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Edukacja - Technika - Informatyka nr 4(18), 425-430

2016

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ISSN 2080-9069
ISSN 2450-9221 online

„Edukacja – Technika – Informatyka" nr 4/18/2016
www.eti.rzeszow.pl
DOI: 10.15584/eti.2016.4.57

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Demand of high quality education at field of automobile electronics

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Abstract

The article deals with electronics in automobile which serve mostly for implementation of without accident road traffic. The article draws attention to using of radars, infrared and video cameras, ultrasound sensors, rescue systems including automatic recall of rescue service towards accident. There are mentioned another systems controlled by electronics for active and passive safety of an automobile. From mentioned above results aim of the article: suggest to necessity of early and high quality preparation of specialists at field of automobile electronics to support needed number of qualified workers at production process as well as for service of vehicles at active traffic.

Key words: automobile, electronics, safety systems, education.

Introduction

Lot of sensors is situated in modern automobile, as part of intelligent safety and autonomous systems that obtain data about vehicle. Most of sensors measure parameters in driving and braking systems and provide data about vehicle motion. Most of measured parameters is not shared and do not expand outside of vehicle by wireless communication. A driver is informed about measured parameters mostly by display panel at car dashboard, eventually by acoustic signalling. In most modern automobiles occur changes in comparison with previous concept however. Intelligent sensors for surroundings of automobile and traffic situation monitoring are implemented into different components of automobile increasingly. These sensors are base for modern, advanced systems as support of automobile driving. These systems are developed for automation of car control, car safety systems improvement and for better controllability of an automobile. Systems are designed so that decrease risk of collisions and accidents by signalling possible risks, or by immediate control of car take over by reason to prevent acute threatening collision. Advanced assistance systems are one of most quickly growing segments at sphere of automobile electronics. It follows necessity to use more intelligent and more precise sensors of surroundings round a vehicle.

Electronic sensors of a car that increase quality of car driving and control

Vehicles for monitoring of surrounding use mostly sensors:

- Multipurpose stereo camera
- Camera with 3D sensing
- Multipurpose infrared camera
- Microwave radar
- Laser radar
- Ultrasound sensor
- Infrared sensor.

Alone sensors have relatively limited exploitation, but integration of information obtained by them into meaningful entities multiple increase capacity of presented total information.

System for visual information enhancement

Majority of information receives driver by vision. Headlights of a car are used during a day for suitable visibility of a vehicle. This task is still outstanding at night and in time of reduced visibility. This is a reason why adaptation of headlight beam routing is used, controlled electronically by specific actual driving regime, in order to roadway in front of vehicle in the direction of forward and side was optimally illuminated. So as a driver see very well, he can not be blind from behind by driving mirror. Automatically darken driving mirror is used for such purpose. An automatic warming that enable de-icing of a mirror and elimination of mirror misting is almost self-evidence. Driving mirrors are supported by electronic system that helps to a driver to identify overtaking vehicle, which is at blind spot of driving mirror, that driver does not has to see early enough. Cameras build in driving mirror receive the vehicle at detected zone and by switching up of signal indicator is driver of passed vehicle warned about overtaking vehicle. So, the driver is informed if any vehicle enters into blind spot of the driving mirror. When the vehicle get out from blind spot signalling turns off. So-called night vision can be used in consequence that driver can see also it, which is not possible to see with naked eye. Night vision can be used at night and at reduced visibility.

Night vision uses infrared emission that does not dazzle pedestrians and oncoming vehicles drivers. Night vision system, together with meeting lights and built-in infrared headlights, expands viewing field of driver by tens of metres. By this system, the driver is able to identify at road early enough: persons, animals, cyclists or another restrictions situated in front of him. The picture of situation is displayed by display on car display board.

