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Berdov V. V., master's student
Nechyporenro O.V., Cand. Tech. Sc., Assoc. Prof.
Cherkasy State Technological University

VEHICLE ACTIVE SAFETY COMPUTER SYSTEM

The modern development of the transport industry is characterized by the active integration of computer intelligent systems into the design of vehicles in order to increase the level of road safety. The significant increase in the number of road accidents creates an urgent need to introduce effective means of active and passive safety, capable not only of reducing the consequences of accidents, but also of preventing their occurrence.

Active safety systems that can detect critical situations, such as emergency braking or obstacles, and automatically initiate preventive actions are becoming particularly relevant. Other solutions are based on the use of the universal, affordable and energy-efficient Arduino microcontroller platform, which allows implementing a functional active safety system with the ability to adapt to different car models.

The goal of the work is to design a universal active vehicle safety system capable of preventing emergency situations by detecting obstacles.

An analysis of modern safety technologies used in automotive vehicles has found that active safety systems, such as anti-lock braking systems (ABS), electronic stability control (ESP), adaptive cruise control, emergency braking (AEB) and parking assistants, aim to prevent accidents and ensure stable vehicle control [1]. Passive systems (airbags, seat belts, crumple zones) are aimed at minimizing the consequences of a traffic accident.

Analysis of the functional parameters of data collection systems showed that the key technologies for road safety control are: adaptive cruise control, which uses lidar and radar sensors to analyze the distance to other cars; emergency braking system, which automatically activates the brakes in case of critical threats; parking assistants, which help the driver perform precise maneuvering in confined spaces.

It has been established that the collection and analysis of information in real time is a necessary condition for the effective functioning of any security system. Today, it is necessary to use intelligent monitoring algorithms that provide analysis of road situations and adjustment of driver actions [2].

Analysis of the mechanisms of operation of the main active safety devices has established that modern cruise controls use a combination of radars and cameras to ensure stable movement. AEB systems significantly reduce braking distances and reduce the risk of collisions. Parking sensors provide accurate measurement of the distance to objects, which helps prevent accidents during maneuvering [3].

Based on the analysis of technological solutions, a functional diagram of a computer-based active safety system for a car is proposed, capable of operating independently of on-board electronics. The choice of the following main components is justified: Arduino Uno microcontroller, which processes data from sensors; LIDAR TF Luna, which provides accurate sensing of the space in front of the car; HC-SR04 ultrasonic sensor for monitoring obstacles at a short distance; A3144 digital Hall sensor for tracking vehicle speed; Blynk platform communication module, which provides information transmission to the driver's smartphone.

An electrical circuit for connecting sensors to a microcontroller has been implemented, ensuring stable interaction of all system components. Algorithms have been programmed: processing input data from sensors in real time; automatic speed correction in case of detection of dangerous situations; monitoring obstacles and remote driver notification.

The proposed configuration allows you to automate the analysis of the traffic situation, determine critical traffic parameters, and initiate automatic corrective actions to prevent emergency situations.

The proposed active safety system can be integrated into most car models. Its functionality allows for timely response to critical situations on the road, including obstacle detection, dangerous proximity to vehicles, and emergency braking, which significantly reduces the risk of accidents.

References

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