



## MODERN TECHNOLOGIES IN VEHICLES

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### ANOTATION

This paper discusses modern systems built into the means of transport. Nowadays, with more and more things being fully automated, some operations that have been clearly linked to the management of the vehicle have been gradually abandoned by the driver. Thanks to advanced computers and many applications, we can almost monitor everything on the vehicle today. In this article, we will focus more on, for example, on an emergency car call system. We are dealing with new systems that are expected to become part of the autonomous management of transport means in the near future.

### KEYWORDS

Active safety, passive safety, autonomous control, automotive, radar, E Call, technology, traffic accidents, legislation, development of security systems, development of autonomous control

## 1 TECHNOLOGIES USED TO INCREASE ACTIVE SAFETY

Active safety has been solved in vehicles since the beginning of their production. The basic task of active safety is to prevent accidents, ideally to prevent them today. It helps the driver in his activities.

### 1.1 History of Active Security Elements

The basic elements of active safety are effective early, which must guarantee the appropriate deceleration until the vehicle stops. Historically we know the fact that the active elements of safety also include a good view from the vehicle, which was solved with glasses in the first vehicles and motorcycles. Not only a good view, but also a seating comfort and is important for the driver. Therefore, adjustable seats, rearview mirrors are used.

Accurate and reliable driving is also a matter of course. Another essential element is the tires and wheels together with their suspension and suspension with damping, it is also important to keep the wheels and the road in contact with the effective brakes.

All of these elements are currently being developed and, thanks to fast microprocessors, are often driven by computers. Many elements already have their memory, so changing drivers in the vehicle does not mean a new set-up, but only instructions for tasks that are done by themselves with controlled actuators.

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## 1.2 Basic used elements

The basic, now used in each vehicle vehicle features include ABS, ASR, EBS, ESP individual systems we will briefly introduce.

### ABS

ABS is an abbreviation of the system with the name of an anti-blocking system, which allows slippery roads to constantly rotate the wheels at maximum braking effect. On a road with a different friction coefficient of the left and right sides, the vehicle allows the vehicle to drive in the right direction by altering the braking effects on the individual wheels.

### ASR

The ASR system is based on the English name and means the wheel slip control system. The system can work on two principles. The first is the braking of individual spinning wheels; the second is the power reduction on the drive axle. The system collects information from ABS sensors.

### EBA

Electronic Brake Assist EBA is a system that helps the driver braking faster to achieve maximum braking performance faster. It senses the speed and pressure of depressing the brake pedal. Legislation is mandatory for new vehicle models from 11/2009 and older models from 2/2011. [3]

### ESP

The electronic stabilization system is a superstructure of the ABS system. Its function is to create a torque for vehicles in a revolving or non-retractable condition. The torque is generated around the center of gravity of the vehicle by braking one of the vehicle wheels.

## 1.3 Developed technologies and above-standard features

### Brake systems

Brake systems are still evolving, mainly because we can drive them faster and better with sensors, processors and actuators.

#### ***Multi-collision brake***

Among the new systems is a multi-collision brake, which, in an accident where the airbags are activated, brakes the vehicle with the maximum braking effect with respect to ABS, thus stopping the vehicle to prevent further accidents. The system also activates warning lights.

#### ***Hill Start Assist***

Hill Start system manages to maintain the braking effect of the brake pedal sešlápnutého two seconds after release. This allows the driver to move the foot from the brake pedal to the clutch and move safely without reversing the vehicle. After the gas has been added, the system is gradually deactivated. It works when driving uphill both forward and backwards.

#### ***Front assistant***

The predictive brake system works in conjunction with the ESP or ESC system together with a radar that controls the space in front of the vehicle. It alerts the driver to individual obstacles. The system's function is to alert the driver that near the vehicle, only the radar function, sends a warning signal when the approach is closer; the vehicle stops if the driver stops braking.

### **Warning lights**

Activating the warning lights is not new. It should be noted that a vehicle moving at a speed higher than 60 km / h with a deceleration of more than  $7 \text{ m / s}^2$  will automatically trigger warning lights. [3]

### **Control systems**

Nowadays, the advancement of modern technologies advances and there is no longer any problem driving the vehicle without driver intervention. So far, however, these systems are predominantly used for the comfort of driving.

