



Emotional Research on Vehicle Intelligent Robot Pet

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Abstract. Guided by the emotional design method, this paper makes design analysis from the instinct level, behavior level, and reflection level of emotional design to design a vehicle intelligent robot pet on the onboard central control table. This product can enrich the shortcomings of existing research, optimizes the modeling and function of vehicle intelligent products, and meets the safety and emotional needs of drivers in the process of driving. The product is displayed in the image of a pet dog. Its main functions include voice interactive chat, emotion recognition, body index detection, body temperature detection, and vehicle motion detection.

Keywords: Onboard Intelligent Products · Emotional Design · Voice Interaction · Onboard Intelligent Machine Pet · App

1 Introduction

In 2021, the number of cars in China reached 292 million, accounting for 76.04% of the total number of motor vehicles. [10] With the development of artificial intelligence, the Internet of Things, and 5G technology, a large amount of digital information appears in the car, and this digital information causes drivers to use part of their energy to focus on driving tasks such as music, entertainment, and answering calls. [11] The driving sub-task will occupy the driver's visual, cognitive and action resources to varying degrees, distract the driver's attention, and thus affect the driving safety. [6] In response to this problem, the market for in-vehicle smart products focusing on intelligence and safety is increasing. However, there are many problems such as cold design, insufficient personalization, and no fun of in-vehicle intelligent products in cars, as also as the driver's emotional experience is rarely considered.

Emotional design is proposed by American cognitive psychologist Professor Donald.A.Norman, the purpose is to make the designed products have emotions and also meet the emotional needs of users. Among them, the most widely used is the three-level theory of emotional design, including the design of instinct level, behavior level, and reflection level, as shown in Fig. 1. [5].

Based on the three-level theory of emotional design, this paper researches and designs an emotional vehicle intelligent product, which is of great significance for improving the safety and fun of the driver's driving process.

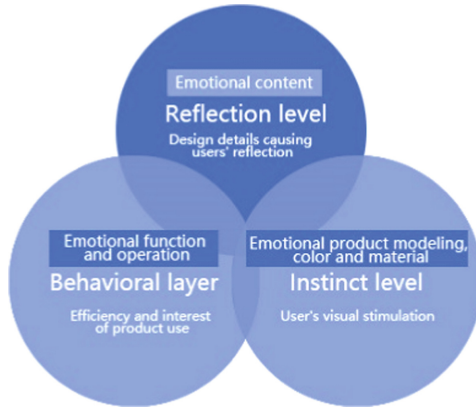


Fig. 1. Three-level theory of emotional design

2 Competitive Analysis of Smart Vehicle Products

2.1 Literature Research

There are few literature studies on vehicle intelligent products. Volkswagen and the Massachusetts Institute of Technology have cooperated to develop AIDA. AIDA can collect the user's common routes and driving habits in a short time, in addition, AIDA can observe the user's emotions and ease the driver's emotions. [2] The carrot car robot independently developed by Lejia Technology projects the information required during driving into the field of vision in front of the windshield so that users can obtain information without shifting their eyes. [3] Fang H proposed a voice image personality design method based on car emotion and selected the MG2030 concept car for voice image personality design to optimize the driving process, and improve the user experience. [7].

2.2 Market Product Research

Figure 2 shows the classification of vehicle-mounted smart products on the market according to four dimensions. Among them, the multi-functional smart car products refer to the addition of voice functions based on the original car products (Bluetooth cigarette lighters, Bluetooth speakers), and their aesthetics are mainly reflected in the bionic design. Xiaomi's vehicle-mounted voice robot is loved by users for its shape and multi-functionality of bionic bees. Toyota kirobo mini has won praise from users for its "human doll" shape and accompanying attributes. The Xiao You vehicle-mounted intelligent robot integrates the functions of the rear-view mirror, which can perform driving records, face recognition, and the functions of changing various expressions, as well as relieve the driver's boring feeling during driving. The vehicle-mounted intelligent robot with emotional perception can better understand the user and have a good emotional connection with users. Baidu vehicle-mounted robot Xiaodu is not only rich in expressions but also can change its expressions according to the different emotions of users in the process of chatting with users, which is more humanized and can also give a better driving experience for users.

