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A New Warning System for Dangerous Driving Based on Internet of Things

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Abstract: *According to the relevant investigation information of China's Ministry of Communications, the three main factors inducing traffic accidents today are drunk driving, dangerous driving and fatigue driving. Among them, China has regulated and treated drunk driving from the legal level, but there is still a lack of effective prevention and treatment measures for fatigue driving and dangerous driving. Therefore, it is necessary to detect fatigue driving and dangerous driving behavior accurately and flexibly. In this study, a new warning system for dangerous driving based on the Internet of Things is proposed, which can be used for various vehicles. It has various sensors (smoke sensor, alcohol sensor), 940 infrared lamp fill light, GPS module, etc. With the help of WIFI module, the user can calibrate the equipment and can alarm and upload it in real time. The device can detect and warn drivers of abnormal behaviors: fatigue detection, mobile phone playing detection, drunk driving and smoking detection.*

Keywords: *Dangerous driving, sensor, GPS, WIFI*

1. Introduction

With the gradual improvement of people's living standards and the continuous improvement of road traffic systems in major cities, the total number of cars in China is also increasing, and the number of private cars is also expanding. Urban road traffic is facing tremendous pressure. In addition, relevant road regulations and driving systems are not perfect, some drivers forget about standardized driving and civilized driving, and drivers often smoke, play mobile phones and drink and drive in cars, which brings convenience to people's travel and also leads to frequent traffic accidents, which is harmful to drivers and pedestrians.

Statistics show that from 2007 to 2009, the number of deaths directly caused by fatigue driving in China accounted for 11.35%, 10.91% and 12.5% of the total traffic accident deaths of motor vehicle drivers respectively, and about 90,000 people died from fatigue driving every year. China has accounted for 20% of the total traffic accident deaths in the world. Therefore, it is of great significance to research and develop high-performance real-time monitoring and warning technology for drivers' fatigue state to improve traffic safety in China. Compared with fatigue driving, the situation of drunk driving is even less optimistic. There are 6 billion people in the world, and 500,000 people die from traffic accidents every year. In China, there are more than 90,000 people who die from road traffic accidents every year. The fatality rate of traffic accidents abroad is much lower than that in China. The mortality rate in Japan is 0.9%, that in the United States is 1.3%, and that in China is 27.3% on average. Smokers are 1.5 times more likely to have a car accident than non-smokers. The smoke they spit out leads to insufficient oxygen, slow response and poor eyesight. Furthermore, because of the habit of holding cigarettes, gestures will become smokers, the center of gravity will shift, and the body will be irregular or deformed, thus causing traffic accidents. Playing mobile phone while driving will narrow the driver's vision and reduce the perception of peripheral vision. Studies have shown that the brain's reaction speed is 30% slower than that of drunk driving, and the risk of a car accident when driving on a mobile phone is more than four times higher than that of normal driving. In case of emergency or unexpected situation, the driver's adaptability and reaction time will be greatly weakened[1-2].

The research related to driver fatigue monitoring technology in China started a little late. Although some domestic cars have been matched with this system, most of them are provided by foreign parts suppliers. Among them, independent research and development is mainly concentrated in colleges and universities, and Tongji University, Shanghai Jiaotong University, Jilin University, Harbin Institute of Technology, etc. all have related research, and have achieved certain research results, but there is still a long way to go before they are commercialized. Therefore, there is an urgent need for a new type of

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dangerous driving warning system based on the Internet of Things, which can quickly and accurately detect the driver's state and make a judgment.

2. Introduction of system functions

A new warning system for dangerous driving based on the Internet of Things (hereinafter referred to as the warning system) can be used for various vehicles, which is mainly divided into K210 face recognition and behavior judgment module, smoke sensor unit, alcohol sensor unit, power management unit, main control unit and WIFI wireless transmission unit. Each functional unit is independent of each other into modules, which is not only convenient for product design and assembly, but also convenient for later product maintenance and repair. It has built-in 128G Micro SD card, 940 infrared lamp fill light, speaker, GPS module and full HD alarm video.

