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## Design of Intelligent Vehicle Multimedia Human-Computer Interaction System

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# Design of Intelligent Vehicle Multimedia Human-Computer Interaction System

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**Abstract.** In the wake of the continuous progress and development of the automotive industry, the automotive era has come. The development and progress of intelligent vehicle networking makes people spend more and more time in the car. Consumers' demand and quality for automobiles are also gradually improving. While enjoying the improvement of work efficiency, rich material life and modern convenient transportation, consumers should also pay attention to driving safety, which makes the research on the direction of human-computer interaction of automobiles and their related products become an important part. In this text, the development status, related technology analysis and future development trend of intelligent vehicle multimedia Human-Computer Interaction system are discussed from various angles. Based on the research results of automobile human-computer interaction, different design concepts in different technical fields are put forward, that is, different technical fields are rooted in to provide the most efficient and safe interactive mode, such as gesture control technology, speech recognition technology, to achieve a full and convenient control interface, minimize distraction of drivers, reduce driving fatigue, and ensure driving safety.

## 1. Introduction

With the development of information technology and network technology, automobiles have gradually changed from a kind of walking tool to a kind of life tool which integrates travel, office, life and other forms of entertainment. And the relationship between automobile and human has changed from simple mechanized basic operation to more intelligent, pay attention to human-computer interaction, human-based interaction including touch, voice, gesture and other aspects. Better development of vehicle networking also makes users more and more demanding for interactive experience of automobile. In the future, the development of automobile design will gradually change from design centered on appearance and function to design centered on user experience. Auto multimedia intelligent human-computer interaction design will be an important symbol of automobile design. This text analyses and explores from various angles, designs and discusses the intelligent automobile multimedia human-computer interaction system with user experience as the center. Based on the design process and method studied in this text, user experience centered interactive design of vehicular multimedia system is carried out, and the interactive detailed design of typical applications such as gesture control technology and speech recognition. Various interactive design methods and innovations are proposed in this text.

## 2. Development status of Intelligent Vehicle Multimedia Human-Computer Interface System

Among many well-developed enterprises abroad, the research on human-computer interaction of automotive multimedia has developed rapidly, and most of the products have been formed and put into production and market. Excellent design companies have invested a lot of time and energy, and also invested a lot of money to support the design, and have achieved remarkable results.



Firstly, the mature design of automobile multimedia human-computer interaction is based on ergonomics to design the interior structure and multimedia structure, color matching, modeling and function.

Secondly, the hottest topics in automotive multimedia human-computer interaction research are multimedia information system design, entertainment system design, voice system design, gesture system design and intelligent system design and so on. These designs are the product of the development of information technology and internet, and also the medium to realize human-computer interaction. Because of the advanced nature of this kind of design, at present, the research on human-computer interaction of automobile multimedia is mainly in the technical field, aiming at the development and design of sensors, intelligent systems and so on. In the field of design, it is mainly the human-computer interaction system interface design under the intelligent technology scenario. With the maturity of this technology, the intelligence of automotive multimedia is gradually improved, from the original physical human-computer interaction to the natural human-computer interaction. From the beginning, the mechanical operation of button type is transformed into multi-channel natural interaction through eyes, gestures and voice.

From a single mode of operation to a complex and diverse means of situation. But now technology-oriented human-computer interaction design for automobile, designers mainly focus on the design of human-computer interaction interface, lack of new means of interaction, new methods of design thinking, there is no unique design research methods for intelligent vehicle human-computer interaction design, lack of practical design guidance.