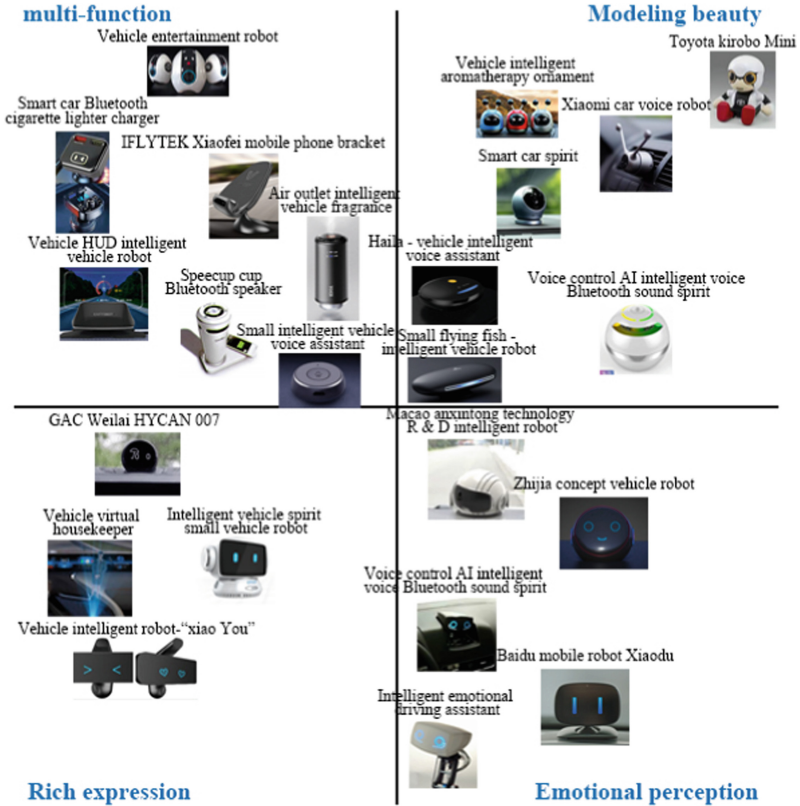


Fig. 2. Four quadrant diagram of competitive product analysis of onboard intelligent products.

2.3 Summarize

Summarizing literature and market products research, in-vehicle smart products mainly have the following problems:

- 1) Multi-function: It does not meet the emotional needs of users well;
- 2) Modeling aesthetics: The modeling design is monotonous and cold;
- 3) Emotion perception: Products with emotional perception are lack emotion in modeling design;
- 4) The traditional interaction method will occupy the driver's tactile and visual resources, easily distract the driver, and bring great safety hazards to the driver.

Through the analysis of literature and market competition products, we found the problems with existing vehicle-mounted smart products. Guided by the three-level theory of emotional design, the good emotional relationship between people and pets is the premise that the products have the characteristics of pets and are designed from multiple perspectives. An emotional in-vehicle intelligent robot pet that enhances the driver's safety and emotional experience, and achieves the goal of harmonious coexistence between people, products, and environments.

3 Emotional Design Orientation of Vehicle Intelligent Robot Pet

3.1 Target Users

In 2021, drivers aged 26–50 in China will account for 70.71%, and these groups will account for a very large proportion of all drivers. [10] People aged 26–50 have strong social attributes, a strong curiosity, and a certain economic ability, and they are the main force of consumerism. With the development of science and technology, all kinds of smart products appear in their lives, constantly stimulating their desire to buy. Therefore, designing a vehicle-mounted intelligent robot pet for middle-aged and young people aged 26–50 can better meet the psychological needs of users.

3.2 Application Scenarios

The main use scene of the vehicle-mounted intelligent robot pet is on the center console of the car. Combined with the functions of onboard ornaments, it can bring a better driving emotional experience to the driver.

3.3 Function Analysis of In-Vehicle Robot Pets

Geng Y. pointed out that compared with graphical interaction and gesture interaction, voice interaction can free people's eyes and body movements from the graphical interface, and voice interaction has a more efficient and more natural expression. [8] Through the research and test of voice navigation and visual navigation, Harbluk et al. Found that drivers have less distraction and better overall performance when using voice navigation. [9] Therefore, this paper selects voice interaction technology as the main interaction method of human-computer interaction.

As shown in Table 1, the onboard intelligent robot pet focuses on voice interaction, combined with the scenes in life. The basic functions and innovation functions of onboard intelligent robot pets are obtained.

Table 1. Basic functions and innovative functions of in-vehicle intelligent pet robots.

| Behavioral layer | Functions | Details | Innovative functions | Details |
|--|-----------------------|--|--------------------------|---|
| Emotional operation/emotional function | Greeting | The product greeting “Hello, to start the trip, please fasten your seat belt, if you drink, please don’t drive”, “Arrived at your destination, please take your belongings and close the doors and windows”. | Alcohol detection | In the power saving mode, a test will be carried out every time the vehicle is started; In the nonpower saving mode, the user gives the instruction “Kirin, help me measure the alcohol accuracy”. The alcohol level is divided into three levels: a little drunk, drinking a lot, and seriously drunk driving. |
| | Timing/networking | With RTC clock chip, combined with TTS chip/Remind to connect to the network. | Physical index detection | Monitor the user’s basic physical indicators (blood oxygen, heart rate, and temperature). |
| | Online interaction | Voice interaction, etc. | Vehicle detection | The sensor judges the vehicle acceleration and gyroscope. |
| | Chat message reminder | Mobile message. Ask whether to play the message. | Emotion recognition | The robot pet rotates left and right to recognize the driver’s facial information, detect the driver’s bad expression, and voice remind the driver. |

4 Emotional Design and Analysis of Vehicle Intelligent Robot Pet

By reviewing different onboard intelligent robots, combined with the three-level theory of emotional design, the emotional design classification of onboard intelligent robot pets is carried out.