#### **Adaptive cruise control**

The adaptive cruise control is the innovator of the classic cruise control, which has the task of keeping the speed specified. The adaptive cruise control co-operates with several systems. It manages to guard the obstacle in front of the vehicle according to the radar; it can adjust (decrease) the specified speed and keep a safe distance from the front of the vehicle. It runs from 30 km / h to 160 km / h. With the manual gearbox, the speed will be reduced to approximately 30 km / h and automatic braking will stop. [3]

#### **City safe drive**

It is a system similar to the adaptive cruise control, but it works at speeds of up to 30 km / h to guard the driver's inattention in urban traffic. The laser CV sensor monitors the distance up to 10 m in front of the vehicle. With an impending obstruction, the brakes will produce the maximum effect and can safely stop the vehicle. [3]

#### **Lane assistant**

Lane assistant prevents the vehicle from lurching from its lane. The correction force is small, so the driver is still driving. If the driver fails, the system can keep the vehicle in the lane, start the hazard warning lights and stop the vehicle.

#### **Colon Assist**

Colon Assist is a combination of several advanced systems. With the automatic transmission, the Lane Assistant and Adaptive Cruise Controls communicate with each other in a safe way to control the vehicle in the column, move slowly around the vehicle, and move safely out of the column.

#### **Self parking**

It is a superior system that can find a large parking space, both transverse and longitudinal. The vehicle spontaneously spins the wheel, the driver pedals and ranks. This increases parking safety. This system has a number of subsystems necessary for its operation, such as ultrasonic sensors for detecting the vehicle's distance from the obstacle. The system can also be equipped with a parking camera or a  $360^\circ$  view of the vehicle. Also, the assistant maneuver system stops when the vehicle approaches the obstacle before impact.

### **Lighting systems**

Smart vehicle lighting is a major trend today. The illumination at the beginning was made by a stronger and weaker bulb and could be determined by a parabola. Gradually switching to halogen bulbs, the quality of lighting increased. A significant transition was through the use of xenon lamps, their separate adjustment according to the load or switching of the driving lights by turning the lens. But today's systems handle much more.

**Smart light assist**

The system that monitors traffic in front of the vehicle records both the vehicle in the same direction and the vehicle in the direction of the vehicle and manages to shade the high beam. After switching on automatically, it will start and shut down at the appropriate time. The passing vehicles are not dazzled; the driver gets a great view.

**Adaptive headlights**

Adaptive headlamps can only be built into xenon headlamps. It can change the light angle depending on the speed and weather conditions or on steering the steering wheel. At speeds of up to 40 km / h, the steering wheel turns the driver into the curve with fog light. Dynamically changes the inclination of the lights according to the tilt of the vehicle.

**Night vision**

The night vision system has been used in vehicles for many years. Today's technology goes forward. The display is on a spacious multifunction display. The driver sees the obstacle clearly and far before his own sight. It is alerted to the acoustic tone and the vehicle can stop and stop without the driver's reaction.

**Light assistant**

The system is now almost on all modern new vehicles. Locks or unlocks the lights for safe travel around the vehicle. When the ignition is switched on, the daytime running lights switch on and, when entering the tunnel, daytime running lights switch to conventional headlights.

**Above standard systems**

Among the above-standard systems, we can include systems that use the best-equipped vehicles. It is worth mentioning, for example.

**Tire pressure check**

Tire pressure monitoring alerts the driver to the tire pressure and prevents the risk. In time, he warns of a defect.

**Recognition of traffic signs**

The Traffic Signaling System works by comparing the image from the multifunctional camera and the tagging database to the GPS. It can warn of the ban on overtaking, the maximum speed or the ordered directions and their expiration.

**Area view**

The system view Area thanks to its four wide-angle cameras in the front, rear and mirrors manages to create a great view of the entire vehicle and the space around it. Thanks to it, the lifts can be more easily coupled or a pedestrian or vehicle center can be prevented from walking in a confined exit or junction.

**2 TECHNOLOGIES USED TO INCREASE PASSIVE SECURITY**

Passive crew safety is undoubtedly an integral part of road vehicle systems. Although we try to prevent accidents very actively, there may be collision situations that vehicle systems cannot yet evaluate. One of the causes is also the age of the fleet; older vehicles have insufficient active safety systems.

## 2.1 History of Passive Safety Elements

The history of passive safety features is very extensive. However, it should be noted that for the first vehicles, the safety of the driver is so much avoided. But this is also related to the fact that the vehicles were not running very well, as well as the accidents, and it was not necessary to deal with this direction in the beginning of production of serial vehicles.

## 2.2 Basic used elements

The headrests of all seats, the three-point seat belts of the whole crew, the airbags, the generally well-developed vehicle body with all the deformation zones can be taken as the basic elements used today in vehicles. Although there has been a series of years between serial use of individual elements, today without them no vehicle can do without.

### Self-supporting body

The bodywork itself, as we can imagine today in modern vehicles, is a set of several sophisticated tasks that, from individual parts, create a self-supporting bodywork. It is necessary to mention the most important parts of the body that can keep the undeformed part of the bodywork, and the space for the crew. These parts are mainly A, B, C pillars, door reinforcements, front crossbar, front rail, threshold, defolements. The body can be divided into two basic parts, a crew compartment that cannot be deformed, and the deformation zones, which on the contrary have to absorb all kinetic energy.

