New system created to prevent traffic jams

August 26 2020

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Holiday exodus. Nine in the morning. The roundabouts that lead to Valencia's A-3 motorway have come to a standstill. Can these traffic jams be stopped or, at least, decreased? A team of researchers from Valencia's Polytechnic University (UPV) has come up with a new system for the automated counting of vehicles that would help achieve this. It is

a tool with a very low cost which is easy to install in roundabouts and intersections, and can generate origin-destination matrixes in a continued and automatic way.

Traffic management is increasingly important due to the high density of vehicles in the road network, as well as due to the increase in the loads carried and traffic speeds. These factors lead to traffic jam issues on all types of roads, both urban and interurban; jams whose annual cost in Spain is said to be around €5,500 million.

In this sense, the UPV researchers explain that having detailed information in real time on the origin-destination matrixes is very useful for an appropriate management of traffic. "These matrixes make it possible to know how many vehicles come from a certain origin (O) and are headed to each destination (D), and with this information, the entity in charge of managing the traffic can make the best decisions, and as fast as possible, to ensure that the traffic is as fluid as possible," explains Rubén Sancho, researcher at the Institute of Multidisciplinary Mathematics of the UPV.

Traditionally, registering the data to obtain these origin-destination matrixes has been done with on-site manual counting. However, for large volumes of traffic, this is not efficient. Furthermore, today's automated recognition systems have certain technical inconveniences, as they require the installation of cameras at a height that can be affected by inclement weather conditions, the traffic congestion itself, etc., which makes the probability of error high, and therefore, they are not very reliable.

For this reason, the research team of the UPV has come up with a system that can use the registration analyses provided by a network of sensors (accelerometers and magnetometers), classify the type of vehicle that crosses an intersection and, at the same time, generate origin-

destination matrixes in real time.

"This tool would contribute to the optimum and accurate management of traffic, which would make it possible to prevent many traffic jams and, in any case, to decrease them quickly, knowing the mobility patterns of the vehicles," says Rubén Sancho.

How does it work?

The system is composed of a unit for the registration and sending of data, and by sensors, accelerometers and magnetometers, that are installed in the road. These devices are distributed across all the roads that lead to and out of the intersection in order to monitor the transit of vehicles, creating a measuring station in each one.

"As they pass each of these stations, the vehicles activate sensors that allow them to be classified and identified. Analyzing the vibratory signal produced by the vehicle-road interaction makes it possible to obtain the number of axles of the vehicle and the distance between them, which makes it possible to classify the type of vehicle using a standardized classification criterion," says Sancho.

Furthermore, the metallic mass of the vehicle and its distribution generate a disruption in the magnetic field that makes it possible to classify the vehicles in a unique and individual way with the so-called "magnetic footprint." This makes it possible to know, for each vehicle, which is their origin (O) and destination (D).

"This data is processed in real time with a series of mathematical algorithms that carry out the filtering and treatment of the signals obtained from the sensors. This way, origin-destination matrixes are obtained for each intersection, learning not only the number of vehicles that use each route, but also their classification, differentiating, for

example, between passenger cars, heavy vehicles, motorbikes, etc.," explains Rubén Sancho.

The system can be connected to cable and wireless communication networks for real-time data transmission to a server or coordination center. This information allows the entities that are responsible for the maintenance and management of the road to learn in an updated way the congestion status, and to feed traffic management and forecasting models to define the actions that are to be taken.

Provided by Asociacion RUVID

Citation: New system created to prevent traffic jams (2020, August 26) retrieved 7 August 2024 from https://techxplore.com/news/2020-08-traffic.html