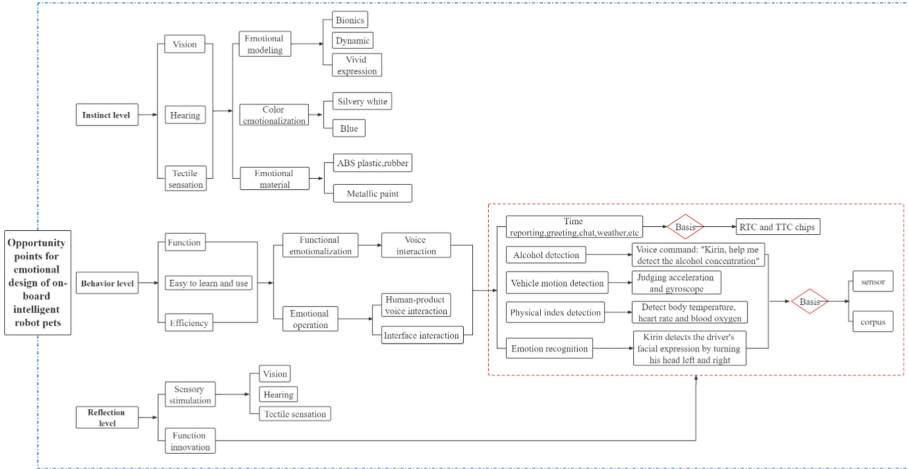


Fig. 3. Opportunity points for the emotional design of onboard intelligent robot pets.

The vehicle-mounted intelligent robot pet conducts a preliminary design analysis at the three levels of instinct, behavior and reflection. Summarize the emotional design opportunities of vehicle intelligent robot pets: Modeling emotional, color emotional, material emotional, functional emotional and operational emotion, as shown in Fig. 3.

4.1 Instinct Level Design Analysis

The emotional experience at the instinct level is composed of three sensory elements of the user’s vision, hearing and touch.

4.1.1 Visual

The shape characteristics and color of the product are the basic aspects of the visual elements. People form their first emotional feelings about a product through vision, such as vivid or gloomy, meticulous or rough, warm or cold. [4].

Modeling emotional. In the appearance design of the vehicle-mounted intelligent robot pet, the method of bionic design is adopted to make it vivid and lively, so that users can empathize. In people’s cognition, dogs are loyal and docile animals, and there is often a good relationship between people and pet dogs. Therefore, the product design is based on pet dogs.

The shape design of the intelligent robot pet dog makes its head turn, reflecting the lively characteristics of the pet dog, and with agile expressions. It “observes” the driver’s emotions, giving people an optimistic feeling.

Color emotional. In the color design of the vehicle-mounted intelligent robot pet, silver-white with high brightness is used as the main color of the product, and blue with high brightness and purity is used as the auxiliary color.

4.1.2 Auditory

Different timbres and tones of products will also bring different emotional experiences to users. Dull sounds can make people feel frustrated, cluttered and roaring sounds can make people irritable and depressed, and soft and rhythmic sounds tend to make people happy. [12] Therefore, the voice interaction process of the vehicle-mounted intelligent robot pet should consider the different experiences brought by different timbre, sound quality and pitch to the user.

4.1.3 Tactile

The shape and material of the product determine the tactile experience. The tactile feeling of the vehicle-mounted intelligent robot pet is the reflection of its structural transition and the texture of the processing technology.

Material emotional. Material refers to the texture of the materials used in the product manufacturing process after a certain processing technology and surface treatment. The material of the vehicle-mounted intelligent robot pet is mainly ABS plastic. ABS plastic is non-toxic, colorless, odorless, easy to color, and has the characteristics of high gloss. It can also be used for secondary processing such as metal spraying and electroplating on the surface. The processing technology is metal spraying on the surface, which makes the product have a sense of science and technology and is more in line with the user group and scene positioning of the product. In addition, its ears are made of soft plastic material, which is softer and in line with the user's psychology.

4.2 Behavior Level Design Analysis

The design of the product behavior level is the function, easy to learn and use, and efficiency.

4.2.1 Function

The function is the primary factor for a product to serve users, and it is the embodiment of the value of the product. The function of the in-vehicle intelligent robot pet is not only to assist driving, but also to make the driving process more interesting, ease the driver's emotions, and provide more added value.

