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MECHATRONIC LIABILITY SYSTEMS CAR CONTROL

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Annotation. The implementation of the mechatronic control of a car depends on the totality of the joint work of many systems. Therefore, the use of modern information systems in automobiles is one of the factors that improve mechatronic driving and allow the client to offer a new level of automobile control. A comparison of the functionality of specific systems designed to drive a car is considered. Testing of information systems in driving cars proceeds from the following main tasks: reducing the complexity of monitoring the operation of vehicles; management of fuel costs (in particular, consumed by a particular car and a set of cars); unification and optimization of information flows and information resource; implementation of accounting policies in the field of transport operation.

Key words: car, mechatronics, diagnostics, information systems, electronic map, mileage, route.

Introduction

Mechatronics arose as a complex science from the merger of individual parts of mechanics and microelectronics. It can be defined as a science engaged in the analysis and synthesis of complex systems in which mechanical and electronic control devices are equally used. [1]

All mechatronic systems of vehicles for functional purpose are divided into three main groups [1]:

- engine management systems;
- transmission and chassis control systems;
- interior equipment control systems.

The engine management system is divided into gasoline and diesel engine control systems.

The interior equipment management is designed to increase the comfort and consumer value of the vehicle. For this purpose, an air conditioner, an electronic dashboard, a multifunctional information system, a compass, headlights, an intermittent wiper, an indicator of burned out lamps, an obstacle detection device when reversing, anti-theft devices, communication equipment, central door locks, power windows, are used. adjustable seats, safety mode. [2]

Satellite support of the information system is a technology of continuous (constant) supply of ground consumers with high-precision coordinate-time information (horizontal and vertical coordinates, velocity and time vectors).

Research method.

In the information system, when an emergency occurs, the driver will be able to give an alarm signal, which is transmitted together with information about the current location of the vehicle

initiating the alarm message. Information is automatically entered into the computer in a tabular form or on an electronic road map. An electronic map allows the user of the information system to monitor changes in the location of vehicles from the sample. There are two methods for determining location - independent positioning from external systems or GPS. At the same time, the information system implements guaranteed timely delivery of messages to a car that has left the territory where communication is not available. In response to the information message received by the driver, the status “Confirmed” or an equivalent record in meaning is generated in the information system. From a practical point of view, information about the event (its content, time and date) allows you to make an adequate decision to the current situation. [1;2]

The use of information systems allows you to: prevent the occurrence of downtime of vehicles; fully control the actions of the respective vehicle.

A modern car is a source of increased danger. The steady increase in power and speed of the car, the density of traffic flows significantly increase the likelihood of an emergency [4]. Figure 1 shows a diagram of the car's passive safety system.

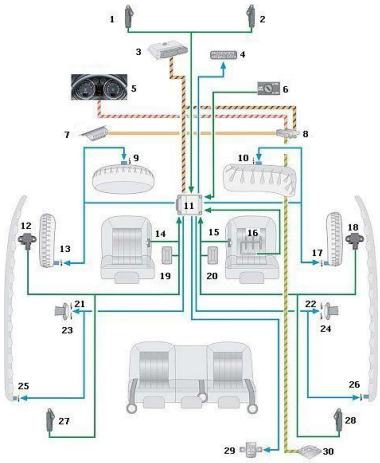

Fig. 1. Scheme of the cars passive safety system: 1- drivers frontal airbag shock sensor; 2- front passenger airbag shock sensor; 3- engine control unit; 4- control lamp of a pillow of safety of the forward passenger; 5- warning seat belt warning lamp; 6- front passenger airbag switch; 7- diagnostic conclusion; 8- gateway; 9- squib driver airbag; 10 - squib front passenger airbag; 11- passive safety system control unit; 12- shock sensor side driver airbag; 13 - squib driver side airbag; 14- drivers seat position sensor; 15- front passenger seat position sensor; 16- front passenger seat occupancy sensor; 17 - squib side passenger airbag; 18- front passenger side airbag impact sensor; 19- driver seat belt lock switch; 20- front passenger seat belt lock switch; 21 - driver belt pretensioner igniter; 22- front passenger belt pretensioner igniter; 23 - driver belt pretensioner force limiter; 24- force limiter tensioner seat belt front passenger; 25- igniter head airbag left; 26- squib head airbag right; 27- shock sensor rear driver's side airbag; 28- shock sensor rear side airbag front passenger; 29- squib of emergency battery disconnect; 30- central control unit for the comfort system.

