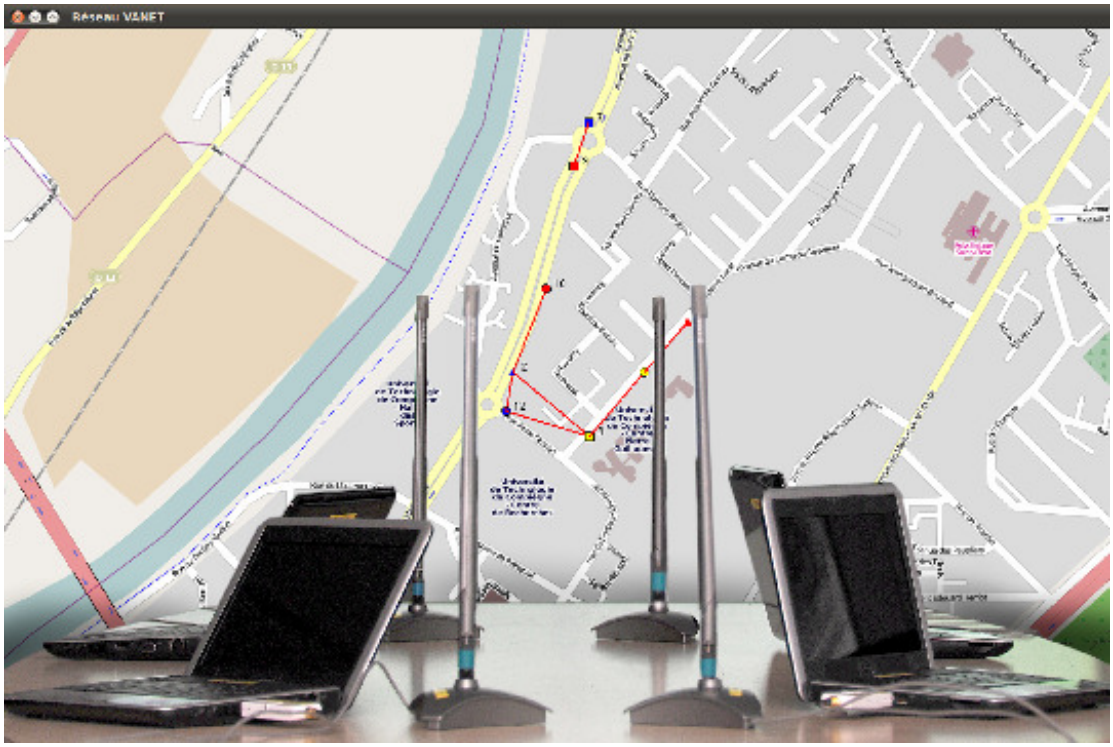


Inter-vehicular communication is a sub-set of a wider class of phenomena, known as dynamic networks. The latter consist of individual computers coupled together in networks where links are constantly created or lost, whereas in conventional networks the computer links are far more stable. The networks may be composed of vehicles, robots, drones, etc. The main challenge, when we want to use a dynamic network, is to find and use the best balance between range and performance; If the transmission range is too high, the target vehicles, etc., would maintain their contact for a longer period but would also receive too many messages, i.e., including those devoid of immediate interest. Moreover, there would be interference phenomena, hence lower performance ratings using current technologies; the aim therefore is to have lower range devices and information selected on a basis of the exact geographic position of the vehicles.



The Airplug software package receives and forwards messages

In order to study dynamic networks under the best conditions, the Heudiasyc "RO" team (Networks and Optimisation) have deliberately chosen a mixed theoretical and field-test approach. As Bertrand DUCOURTHIAL sees it, both angles are necessary. *"Road experience provides new ideas while theory comes up with solutions that help solve practical situations."*

The team has developed a software package called 'Airplug', to test and validate the hypotheses and the algorithms developed. The latter are designed to handle system outages and temporary loss of signal (LOS) between vehicles. *"The software is also capable of "recognising other vehicles on the same road but oncoming, as well as those heading in the same direction but in a different lane. In this way"* says Bertrand DUCOURTHIAL "the vehicles only receive those messages that they are supposed to pick up". Once the Heudiasyc RO team has programmed its algorithms in Airplug,

tests will be carried out on the roads in and around Compiègne.

Of course one of the main difficulties of the experiments is that the environment is constantly changing, as the traffic itself changes. This inter-vehicle communication mode will help improve road safety. With the Airplug software package, if a vehicle brakes suddenly, i.e., makes an emergency stop, or if the weather conditions are worsening (with the wind-screen wipers and head-lights on), the car can send an automatic status alert to nearby vehicles.

In this way, the drivers can anticipate an impending danger, simply by slowing down, for example. Going farther, we could imagine the vehicle receiving parameter change orders. For example, the smart car team at Heudiasyc proposed stiffening the accelerator pedal movement, thereby discouraging the driver from accelerating in a potentially dangerous event ahead. With such a system, real-time alerts can be issued about traffic jams, road works, slow traffic, etc., and drivers can adjust their road manners accordingly. If a car is involved in an accident, an alert message could be issued and transmitted with exact GPS references. Road intersection traffic lights can be fitted so as to shift to green when ambulances (or other emergency vehicle) are approaching. *"Tourist type information can be issued, such as pump prices ahead, and even 'chat' facilities could be offered,"* Bertrand adds.

