Realization of Future Car Sharing Speed Safety System Based on Internet of Vehicles

Min Chen 1, Jiang Fu 1, Jigui Zhang1, Jianjun Ma1 and Yi Wang 1,2*

1 Applied Technology Research Institute, Guizhou City Vocational College, Guiyang, Guizhou,550025, China
2 School of Physics and Electronic Science, Guizhou Normal University, Guiyang, Guizhou, 550025, China
*Professor Yi WANG is the corresponding author.
E-mail: 624261835@qq.com

Abstract. In the future, cars will integrate the advantages of intelligent network technology on the basis of car networking applications formed by car bus technology, communication technology, and Internet technology, and be equipped with safer, smarter and more comfortable car control systems. Based on the Internet of Vehicles technology, this paper proposes a car sharing speed safety system, analyzes its structure, composition and working principle, and expounds the advantages of the application of the system in the Internet of Vehicles technology. The application of the shared speed safety system will play a good supporting role in the unmanned driving, peer optimization and safe driving of future cars.

1. Introduction
According to data provided by the World Health Organization, there are approximately 1.25 million road traffic accidents deaths worldwide each year, which is equivalent to 3,500 deaths per day, and 80 million people are injured or disabled by traffic accidents each year [1]. The World Health Organization also stated that one of the main factors causing road traffic deaths and injuries is that the speed of the vehicle is too fast and the vehicle does not slow down in time. Road traffic accidents are generally caused by a series of rear-end collisions of vehicles. Therefore, how to share speed between vehicles and how to ensure driving safety is one of the urgent problems to be solved. With the rapid development of Internet of Vehicles technology, automobiles will develop in the direction of connectivity, intelligence and unmanned driving, and various intelligent systems and communication technologies will be widely used in automobiles. This article proposes an implementation method of a car sharing speed safety device based on the Internet of Vehicles, which can provide a meaningful reference for the development of future cars.

2. Car networking system architecture
The application areas of the Internet of Things involve logistics, transportation, security, energy, medical treatment, construction, manufacturing, home furnishing, retail and agriculture, and the Internet of Vehicles is a typical application combining the Internet of Things and transportation.

The Internet of Vehicles is based on in-vehicle networks, wireless communication networks, and the Internet. According to the agreed communication protocols and data interaction standards, real-time wireless communication and information exchange are carried out between cars and people,
cars and roads, and cars and cars. It can realize intelligent traffic management, intelligent dynamic information service and vehicle intelligent control between vehicles [2]. The car networking system corresponds to a three-tier architecture, as shown in Figure 1.

2.1. Perception layer
The vehicle's own data, vehicle driving data and external data are acquired through on-board sensing equipment, road test equipment and other equipment, and the vehicle's own data and environmental data are collected and sorted through on-board intelligent equipment.

2.2. Network layer
In the network layer, different network technologies can be compatible, and the information collected by the perception layer can be transported to the data center through the network to provide guarantee for information transmission and ensure that the data is complete and reliable.

2.3. Application layer
Carry out management and application around car data, process different data, and provide a variety of vehicle services to traffic managers, traffic travelers in various modes of transportation, and information service operation companies.

Independent sensor networks, flexible and diverse in-vehicle networks, and multi-application integrated vehicle terminals will become the huge features of future automobiles. Vehicle access to the Internet becomes a brand-new in-vehicle social network that can realize free interaction of information [3]. In the future, the development of in-vehicle network information systems can realize the free interaction of information between people, vehicles, and the environment, which has a very important guiding role in car data sharing and can realize many application innovations.

3. Car security system
Automobile safety system mainly includes two aspects: active safety system and passive safety system [4]. The role of the active safety system is to avoid accidents, and the passive safety system can protect the members of the car or protect the crashed vehicle or pedestrian in the event of a vehicle accident. Active safety systems include anti-lock braking system (ABS), electronic brake force distribution system (EDB), traction control system (TCS), high-position brakes, front and rear fog lights, rear...
window defogging and other active safety designs. Passive safety systems include passive designs such as seat belts, airbags, and door anti-collision steel beams.

The signal of vehicle speed is a very important driving parameter for vehicle drivers. Under the development of vehicle active safety system, to realize the reliable operation of vehicle deviation, car navigation and other systems, it is necessary to accurately grasp the vehicle speed [5]. In addition to the vehicle's own data, it is also necessary to have a certain grasp of other vehicle data in order to accurately grasp the driving environment and guide the vehicle to drive in a safe environment.