After research, the basic process is determined. That is, MQ-7 CO gas sensor, ZPH01 dust sensor, MQ-3 alcohol sensor, etc. acquire the data of gas concentration in the air, convert chemical signals into electrical signals, and transmit them to STM32 single chip microcomputer for signal processing. The camera acquires the driver's driving status, transmits it to K210 for processing, and converts physical signals into electrical signals. If the detected related data are compared to obtain dangerous driving signals, the alarm will give an alarm, and then the signals will be transmitted to the central host computer by the WIFI module for storage. At the same time, it is more obvious to visualize the complex and difficult data and reflect the overall changes with data changes, as shown in Figure 1.

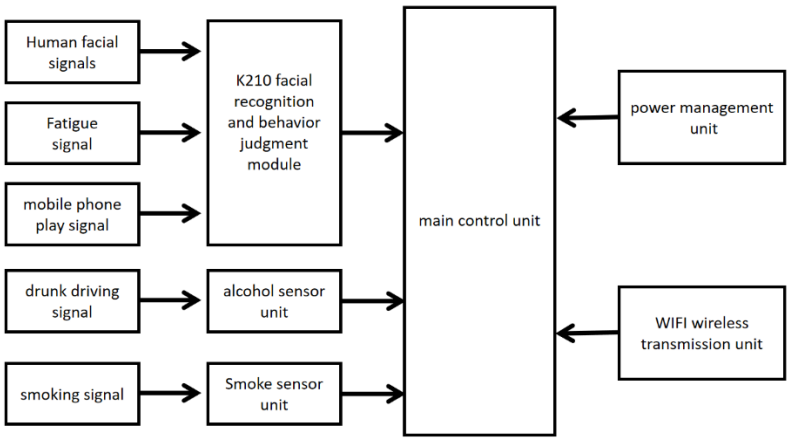

Figure 1: Flow chart of system operation

3. Overall structure and principle of the system

The alarm system is mainly divided into K210 face recognition and behavior judgment module, smoke sensor unit, alcohol sensor unit, power management unit, execution unit, main control unit and WIFI wireless transmission unit. The main control unit is mainly responsible for the management of various internal control processes and the conversion between analog signal data and digital signal data. The device can detect and warn drivers of abnormal behaviors: fatigue detection, mobile phone playing detection, drunk driving and smoking detection.

1) main control unit

For the detection and alarm of a driving situation, drivers are faced with a variety of environments, which require high stability and reliability of the system, not only for the stability of the main control chip, but also for the anti-interference characteristics of the whole circuit. The main control part of embedded WIFI system is designed and developed separately, which not only helps to reduce the interference signals generated by other functional units, but also facilitates the later hardware maintenance and firmware upgrade. The main control part adopts STM32, which is compact in size, rich in functions and high in stability, ensuring the stable operation of each function. Bootloader inside the main control chip uses USB2.0 PHY peripheral as a virtual serial port, which can facilitate debugging information output and later firmware upgrade. Users only need to connect the main control part to the computer through USB cable to realize the above functions without additional equipment ,

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as shown in Figure 2.

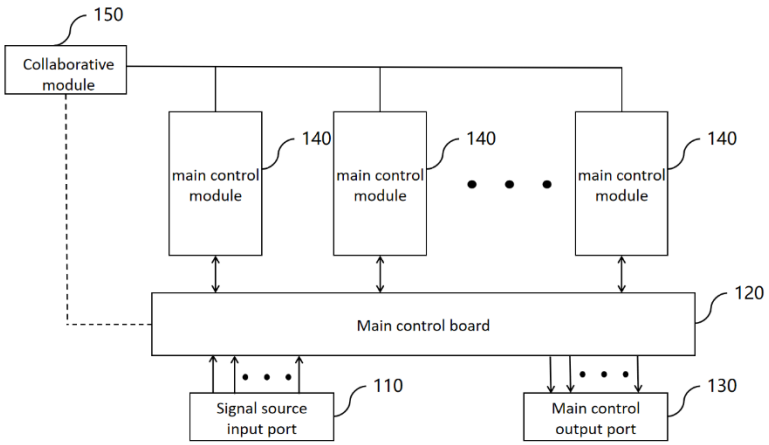

Figure 2: Working schematic diagram of main control module

2) Power management unit

The power supply part is designed separately to ensure the stability of power supply. An independent dc-dc power supply circuit is provided for each other in the power management unit to ensure the stability of each part of the power supply, and at the same time, each dc-dc can control its enabling state independently, which is convenient for realizing the overall low power consumption function , as shown in Figure 3.