### **3. Hidden dangers in vehicle driving**

With the rapid development of automotive electronic technology, automotive equipped with more and more electronic equipment, in order to meet the needs and hobbies of various consumers, suitable for a wide range of people, automotive human-computer interaction system has more and more extensive research space and market needs. However, with the increasingly complete functions and comfortable driving, the control interface becomes more and more complex, which increases the driver's operation action in varying degrees and diverts the driver's energy. Although the active and passive safety systems of automobiles are becoming more and more mature, the driver's safe driving is still the main aspect. Driving distraction seriously affects traffic safety. More and more on-board intelligent devices are important sources of driving distraction. From the perspective of ergonomics and human-computer interaction design, these vehicle-borne intelligent devices do not fully take into account the complex factors that lead to distraction in the human-vehicle-environment and the situation that may cause excessive cognitive load on drivers. As a new natural interaction mode, voice interaction is an important direction to optimize the human-computer interaction of vehicle-borne intelligent equipment, and has reached a relatively mature level in technology. At present, only a small number of high-end vehicles integrate voice interaction technology into their on-board systems. On the other hand, various voice interaction applications on smart mobile devices emerge in endlessly, but they do not take into account the mode of use in driving situations, so they are not fully and reasonably utilized.

First of all, the driver's misoperation is a major hidden danger of traffic accidents. The increase of function keys increases the probability of misoperation to a certain extent, plus the uncertainty of complex road conditions, it is necessary to improve the accuracy of operation.

Secondly, if the navigation information needs to be input manually in the driving process, the cumbersome operation will distract the driver's attention, and the sight cannot take into account both road information and navigation input. With the improvement of vehicle networking and electronic information technology, drivers need more keys and touch controls to distract their attention from giving instructions, which not only causes the slack of steering wheel control, but also diverts their attention from the road condition.

Thirdly, the diversification of air conditioning, navigation, entertainment and other configurations is a progress, but the way to control these functions should not become cumbersome. It is ideal to cover more comprehensive functions with fewer buttons.

Finally, there are many factors that cause hidden dangers of driving safety. Apart from the uncertain factors of objective road conditions, drivers' ability, habits, psychology, quality and emotional state are directly or indirectly related to driving safety. While enhancing the driver's skills training and safety awareness, it is particularly important to continuously improve the vehicle human-computer interaction operating system to reduce potential safety hazards and avoid traffic accidents.

Development status of Intelligent Vehicle Multimedia Human-Computer Interface System

### *3.1 Analysis of Multimedia Display Mode*

#### *3.1.1 Screen-based Display*

With the rapid development of display technology and the continuous increase of vehicle-mounted functions, the early code-breaking screen used to display the frequency of car-mounted radio has been gradually eliminated, replaced by liquid crystal screen. Screen display technology is developing in the direction of clearer, larger, thinner and flexible, which provides more space for car designers to play. In recent years, more and more consumers like the clearer, bigger and thinner display screen, and quickly occupy the market.

#### *3.1.2 Projection-based display*

In recent years, projection display technology has also developed rapidly. It uses optical projection principle to project light on the front windshield. It was first used in flight AIDS on aircraft to ensure that the driver can see the relevant information of driving in the state of head-up. It solves the hidden safety hazards caused by the need to scan the line of sight when looking at the information in the instrument.

The most typical application scenario is road navigation. By superimposing the virtual image of navigation indication information on the real road, the driver can understand the navigation information more intuitively and know the next direction.

#### *3.1.3 Holographic projection*

Holographic imaging technology uses the interference principle to record the specific light wave emitted by the object in the form of interference fringes, so that all information of the object wave front is stored in the recording medium, so the recorded interference fringe pattern is called hologram. When the hologram is illuminated by light wave, the original object light wave can be reproduced by the principle of diffraction, thus forming a realistic three-dimensional image of the original object. At present, the development of this technology in the automotive field is relatively slow, which is a direction for further research and exploration.

### *3.2 Analysis of Multimedia Display Mode*

#### *3.2.1 Mechanical Interaction*

Mechanical interaction, also known as physical interaction, mainly includes physical keys, knobs, touch boards, rollers and other operating devices. Compared with touch screen, the advantages of mechanical interaction lie in the fixity of its spatial position and real tactile feedback, which can help users get confirmation and feedback without looking at the solid device, and the operation is fast and convenient. However visual participation is still needed in actual use, to ensure the accuracy of the operation.