For traditional navigation, it cannot detect and discover accidents. Although the traditional navigation map can understand the real-time road conditions ahead, it is not accurate enough in real-time and has a large delay, and the traditional navigation map cannot detect and set the safe distance between two vehicles.

At present, the mid-to-high-end cars on the market are equipped with a car following system, but this system can only detect the distance between the car and the car in front, and cannot detect the speed of other vehicles in front of it, so it cannot know the operating conditions of other vehicles in front of it in time. Nor can it inform other vehicles of the operating status of the vehicle. The future car sharing speed safety device can effectively solve the above problems and improve the safety of car driving.

4. The overall architecture of the future car sharing speed safety system
According to the connection characteristics of the shared speed safety system in the vehicle network, the architecture of the shared speed safety system is divided into four layers:

![Overall Architecture of the Shared Speed Safety System](image)

Figure 2. The overall architecture of the shared speed safety system

4.1. Data perception layer
Obtain dynamic driving data of the vehicle through the use of vehicle sensors.

4.2. Data transmission layer
Realize the collection and upload of vehicle data through vehicle network, Internet, mobile communication and other methods, and realize the data information interaction between vehicles.

4.3. Data platform layer
The data processing system is adopted to realize data storage-analysis-sharing. The data platform layer is the basic technology platform of the entire system.
4.4. Alarm/display layer
Comprehensive display of different types of information, and alarm for abnormal information.

5. The composition of the future car sharing speed safety system
The shared speed safety system is composed of power supply, LCD display, alarm device, signal collector, signal transceiver and signal processor, as shown in Figure 3. The power supply provides operating voltage for the system, and the signal collector collects the vehicle's own speed data and sends it to the signal transceiver and signal processor. The signal transceiver sends the data collected by the signal collector and receives data from other vehicles and sends it to the signal processor, which analyzes and processes the data collected by the signal and the data received by the signal transceiver. Finally, the speed of vehicles within one kilometer is displayed on the LCD screen.

![Figure 3. Structure diagram of shared speed safety system](image)

The power-on work of the shared speed safety system includes two modes: manual start mode and automatic start mode, which realizes automatic start based on position sensor data. The signal collector includes a vehicle speed sensor and a position sensor. The vehicle speed sensor is used to detect the speed of the vehicle, and the position sensor is used to detect the section where the vehicle is traveling and the direction of the vehicle; In addition to sending the vehicle's own data and receiving other data, the signal transceiver is also used to send reminders of vehicle deceleration or vehicle stop; The signal processor mainly includes a data filtering module, which is used to filter out the useful data of the same vehicle driving section and driving direction when the distance between the two vehicles received by the signal transceiver is less than 1km. The vehicle's own data includes the vehicle's own driving speed, the vehicle's driving section and the vehicle's driving direction, and the other vehicle data includes the driving speed of other vehicles, the driving path of other vehicles, and the driving direction of other vehicles.

The abnormal conditions that exist during the driving of the vehicle include the situation where the speed of the vehicle is zero, the speed of multiple vehicles in front of the vehicle suddenly decreases, the speed of the vehicle with a distance of less than 100m in front of the vehicle suddenly decreases, and the vehicle behind the vehicle is too fast, these abnormal situations can be alarmed through alarm devices and defined alarm methods. The forms of alarm include language prompts, image display and flashing prompts.

Working steps of shared speed safety system:
• When the vehicle enters the high-speed section, the shared speed safety system is powered on;
• The signal collector collects the vehicle's own data and sends it to the signal transceiver and signal processor;
• The signal transceiver sends the vehicle's own data and receives other vehicle data;
• The signal processor analyzes and processes the received data of other vehicles in combination with its own data, and sends an alarm signal to the alarm device under abnormal conditions;
• The speed information of vehicles within 1km is displayed on the LCD screen;
• The alarm device alarms.

6. Conclusions
Car driving is related to the safety of people's lives and property. As one of the important factors that cause car accidents, car speed has very important practical significance for the research and use of car-car speed data. The development of the Internet of Vehicles technology provides support for workshop communication, in-vehicle communication, out-of-vehicle communication, and vehicle-to-road communication. Through the connection of the network, the interconnection of various units is established to realize data processing and data interaction between data centers and vehicles. On this basis, the use and interaction of useful information between vehicles has a huge impact on car driving. Through the data collection of car speed and surrounding environment, the car data and environmental data are quickly processed, analyzed, screened and utilized, so as to realize real-time feedback and driving motion guidance. The future car sharing speed safety system based on the Internet of Vehicles can provide important safety guarantees for car driving on highways.

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