A Matrix Headlamp Design Based on Artificial Intelligence Controller Control

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Abstract. In recent years, with the progress of technology, the requirements of lighting in various fields are getting higher and higher. Matrix headlights break through the shortcomings of traditional headlights and show greater application advantages. The purpose of this paper is to promote the wide and good application of matrix headlights by deeply studying the design of matrix headlights controlled by the controller based on artificial intelligence. This paper first introduces the concept and advantages of matrix headlights, and introduces the main algorithms of artificial intelligence in the design of controller control matrix headlights. Then, on the basis of the application design experiment, the specific design idea is explained in detail, and finally, the design method proposed in this paper is tested and analyzed. The experimental results show that compared with traditional headlamps, the energy consumption of matrix headlamps is reduced by about 16%, the regulation rate is increased by 34%, and the illumination rate is increased by 12%. The matrix headlamp designed in this paper not only effectively reduces the energy consumption of the headlamp, but also improves the regulating effect and lighting effect of the headlamp.

Keywords: Artificial Intelligence, Controller Control, Matrix Headlights, Intelligent Control

1. Introduction

With the continuous development of artificial intelligence technology, its application field is gradually expanded, and it has been widely used in lighting field. The controller control supported by artificial intelligence technology can realize autonomous control of lighting according to the actual situation, which greatly improves the overall effect of lighting and is a major change of traditional lighting technology [1-2]. As a popular lighting tool in recent years, matrix headlights are gradually applied to controller control devices based on artificial intelligence [3].
Artificial intelligence control and matrix headlights are hot research topics in recent years, and domestic and foreign scholars pay relatively high attention to them. In literature [4], the author designs an infrared image intelligent processing system with artificial intelligence as the core technology. The system can capture and process the target information with the help of infrared ray, which can not only correctly distinguish the moving target, but also quickly collect and analyze the moving target data. In the literature [5], based on the controller control, the author designed a hall matrix headlamp, which can provide variable lighting according to the movement of human body at night. In literature [6], the author focused on the specific design of the matrix headlamp controlled by the controller in automobile lighting. The experimental results show that the use of the matrix headlamp controlled by the controller in automobile lighting not only promotes the improvement of the alternate use mode of far-near light in traditional automobile lighting, but also can carry out the automatic light conversion according to the actual road conditions.

In order to promote the design and application of controller control matrix headlights supported by artificial intelligence technology, this paper first introduces the concept and advantages of matrix headlights, and introduces the main algorithms of artificial intelligence in the design of controller control matrix headlights. [7-8] then, on the basis of applied design experiments, the specific design ideas are explained in detail, and finally, the design method proposed in this paper is tested and analyzed. On the one hand, the research of this paper promotes the scientific design and good application of the matrix headlamp controlled by the controller based on artificial intelligence, on the other hand, it also lays a theoretical foundation for future research in related aspects [9-10].

2. Method

2.1. Matrix Headlights

LED light sources arranged according to rectangular arrays are called matrix headlights. Compared with ordinary LED headlights, matrix headlights have obvious advantages, which can achieve a larger range of lighting, and the light source is straighter and brighter. Matrix headlights can achieve the variation and accuracy of lighting in the front area. At present, matrix headlights are not only gradually promoted in the home, but also widely used in the field of automotive headlights. Its practical application is mainly reflected in the following two aspects: first, according to the distance lighting intensity matrix headlights can realize the automatic adjustment of headlights. It can not only realize the automatic switch of the headlamp, but also realize the free adjustment of the light distance and the automatic adjustment of the irradiation height. Second, in the use of automotive matrix headlights, it has a different flashing mode from the ordinary LED turn signal. Matrix turn signal flashing is dynamic, also known as water steering.

2.2. Artificial Intelligence and Its Algorithms

Controller control based on artificial intelligence, referred to as intelligent control. Intelligent control, supported by artificial intelligence technology, can realize intelligent processing of information processing, feedback and control decision in controller control. The idea was first put forward by foreign scholars in the 1960s. The key of intelligent control lies in the autonomous learning and adaptation of the system. Based on this adaptive algorithm, it also becomes a key algorithm of intelligent control. The specific formula of this algorithm is as follows:
\[
E = \langle a_1, a_2, \ldots, a_n \rangle
\]  
\[
F = f_1 + f_2 + \ldots + f_n
\]

In formula (1), E represents the path existing in the artificial intelligence test program, in which the program can automatically output a and make it pass through the path E. Therefore, the original problem target is simplified into a series of sub-target problems, and then the sub-target to solve the problem is found on the basis of artificial intelligence algorithm. In formula (2), F represents fitness function, and F represents the sum of the accumulated values of different paths.

3. Matrix Headlamp Design and Planning

Combined with the existing research data and the basic characteristics of human common intelligence, the design plan of matrix headlamp controlled by controller is put forward. The design mainly includes lamp set, data acquisition, communication, time unit and controller and control panel. Generally speaking, the controller mainly includes the microprocessor, which can control the switch of the luminaire group according to the data acquisition. The connection between the communication device and the mobile intelligent terminal is through. Headlamps designed for matrix is controlled by the controller to realize the control of, with the help of data collection to the perception of information, to the human body in the night, the controller can accompany the body's moving to the matrix form control headlight, promote the headlight of effectively reduce energy consumption, can also use mobile intelligent terminal real-time reports matrix headlight switch status, to monitor the quality of light through the set the time to home, have a certain effect of guard against theft.