### Seat belts

In 1967, the obligation to use seat belts in front passenger seats was introduced. But they were developed much earlier in the 19th century. The five-point seat belt was then adjusted to three-point.

The seat belt works in a way to fire a pyrotechnic patch that extends the belt by up to 10 cm. In the event of a greater load than 500 kN, the belt starts to deform by shaft deformation. This situation can occur when the crash and unattached crew in the rear seats. [3]

### Airbags

Airbags are used to minimize the consequences of an accident by filling the space between the crew and the fixed part of the vehicle to minimize impact on the fixed part of the vehicle. Previously, airbags were used only as fronts, and today there are many more. In today's vehicles, side airbags, head and knee airbags can be found.

The airbags are filled in approximately 0.04 s and are expelled in a controlled manner so that the body does not flip, but is slowly absorbed into the cushion [3]

### Baby seats

The safety of our small passengers needs to look a little from another perspective. Their body is considerably smaller and more fragile. Most invulnerable movements for an adult can lead to their killing.

The distribution of child seats is based on the age of the child in the 3 categories. Within one year, one to four and four or more years. A child over 150 cm can be transported without a child seat. Exceptions to transport are law, firefighters, police, IZS, mountain service and taxis. [3]

## **2.3 Developed above-standard elements and technologies**

### **E-Call system**

The E-Call system is not a system that will be born in recent years. It is talked about it for decades, the first use, to date very outdated models, dating back to the eighties and nineties of the last century. At that time, he worked on the principle of radio broadcasting.

### **System Features**

The E-Call system has two basic functions that are built on one powerful idea and is to help the crew as quickly as possible in a traffic accident. The first option is that the vehicle is part of a traffic accident, so it crashes and blows its airbags at this time the system automatically calls on the emergency line and sends a GPS signal to determine the exact position of the vehicle. Using the Emergency Line, rescue units can be launched immediately. The system and its own code will tell you what kind of vehicle is, how much fuel you drive, how many activated safety belts and more. The second feature is that the driver can automatically turn on the system and call the emergency line if it is only witnessing a traffic accident.

### **Legislation**

The European Parliament has approved the mandatory incorporation of E-Call for new models of passenger cars and light commercial vehicles from March 31, 2018. Within three years, an evaluation report will be prepared to decide on the incorporation of E-Call into other vehicle categories. [2]

### **Abuse**

The system is activated only in an accident or manual start; otherwise, it is inactive, therefore unattainable. All data is forbidden to entrust to third parties unless the consent of the owner.

## **3 AUTONOMOUS CONTROL OF VEHICLES**

Autonomous vehicle management has been developing for many years. A lot of new modern vehicle systems resemble almost autonomous driving. But it's just a certain situation, fully autonomous driving, that is, a vehicle driving without a driver, is not yet legislatively approved. but there are several degrees of autonomous control.

### **3.1 First degree of autonomous management**

It is nowadays well known for use in modern vehicles. These are, for example, adaptive cruise control or Lane assist system and the like. These systems may slightly interfere with driving or change direction slightly, but the driver is superior to them. There can always be one action element. This is driver support

### **3.2 Second degree of autonomous management**

Partial automation can be called, for example, an automatic parking system, which can also use multiple actuators at once, turning the steering wheel and adding gas. However, the driver must be prepared to intervene if necessary.

### **3.3 Third degree of autonomous management**

This category includes vehicles with a system so sophisticated that, for example, on the highway, with well-marked bands, the driver does not need to notice the steering. But it must respond to all vehicle alert messages.

### 3.4 Fourth degree of autonomous management

This category is another technical upgrade to category three. For example, the driver must be in bad weather, reduced visibility due to fog or heavy snowfall. If the driver is not responding to the challenge to take control, the vehicle stops safely.

### 3.5 Fifth degree of autonomous management

It is a fully automatic control, the driver only nudges and enters the destination destination. The vehicle is not equipped with pedals or steering wheel. [4]

## 4 CONCLUSION

The future of autonomous governance is quite out of the question. We are currently in Automation Level 2, some systems have been introduced in previous chapters. Many of the older systems are now at a great level, the general public and drivers believe the systems are believed. The problem of launching other new systems on the market is not only technical but mainly legislative. Of course, systems are developed at all levels of automation, but their price, size, energy intensity, but also reliability are solved. If this is not an accident caused by a human factor, but a machine or a failure of a subsystem, the public might lose interest in development and confidence in technical progress.



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