Fig. 1. Display system of vehicle equipped by night vision [Internet]

Electronic systems for support of enhancement of vehicle control

Keeping of constant driving speed is important in term of continuousness, safety and ecological transportation. Constant speed keeps up speed control system. Using of simple speed control system increase possibility of rear end collision caused by inattention, long response time or very short following distance. This risk markedly decreases adaptive speed control system (together with integrated braking assistant) with function of optimal following distance keeping up from antecedent vehicle. The system markedly decreases risk of accidents by method, that in case of need autonomously slow down, accelerate or completely stops vehicle at safety distance from antecedent vehicle.

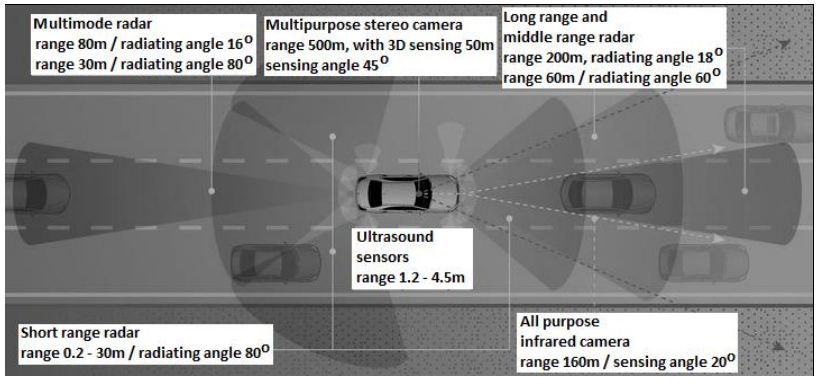

Fig. 2. Sensors conception of autonomous vehicle [Kiaba 2015**]**

Adaptive speed control system uses some of sensors displayed in Fig. 2. Adaptive speed control system cooperates with some radar and several systems of vehicle. One radar scans near space with range to some tens metres and with relatively wide emitting angle, second radar has range to hundreds metres and

relatively narrow emitting angle. Data from radars, speed of vehicle and movement of other traffic participants are evaluated at control computer unit of the system. The system holds safe distance from antecedent vehicle and in case of need it automatically slows down vehicle. If distance (adjusted by driver) from antecedent vehicle decreases rapidly, the system produces warning signal for driver warning to his attention increasing and necessity of his reaction. A vehicle is automatically decelerated at dangerous situation by the system without driver intervention. The system automatically accelerates vehicle to adjusted speed when traffic restriction terminates. From mentioned above results complexity of the system which contains: microwave radar with all complexity of its decoding circuits of objects determination and objects skidding speed, circuit of car own speed measurement, control circuits for deceleration and acceleration to keep constant selected distance towards antecedent vehicle. By mentioned above results that complete system enabling high quality deceleration and high stability of vehicle is exercisable at mentioned system, with all its subsystems including: anti block system of brakes, assistant of braking pressure, electronic distribution of braking forces, electronic stability of vehicle, traction slip control system. A system of intelligent springing and monitoring of pressure inside of tires is applied to utilize maximal possible vehicle running characteristics. This requirement results from necessity to realize vital but stable obstacle avoidance manoeuvre at critical situation. Without using steering – wheel servo unit with adaptive adjusting of transmission ratio (and force by which driver acts on steering wheel) this task would be more demanding then, when optimally adjusted steering – wheel servo unit is applied. With using steering – wheel servo unit closely relates parking assistant which is able to measure autonomously area for possible parking. Thereafter it controls deflection of wheels so that vehicle parks autonomously at determined area. Video cameras and ultrasound sensors are used for vehicle orientation towards surrounding barriers. Driver monitors whole process of automatic parking by display and acoustic information eventually warning signals.

In spite of using quantity of assistant and supporting electronic systems, which increase safety of vehicle movement, there can collision situation occur. At such event, there are used with advantage: safety belts, airbags, active head restraints and other components that reduce risk of injury. Complex system is active since engine start up. In case of accident, control unit evaluates situation by signal from sensors of deceleration by build in algorithms and transmits signals to fuse of safety belt constraint system and airbags. Thereafter explosion of fuse and pyrotechnic cartridge occurs, which is reason for gas generation that charge an airbag by carbon dioxide and nitrogen. Process of an airbag charging comes through 40ms. Discharging of airbag comes through 80–100ms.