**Table 1. Original data of traditional LED lights**

| Project                | Actual status | Ideal state |
|------------------------|---------------|-------------|
| Rate of energy consumption | 78.14%        | 63.21%      |
| Adjust the rate         | 39.24%        | 57.21%      |
| Lighting rate           | 68.14%        | 73.72%      |

* Data comes from the results of the collation survey

4. Discuss

4.1. Specific Ideas of Matrix Headlamp Design

(1) Detailed structure of matrix headlights

As mentioned above, the matrix headlamp is mainly composed of lamp group, data acquisition, communication, time unit, controller and control panel. The microprocessor is the main component of the controller, which can control the switch of the lamp group with the information collected by the data acquisition module. The data collection includes the light sensitive, the sound and the infrared sensor sensing data information. Among them, the light sensor collects the indoor light information, the sound sensor collects the indoor sound information, and the infrared sensor collects the indoor
human body's infrared information. The luminaire set comprises four light sets, which are defined as the first, second, third and fourth light sets. Arrange the four light sets in a matrix in the selected internal space, and install the infrared sensor at the bottom of the four light sets; The controller is connected with the mobile intelligent terminal by means of the communication plate to realize the connection with the control panel and the time unit respectively. Table 2 shows the specific functions corresponding to different components of matrix headlights.

| Project                        | Specific function          |
|--------------------------------|----------------------------|
| Set of lamps and lanterns      | Lighting                   |
| Data collection                | Information collection     |
| Communications sector          | Data transfer              |
| Time unit                      | Time control               |
| Controller                     | Switch control             |
| Control panel                  | Information collection     |

*Data comes from collecting and sorting

(2) Matrix headlight working process implementation

Photosensitive, sound and infrared sensors firstly accurately sense indoor light, sound and infrared information of human body. When the indoor light is in a bright and sufficient state, the controller will automatically disconnect the power supply of the lamp set; When the dark light is insufficient, the controller will automatically switch on the power switch of the luminaire. In general, the controller mainly controls the light switch through the data information sensed by the sound and infrared sensors. When the space is in the state of being occupied, the sound and light sensors can directly transmit the data signals to the controller, and the controller automatically turns on the light set. Among them, four light groups should be arranged in the form of matrix at the top of the space, and the infrared sensor should be installed at the bottom of different light groups. Then, according to the data information collected by the infrared sensor, the controller controls the switch of the light group. This infrared control mode can control the switch above the head of the human body in the movement state of the human body, and finally play the role of saving electricity and energy consumption. Among them, mobile phone and smart tablet are the two main components of mobile intelligent terminal. Users can set and specify the time of leaving home with the help of mobile intelligent terminal and control panel. When the space personnel are in the leaving state, once the light in the space is on, the controller can quickly transmit the signal to the mobile intelligent terminal device with the help of the communication module in the first time, which has certain anti-theft function. Among them, the control panel specifically adopts the control panel of LED touch screen mode, which can set the specific control mode of lighting. The light control mode mainly includes two modes, namely manual mode and intelligent mode. Traditional headlights generally adopt manual control mode, so the adjustment rate is low. According to the data in table 1, the adjustment rate of traditional LED
headlights is only 39.24%. The manual mode of the matrix headlamp proposed in this paper can directly control the switch of the lamp group with the help of the control panel. The controller will automatically switch to the intelligent mode from 22pm on the same day to 6am on the next day. In this mode, the controller can automatically control the switch of the lamp group on the basis of the data taken.

4.2. Matrix Headlamp Detection Experiment

In order to verify the scientificity of the design and planning of the matrix headlights based on the artificial intelligence controller proposed in this paper, the author carries out the actual testing experiment of the matrix headlights. Through experiments, the author obtained the following experimental data. The specific experimental data are shown in figure 1 and figure 2. The data in the charts are the results of the author's experimental arrangement.

![Matrix Headlights and Traditional Headlights Data Comparison](image)

**Figure 1.** Data comparison between matrix headlights and traditional headlights
Figure 2. Practical application analysis of matrix headlights

Figure 1 shows the comparison of detection data between the matrix headlamps designed in this paper and the traditional headlamps. It can be seen from the data in figure 1 that compared with the traditional headlamps, the energy consumption of the matrix headlamps is reduced by about 16%, the adjustment rate is increased by 34%, and the illumination rate is increased by 12%. In general, the matrix headlights designed in this paper not only effectively reduce the energy consumption of the lamps, but also improve the regulating effect and lighting effect of the headlights. Figure 2 is the application data analysis of matrix headlights. It can be seen from the data in Figure 2 that the actual application state of the matrix headlights designed in this paper has not yet reached the ideal effect, and its energy consumption rate is still 10% higher than the ideal state, its regulation rate is about 13% lower than the ideal state, and the illumination rate is about 9% lower than the ideal state. In general, the practical application of the matrix headlights designed in this paper has not reached the ideal effect, which needs further improvement and improvement.

5. Conclusion

Based on artificial intelligence technology, this paper designs a matrix headlamp controlled by a controller, which makes up for the deficiency of traditional headlamps, not only effectively reduces the overall energy consumption of headlamps, but also effectively improves the adjustment effect and lighting effect of headlamps. But at the same time, the actual application of the matrix headlights designed in this paper has not reached the ideal effect, which needs to be further improved and improved.

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