Results and discussion.

Car airbags (generally accepted world name - **airbag**) are designed to mitigate the impact of the driver and passengers on the steering wheel, body elements and windows in a car accident. Airbags are used in conjunction with seat belts.

Fig. 2. Location of airbags

Modern cars have several airbags that are located in different places in the passenger compartment fig. 2. Depending on the location, the following types of airbags are distinguished: frontal airbags;

side airbags; head airbags; knee airbags; central airbag.

Currently, airbags go beyond the boundaries of a passenger compartment. There are airbags for pedestrians.

The airbag control system combines traditional components with shock sensors, a control unit and an actuator (*gas generator squib*).

Airbag activation occurs upon impact. Depending on the direction of impact, only certain airbags are activated. If the impact force exceeds a predetermined level, the shock sensors transmit a signal to the control unit. After processing the data of all sensors, the control unit determines the need and time for the deployment of airbags and other components of the passive safety system.

Depending on the type and severity of the accident, for example, only seat belt pretensioners or seat belt pretensioners together with airbags can be triggered. The control unit provides an electrical signal to activate the gas generators of the respective airbags. The airbag deployment time is about 40 milliseconds. The gas generator provides the opening and inflation of gas cushions. After contact with a person, the pillow is torn and deflated.

Airbags are disposable devices. In the event of a car ignition (increase in temperature in the cabin to 150-200 ° C), all airbags automatically deploy.

The airbag deployment algorithms are constantly being improved and become more complex. Modern algorithms take into account the speed of the vehicle, its deceleration rate, passenger weight and location, the use of a seat belt, and the presence of a child seat.

Modern cars are equipped with seat belts with tensioners (pretensioners). The seat belt tensioner is designed to prevent a person from moving forward (relative to the movement of the car) in case of an accident. This is achieved by reeling up and reducing the freedom of the seat belt.

According to the principle of action, the following designs of seat belt tensioners are distinguished: cable; ball; rotary; rack and pinion; tape.

The specified tensioner designs are equipped with a mechanical or electric drive. The tensioner drive is a method of igniting the squib:

- the mechanical drive is based on the ignition of the squib cartridge mechanically fig. 3. (striking with a striker);

Fig. 3. Seat belt tensioners

- an electric drive involves ignition of the squib cartridge by an electric signal from an electronic control unit (or from a separate sensor).

As a measure against non-use of seat belts, there are automatic seat belts. These seat belts automatically fix the passenger when the door is closed (engine start) and release it when the door is opened (engine stop). Automated, as a rule, the movement of the shoulder strap, which moves along the edges of the door frame. The lap belt is fastened manually. Due to the complexity of the design, the inconvenience of getting into a car, automatic seat belts are practically not currently used.

The pedestrian protection system is designed to reduce the consequences of a collision between a pedestrian and a car during a traffic accident. The system have a similar design fig.4. Like any electronic system, the pedestrian protection system includes the following structural elements: input sensors; Control block; executive devices [6].

Fig. 4. The scheme of the pedestrian protection system: 1 - acceleration sensor; 2 - contact sensor; 3 - hood lift; 4 - control unit

Acceleration sensors (Remote Acceleration Sensor, RAS) are used as input sensors. 2-3 of these sensors are installed in the front bumper. Additionally, a contact sensor can be installed.

The system can work both with its own electronic control unit and with the passive safety system control unit. It is preferable to use a passive safety system control unit, implemented using integrated software. This achieves an increase in the efficiency of the entire passive safety system.

The executive devices of the pedestrian protection system are the hood lifts installed on both sides of the hood in parallel with the movement fig.5. Lifts have a pyrotechnic or spring-pyrotechnic drive.

Fig. 5. Bonnet protector

The principle of operation of the pedestrian protection system is based on the opening of the hood when a car collides with a pedestrian, thereby achieving an increase in the space between the hood and engine parts and, accordingly, a reduction in human injury fig.6. In fact, the raised hood acts as an airbag. [14].