An accelerometer is sensor for actual deceleration sensing by which evaluation of the airbag activation is realised. It is integrated circuit, based on micro mechanic elements action, which react to acute deceleration. Signals from accelerometers are evaluated by control unit of airbags. Control unit of airbags send signal to generator of gas in case of need. At the same time, control unit generates signal (by intensity of deceleration) to autonomous recall system for rescue service activation.

System of autonomous activation of rescue service

Automatic system of autonomous activation of rescue service, in a case of traffic accident, automatically transmits microwave signal.

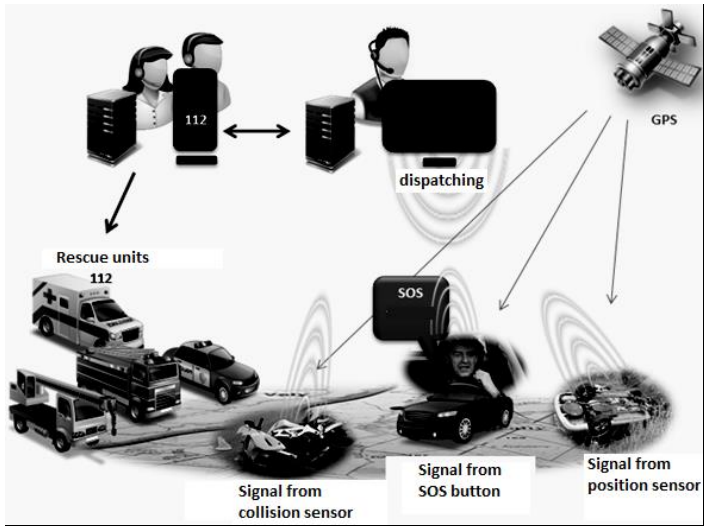

Fig. 3. Automatic system of autonomous activation of rescue service [Kiaba 2015**]**

Sensors of vehicle bump (sensors of airbags) activate system of autonomous activation of rescue service which recalls rescue units of integrated rescue service. When accident occurs, this system transmits information not only about location of vehicle but complex data, for example speed of vehicle, overloading at x, y, z axis during bump of vehicle, etc. which are displayed to operator of rescue service. Each vehicle, which will have automatic system of autonomous activation of rescue service, will contain emergency button for manual activation of the system used in the event of driver nausea or if driver is witness of traffic accident to activate rescue service. Telemetric equipment, which supports automatic system of autonomous activation of rescue service, is based on exploitation of standard SIM card or card chip by which is able to realize relations at GSM net.

Conclusion

Automobiles at present time exploit a lot of electronic circuits to supply safety of road transportation. Electronic circuits are from different spheres of complex scientific disciplines. Examples of electronics exploitation at vehicles are presented upper. Examples utilize:

- Microwave radiation of radar with everything which relates with radar function;
- Ultra sound sensors and whole system of ultra sound waves processing;
- Sensing by video camera and video signal processing including display;
- Infrared sensing and situation displaying;
- GPS navigation and precise identification of location;
- Microwave satellite communication;
- Complex microelectronic circuits for control and evaluation;
- Data and communication links and buses;
- Sensors of physical values of various sorts;
- Actuators that realize required actions, etc.

From mentioned above results large range of knowledge exploited at modern automobiles, as well as requirement of education of workers who produce automobiles and realize their maintenance. Along with that, this situation requires elementary margin of knowledge from drivers, at least from point of view of effective and correct exploitation of all systems. From all mentioned results: need of high quality study programs and optimal forecast of number of workers at different study specializations – that mean numbers of students as man-power as well as pedagogues for make-ready future specialists at satisfactory lead-time. Make-ready of specialists during study should include perspective of development at various scientific disciplines also. Thereat, high quality preparation of numbers of specialists is needed at various specializations for: cars production, operating diagnostics and maintenance of existing equipment during life of vehicles.

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