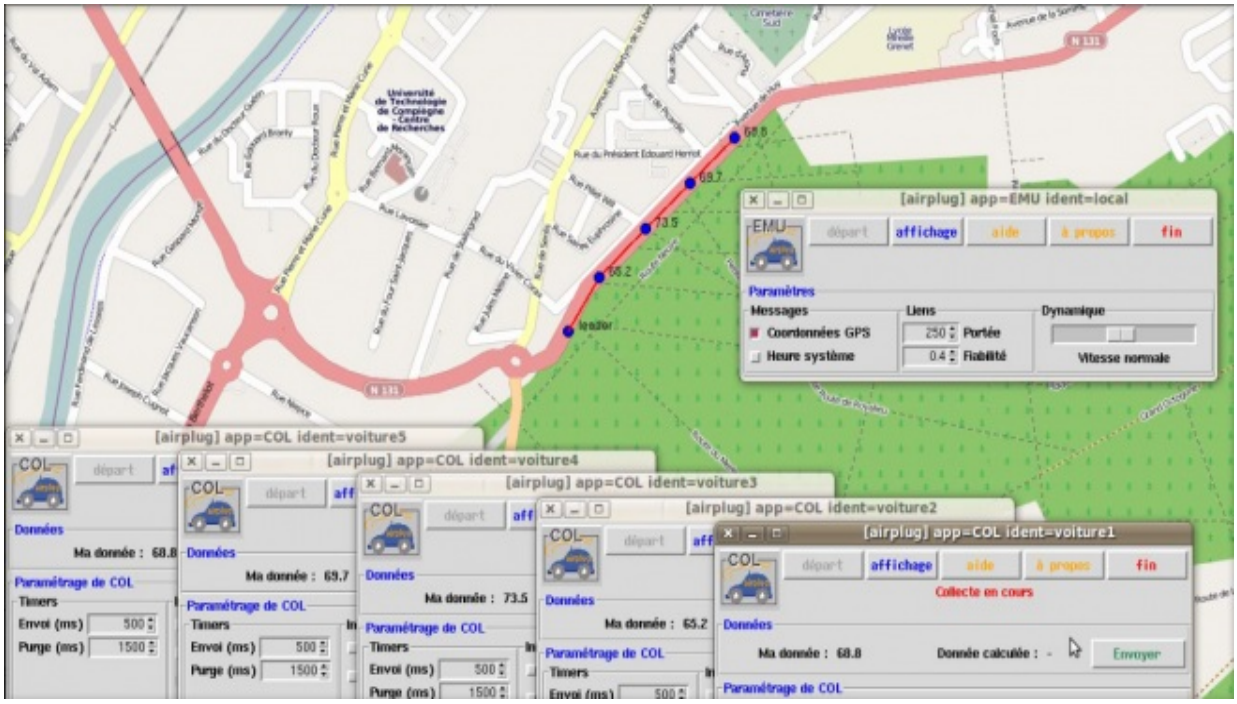
Special relay antennae for certain road segments

In order to have a robust system, you need to have a sufficiently dense set of vehicles equipped with the Airplug package. On roads with low traffic levels, you could install relay antennae in the dangerous bend sectors that would store and forward information between two car passé.

Using such communication antennae and also the 3G mobile phone networks, vehicle networks would receive and store road and

weather conditions, traffic levels and problems, etc., and would forward these to vehicles before they reach the zones and also to inform the appropriate road authorities.

To expand the possibilities of the system, the Heudiasyc research team are working on what they call 'augmented status. *"Cars equipped with Airplug share data produced by their sensors and build up a collaborative, reliable, accurate information, that can be sent in a few bounds either to approaching vehicles or to the infrastructure authorities, via road-side antennae"*, explains Bertrand DUCOURTHIAL.



Data and Information content control is essential

However, if we want a fully efficient inter-vehicular communication mode, we still have a few problems to solve, described briefly by Bertrand: "Firstly, the system must not only be able to authentify the origin of information by positively identifying the emitter, but must also ascertain that the alert is not due to a system failure.

Moreover, with the equipment as is exists today, information cannot be forwarded, generally speaking, beyond a small number of vehicle to vehicle retransmissions. The range of the equipment in the test configurations is set at 400m, but more recent equipment, that comply with a new onboard wifi standard (IEEE 802,11p) should extend the range to 800m. Certain transmission channels have been reserved for exclusive priority safety alerts. These changes should allow for a better, more fluid inter-vehicular data flow.

The Airplug system could be rapidly deployed to all vehicles, if the price is reasonable and seen to provide a real service to drivers. One factor in the cost of installing such a system, would be to use the sensors that are already factory fitted to new vehicles.

Nonetheless, to pursue and develop the system in the future, more research is needed particularly in terms of protocol standards; decisions will also be needed to decide who is going to pay for the system and who will be responsible for operating it.

More about Airplug

More about Heudiasyc