Emotional function. In emotional design, functional emotionalization means that the product has high efficiency of use and brings a sense of pleasure. In addition to voice interaction, entertainment, and assisted driving, the emotional expression of the in-vehicle intelligent robot pet is also reflected such as emotion recognition, alcohol detection, basic body index detection, and provision of suggestions, which can bring surprises to users and arouse their emotional resonance.

4.2.2 Easy to Learn and Use

The ease of learning and using the product is what the user feels during the operation. The ease of learning of the vehicle-mounted intelligent pet robot mainly refers to the user's understanding of its functions and the learning time. The ease of use mainly refers

to the smoothness of the human-computer interaction between the product and the user, and whether it meets the user's expectations.

Emotional operation. Emotional operation refers to the method in the process of using the product. The emotional operation of the vehicle-mounted intelligent pet robot refers to the interaction between the user and the robot pet, which is mainly realized in the form of voice interaction, as well as human-computer emotional interaction.

4.2.3 Efficiency

Product efficiency is a product sublimation based on the product's functions, ease of learning and using. Products with high quality and good stability make users feel good in the process of using the product, which in turn makes users emotionally satisfied. [13].

4.3 Reflection Level

The purpose of the emotional design of products is to have emotional interaction with users. The instinct and behavioral levels are the immediate feelings of users when they use them. The design of the reflection level involves the user's psychology and is a higher level of feeling, which can bring users continuous emotional projection, increase user loyalty, and establish long-term associations in this relationship. [1].

4.3.1 Sensory Stimulation

Good product appearance will bring sensory stimulation to users. This is the premise for users to like the product and continue to contact and use the product. It is also the key point of the design of the vehicle-mounted intelligent robot pet.

4.3.2 Functional Innovation

People like new things, which is an innate characteristic of human beings. Analyze the status quo of vehicle-mounted smart products, and the psychology and physiology of users, optimize and innovate product functions, increase user experience, and leave users with good memories.

4.4 Summarize

The vehicle-mounted intelligent pet robot designed for young and middle-aged people should fully understand the user's cognitive, psychological and physiological needs, design the product's appearance, and function on the reflection layer so that the driver can be used before and during driving. After driving, they can perceive the meaning of product design, so they can produce a positive emotional experience.



Fig. 4. Logo design.

5 The Emotional Design Practice of Vehicle Intelligent Robot Pet

According to the analysis of the competitive products, users and target scenes related to the onboard intelligent robot pet, the design optimization of the function and shape of the existing onboard intelligent products is made under the guidance of the three-level theory of emotional design.

Kyryn is one of the four auspicious beasts in ancient China, which means auspiciousness and peace, so “Kyryn” is chosen as the name of the product. The vehicle-mounted intelligent robot pet is a kind of vehicle-mounted intelligent robot. It adopts the shape of a bionic pet dog and is named after “Kirin”.

5.1 Logo Design

The logo of the onboard intelligent robot pet comes from the initial letter “Q” of Pinyin, as shown in Fig. 4. The round shape is composed of two semicircles, which means that everything can be installed, reflecting a large amount of data and information that can be accommodated; The overall color is mainly blue, which reflects the sense of science and technology of the product and gives people a simple and generous feeling.

5.2 The Appearance Design of Vehicle-Mounted Intelligent Robot Pet

As shown in Fig. 5, the shape of the vehicle-mounted intelligent robot pet is presented in a sitting position, with both hands raised and a smiling dog, which can better reflect the optimistic emotions brought by the product. In terms of function, the daily life and work characteristics of office workers who drive to commute every day, so the onboard intelligent robot pet has the functions of measuring body temperature, blood oxygen (using the principle of finger-clip oximeter), and heart rate. In the design of material and processing technology, ABS plastic is used as the whole body material, soft plastic is used as the ear material, and the processing technology is sprayed with metallic paint so that the product has a fashionable feeling, which is more in line with the user’s cognition. In color design, mainly blue and white, blue is a calming color, and it is also a color that expresses technology, and can also be well integrated into more environments.



Fig. 5. Emotional design practice of vehicle-mounted intelligent robot pet.

6 Conclusion

With the increase in the number of automobiles in China and the advancement of science and technology, more and more novel intelligent products appear in the car. However, the various interactive forms of these products occupy the driver's multi-sensory resources, and the driver is prone to operate load, which is very unfavorable for driving safety. In addition, the appearance and functional design of the vehicle-mounted smart products are not coordinated, which cannot meet the user's emotional needs to use the product.

Therefore, this paper provides theoretical guidance with three levels of emotional design: instinct layer, behavior layer, and reflection layer to design a vehicle-mounted intelligent robot pet-Kirin, which is mainly based on voice interaction. This can monitor users' physical indicators and emotions, detect vehicle faults, and optimize its modeling

to make the appearance and function of the product more harmonious. Unify and increase the emotional connection between users and the product. To give users a complete driving experience.

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