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Method of Traffic Safety Enhancement with Use of RFID Technologies and its Implementation

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Abstract

A new solution for the problem of traffic safety regulation with use of RFID technologies is suggested. Traffic safety enhancement is achieved by polling with a modulated radio signal of all electronic analogues of traffic signs and traffic lights representing RFID markings duplicating main traffic signs and traffic lights and located on them directly or nearby. Polling is performed with a radio signal from a transmitter/receiver unit (radar) focused on a narrow zone of radiation action. The suggested method as distinct from the known ones allows for active control of traffic speed in high-risk areas, elimination of the risk of traffic movement along tram rails, pavements and bus lanes as well as for stopping a car when police chases an offender.

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Keywords: RFID; safety; traffic; radio signal

1. Introduction

Life hazard on roads for drivers and pedestrians continually grows as a consequence of the population growth and increase of the number of vehicles. Thereby, traffic regulation remains rather archaic on the assumption that road participants with some degree of certainty observe road traffic regulations (RTR). The only constraining factor is punishment in the form of continually growing penalties (if it is not connected with the immediate risk of loss of life or health damage). Active methods for safety regulation are aimed at excluding of drivers from driving of vehicles by

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the implementation of driverless cars [i10.ru (2016)], which will allow to exclude of the human factor when interpreting this or that notion of RTR and essentially approach the RTR observation. This is exactly what ensures the efficiency of active methods for traffic safety (TS) regulation. The main factors hindering the implementation of driverless cars are their price and costs associated with ensuring their orientation by means of signs, commonplace road marking, etc. As in the near future not everybody will be able to afford such a car, the road situation at least will not improve.

2. Main text

The safety enhancement is aimed at the implementation of an electronic assistant duplicating traffic signs [Suslinnikov (2016)]. The practice shows that sometimes it is necessary to duplicate the information available on traffic signs as well as actively influence the speed of individual vehicles or the entire flow in the following cases: driver fatigue cumulation or diseased state; lack of control over a situation by beginners or elderly drivers when driving in a city; availability of banners, advertising bills, etc. distracting drivers' from traffic signs; installations of temporary traffic signs often with deviations from GOST or in areas inconvenient for viewing by drivers.

The existing traffic sign recognition systems (TSR) are produced by many auto manufacturers such as Audi, BMW, Ford, Mercedes-Benz, Opel (Opel Eye jointly with Lane Departure Warning), Volkswagen, Volvo (Road Sign Information, RSI). All these systems have a typical structure: a video camera (as a rule it is located on a windshield behind a rear-view mirror), a control block (controls the recognition of a traffic sign form, traffic sign color. lettering, information plate, analysis of the actual car speed, comparison of the car speed with the maximum allowable speed, visual and audio driver warning) and data output medium (display, windshield or combination of devices).

Sometimes, a recognition system is combined with a navigation system which allows for use of the information about speed limit signs from navigation charts if it is impossible to define a sign by a video camera.

The traffic sign recognition system of the second generation recognizes such signs as "Stop at Intersection"; "Road Up"; "Main Road" ("Main Road End"); "Priority to Oncoming Traffic" ("Priority Over Oncoming Traffic"); "Yield"; "All Constraints End Zone"; "Beginning (End) of a Built-up Area"; "Beginning (End) of a Speed Highway"; "Home Zone".

The sign recognition block functions in a rather simple way: traffic signs shot by a camera are checked against the tables available in a database, similar in form, set and arrangement of symbols. This algorithm determines the limits for the most of such systems; there were cases when the maximum speed limit sign applied to a vehicle tank was treated as a traffic sign [OOO "Za Rulem" (2016)].

In course of testing of various systems it was also noted that, for example, BMW system rarely recognizes signs "80" located on the right road side of Moscow wide highways; if a scanner does not see a traffic sign or cannot recognize it, a processor starts using the data from a navigator road chart which do not always reflect the reality; the limits imposed by signs banning overtaking are automatically cancelled in 15 seconds irrespective of whether the limit is lifted or not. Opel system, in its turn, is sensitive to sign orientation (inclination or turn), and operation of windshield wipers when it rains or high beam actuation in night time decrease the certainty of the information incoming to a driver twice as much.

Besides, considering the "one hundred meters hitting range" stated by the manufacturers, "Opel and BMW cameras output the information to displays only when a front bumper reaches a sign" [OOO "Za Rulem" (2016)].

Finally, the most essential drawback of such systems is as follows: if a sign at least partially closed with a hindrance (a truck, trees branches or advertising bills), the systems are one hundred per cent useless. However, a person manages to response in this case as well.

On the other hand, one can see the far and wide application growth of the technology of radio frequency identification which is successfully used today in automobile security systems, automated automobile fuel stations, premises access control systems, electronic ticket systems, RFID-passports for tourists and travelers, identification of moving objects in real time (registration of auto transport, rolling stock wagons), identification of auto vehicles in parking lots and bus terminals, expedited delivery of dispatches, baggage treatment and delivery on airlines, prevention of counterfeiting of goods of various categories [SecretLock (2016), Corporate Systems (2016)].

Practically, the only constraint in using RFID markings in transport is the speed limit. In course of the registration