#### *3.2.2 Touch interaction*

At present, touch screen interaction is the main method of touch interaction, that is, the driver operates through gesture on the central control screen. The application of touch screen interaction on mobile devices satisfies the user's interaction needs well, but it has some limitations on locomotive side. Unlike mechanical interaction, touch screen interaction has no obvious physical feedback, which

invisibly increases the driver's perceived load. In the future, touch technology will break through planar touch, relying on ultrasonic equipment to send pulse signals to fingertips, making fingertips have a slight sense of pressure. This technology can be combined with holographic imaging technology, and then holographic interaction will become a reality.

### 3.2.3 Natural Interaction

Natural interaction is a human-centered way of interaction. It pays attention to the barrier-free interaction between people and cars in the same way that people can communicate naturally. Natural interaction technology includes speech recognition, gesture recognition, the movement of the eyes control and so on. At present, speech recognition is widely used, which is an interactive way to completely liberate both hands and vision. However, at this stage, only simple imperative voice is the most, but speech recognition developers need to make speech recognition gradually extend to natural language interaction through the continuous improvement of artificial intelligence technology and semantic database. Gesture recognition is also an important research direction of natural interaction, which can minimize the cost of cognitive and visual interaction. At present, BMW has applied this technology in real vehicles. Drivers can simply control it by swinging their hands around and rotating their fingers.

Voice interaction technology can be simply understood as the dialogue between human beings and machines. For one thing, human beings communicate instructions to the machine through voice to make the machine understand human intentions. For another thing, after understanding the meaning of voice, the machine also outputs feedback information in the form of voice or performs a corresponding operation. Therefore, human-computer voice interaction often involves two important technologies, the Speech Recognition Technology and Text to Speech Technology, these two aspects are represented respectively. With the continuous development of computer technology such as artificial intelligence, machine learning and pattern recognition, speech recognition technology has gradually matured and become practical, especially in recent years to achieve a large-scale commercial level. For a while, a series of concepts such as speech recognition, speech translation, voice search, voice control and so on, accompanied by voice interactive automotive multimedia products, have entered our daily life.

## 4. Development Direction of Vehicle Multimedia Human-Computer Interaction Design

In the future, natural interaction will become the mainstream trend of automotive intelligent multimedia human-computer interaction design. On the basis of existing speech recognition and gesture recognition technology, the application of human-computer interaction in automotive multimedia field will become more mature.

The use of mobile phone voice interaction in driving can cause serious distraction to drivers. Although voice input has reduced many visual distractions compared with text input, drivers still need to choose mobile phones to get feedback information after voice search. At present, the best solution is speech recognition technology. Speech recognition is different from other applications. It enters the application through the voice wake-up button on the steering wheel. When the voice recognition function is normally withdrawn, the interface should display the interface and state before voice wake-up. Therefore, the return button is set in speech recognition instead of the home button. Considering that the primary users do not understand the speech recognition function, the help button is set to facilitate users to view and learn at anytime and anywhere. In order to improve the user experience of the product, small voice assistant is added to the design of speech recognition function to create a lovely voice image for the brand to meet the emotional needs of users.

## 5. Conclusion

With the wide application of computer technology and network technology in the field of transportation and the continuous development of vehicle technology, the interior space, man-machine interface, operation and interaction of automobiles are undergoing revolutionary changes. At present,

the information model of automobile interior has evolved from a single driving and condition information model to a complex information system including automobile information, Car to Car information, and the interaction of automobile and other information carriers. In such a complex information system, besides the main driving tasks of controlling the car, maintaining the lane and monitoring the road condition, drivers also perform a large number of driving tasks that are not directly related to driving. These secondary tasks will occupy the driver's visual, cognitive and action resources to varying degrees, divert the driver's attention and produce higher cognitive load. Many studies have proved that the secondary tasks represented by in-vehicle information interaction seriously affect driver's driving efficiency and traffic safety. Nevertheless, the pursuit of complexity is the embodiment of human demand for product function and emotional experience. Therefore, the key to the problem is not simply to reduce the complexity, but to manage the complexity well through careful design and provide users with complex but easy-to-use products.

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