Fig. 6. Opening the hood in a collision with a pedestrian

When a car collides with a pedestrian, acceleration sensors and a contact sensor transmit signals to the electronic control unit. The control unit, in accordance with the program laid down, if necessary, initiates the activation of the squibs of the hood lifts.

In addition to the presented system on cars, the following design solutions are used to protect pedestrians, which reduce injuries in a collision: a “soft” hood; frameless brushes; soft bumper; sloping slope of the hood and windshield; increased distance between the engine and the hood.

And also to protect drivers, active and passive headrests are distinguished. In passive systems, the safety of the cervical spine is achieved through the design of the seat and head restraint. During an accident, the active head restraint approaches the head, thereby reducing the likelihood of injury to the cervical spine. The design of the active head restraint may have the following types of drive: mechanical; electric.

The mechanical drive is simpler. In an accident, the inertial movement of a person in a car seat is transmitted through a linkage to a head restraint that moves to the head fig.7. As soon as the pressure on the back of the seat is reduced, the spring returns the head restraint to its original position.

The implementation of the electric drive of the active head restraint requires an electronic control system. The control system includes shock sensors, a control unit and the actual drive mechanism. The basis of the mechanism is an electric igniter.

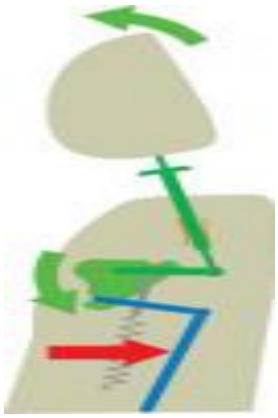

Fig. 7. Link diagram

Impact sensors are installed at the rear of the car. Signals from the sensors are received by the common passive safety control unit. Depending on the strength and direction of impact, it regulates the operation of the drive.

Another of the passive safety geographic information systems is the emergency call system fig.8.

The emergency call system is used to automatically alert emergency services of a traffic accident and provide timely medical assistance to car passengers. Using the emergency call system can significantly reduce the level of injuries in road traffic accidents.

The system recognizes the severity of a traffic accident according to the readings of sensors of active and passive safety systems. Then she scans all available GSM-networks and selects a channel for sending SMS-messages about the accident. The system automatically contacts the call center (call center) and provides detailed information about the accident: exact location; vehicle speed; vehicle deceleration rate; number of passengers; car (rollover); the number of airbags deployed; the number of activated seat belt tensioners. [10].

Fig. 8. Emergency call system

According to the data obtained, the severity of passenger injuries, urgency and the volume of medical care are predicted. Immediately after the incident, the system establishes a direct voice connection between people in the car and call center specialists. The nature of the accident and the condition of passengers are being clarified. Emergency services are called based on aggregated data. If passengers are unconscious and do not respond to requests, the emergency services are called based on the data transmitted by the system.

To the scene of the accident are specialized cars. If necessary, a helicopter can be used. In parallel, the nearest medical institution is selected that matches the type and severity of the injuries received.

Emergency services can be called manually from the passenger compartment, for example, in order to warn about an incident with other traffic participants.

And also in the event of a car accident, there are emergency circuit breakers designed to prevent a short circuit in the electrical system and possible fire of the car fig.9. The emergency battery disconnect switch is provided for vehicles in which the battery is installed in the passenger compartment or in the luggage compartment.

The following emergency breaker designs are distinguished: squib disconnector; battery disconnect relay. [10].

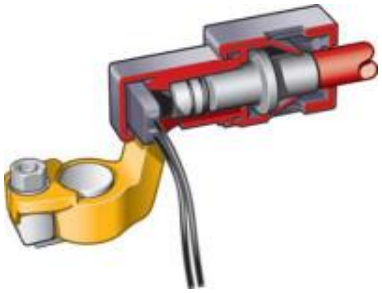

Fig. 9. Emergency release

The trip igniter is mounted on the positive terminal of the battery. The igniter is triggered by the command of the passive safety control unit. Opening is due to gases arising from the operation of the squib. The trip relay is also triggered by a command from the control unit. The igniter or relay activated during an accident must be replaced.

Conclusion

Thus, the information system harmonizes the interests of drivers, automating the accounting of events in the automotive industry. In addition, the geographic information system contributes to the decision on the need to inform the driver about changes in the technical condition of vehicles.

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