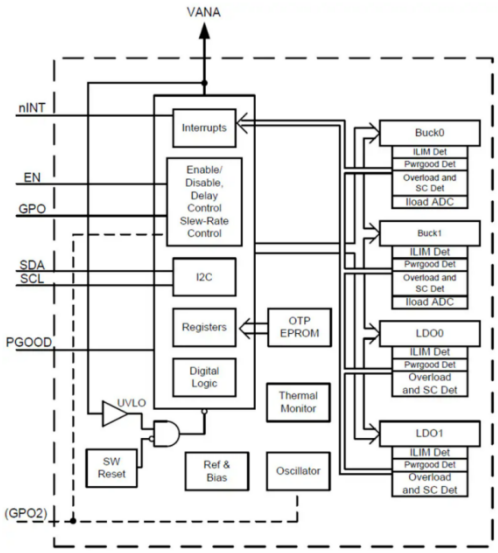

Figure 3: Working block diagram of power management module

3) Wireless transmission unit

The biggest feature of this WIFI system is that it travels farther than other wireless methods under the same power consumption, realizing the unity of low power consumption and long distance, and expanding the distance of traditional wireless radio frequency communication by 3-5 times under the same power consumption. The common LoRa system has low anti-interference ability, uses the same frequency and sends signals to the host at the same time, and does not interfere with each other, thus solving the pain point that wireless signal communication is easily interfered. The receiving current is only 10mA, and the sleeping current is less than 200nA, which greatly prolongs the service life of the battery[3-4].

In order to obtain the specific position of each ball valve in the case of multiple ball valves networking, a satellite positioning module is added to the embedded WIFI transmission system. The internal satellite positioning module supports both GPS satellite signals and Beidou satellite signals,

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which can make accurate positioning more quickly and stably. The satellite positioning module can also obtain accurate satellite timing signals. The satellite positioning module is also installed in the wireless transmission unit, which can greatly reduce the signal interference between the module and other units and greatly enhance the stability and reliability of the system , as shown in Figure 4.

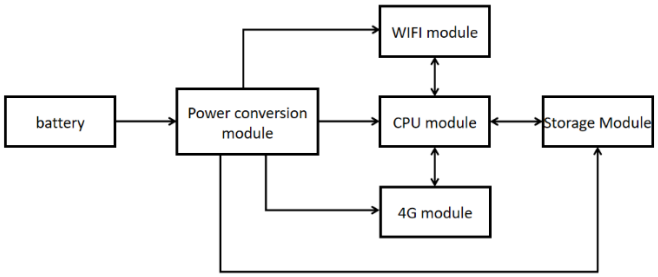

Figure 4: Working block diagram of wifi module

4) Execution unit

Using electric ball valve as the core implementer, the sensor transmits the received data to STM32 chip, and STM32 processes the data, makes a judgment, and transmits the command to the motor drive, thus realizing the opening and closing of the ball valve. In addition, STM32 has fast operation speed, and the peripheral interface function is more abundant, which can collect and process data at high speed and effectively, thus making the valve switch more sensitive[5-6].

The product has stable sealing performance and long service life. In remote areas and areas with complex terrain, even if the climate and environment are bad, it can accurately judge and send signals.

4. Conclusion

Doing a good job in the warning system of dangerous driving is particularly important for the orderly progress of the whole traffic regulation work. And a complete, convenient and reliable warning system for dangerous driving is an important guarantee for the whole traffic work. The buoy based on the Internet of Things dangerous driving warning system will minimize the occurrence of danger, and adopt flexible module design sensors to meet different needs.

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