

Raspberry Pi-based Virtual Reality Headset for Cyclist Services

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Abstract: Following the development of technology and people's pursuit of a better life, MR technology has been applied in more and more scenarios. Based on the current research status, this project proposes to design a MR headset for cyclists. The helmet is developed based on Raspberry Pi, equipped with heat dissipation function, HD camera, and infrared camera are selected as sensing devices, HD camera is enabled in good light conditions, and the infrared camera is enabled in bad light conditions. The rider can observe the road conditions and outside information through the camera displayed in MR glasses in real-time. In addition to the live camera screen display, it can also display the time, memo information, and other functions. The map screen can be called up to show real-time navigation information. In addition, the helmet has built-in small Bluetooth audio. It can be connected to the phone via Bluetooth. The helmet is equipped with a total of three high-brightness LED light strips installed on the front and rear side of the helmet, which can be controlled by a button to make the light strip achieve the function of the turn signal. The gyroscope is installed in the button box of the light belt control. After detecting a fall, the buzzer and LED lights will go into alarm mode, which can improve the safety of the user's ride.

Keywords: Raspberry Pi; virtual reality technology; infrared camera

1. Introduction

The research and development of virtual reality technology originated in the 1960s. It is characterized by the creation of virtual environments or the application of virtual environments to real-life scenarios. By blending the boundaries between virtual and real environments, the user's five senses are immersed in the created scenes. The user can perform a series of operations in virtual reality to adapt to different scenarios and switch between applications.

In 2016, VR became the most favored object in the technology world. Virtual reality has created a "new world," and the market development driven by the technology inherent and product architecture has shown a broad application prospect. With the increasingly competitive VR industry environment, consumers' requirements for user experience and product quality are becoming more and more extreme. The positioning of the product is also increasingly in line with the concept of human-computer interaction, portable and sophisticated. Oculus Quest 2, the best-selling VR headset in the market, is actually a VR headset based on MR technology. Mixed reality is a technology between AR and VR. It displays info just like augmented reality, but still uses a completely virtual screen as a headset, rather than a glass panel and a micro projector.

Based on the above design requirements and trend analysis, this paper proposes to design a MR headset for cyclists.

2. Program design

2.1. System block diagram

System for MR headset as a whole, using Raspberry Pi to get camera information and display it on MR glasses. The original components, such as the case-control buzzer, are implemented using Arduino. The system also includes Bluetooth speaker functions.

2.2. Functional details

2.2.1. Raspberry Pi



Figure 1: Raspberry Pi

It is a miniature ARM-based computer motherboard with SD/MicroSD card as the memory hard disk, a card motherboard surrounded by 1/2/4 USB ports, and a 10/100 Ethernet interface (A-type no network port), you can connect the keyboard, mouse, and network cable, as shown in Figure 1. It also has a video analog signal TV output interface and HDMI high-definition video output interface. All of the above components are integrated into a motherboard that is only slightly larger than a credit card and has all the basic functions of a PC.

2.2.2. Infrared camera



Figure 2: Infrared camera

Infrared cameras use infrared lamps to emit infrared light to irradiate objects, and the infrared light is diffusely reflected and received by the camera to form a video image. Its work does not require visible light, and the image clarity at night can exceed that of daytime, as shown in Figure 2. In addition, infrared light is able to pass through dense smoke without attenuation and partially attenuated through dense fog. Therefore, infrared camera imaging is better than HD cameras in the rain and fog.

2.2.3. LED strip light



Figure 3: LED strip light

Flexible LED strip is using FPC to do assembly circuit board, assembled with SMD LEDs, so that the thickness of the product is only 0.1CM thickness, does not occupy space, as shown in Figure 3. Common specifications are 30cm long 18pcs LED, 24pcs LED and 50cm long 15pcs LED, 24pcs LED, 30pcs LED, etc. There are also 60cm, 80cm, etc., different users have different specifications. And can be cut at will, can also be arbitrarily extended without affecting the light. The FPC material is soft and can be bent, folded, and wound at will, and can be moved and expanded in three dimensions without breaking.

2.3. Skill application

2.3.1. Linux operating system

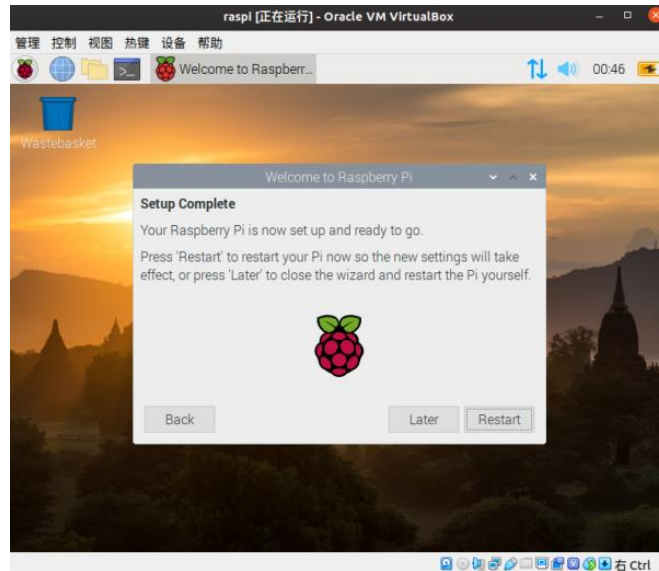


Figure 4: Linux operating system

Linux is free to use and freely distributed Unix-like operating system. It is a multi-user, multi-tasking, multi-threaded, and multi-CPU operating system based on POSIX and UNIX. Linux is capable of running major UNIX tools, applications, and network protocols, as shown in Figure 4. It supports 32-bit and 64-bit hardware. Linux inherits Unix's network-centric design ideology and is a stable multi-user network operating system with high performance.

2.3.2. CAD drafting and laser cutting

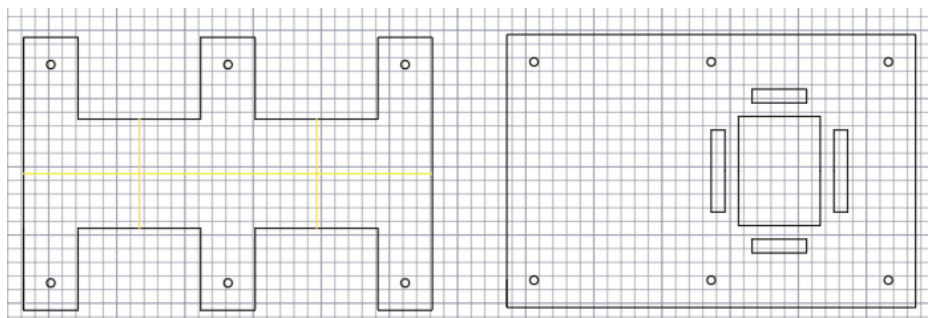


Figure 5: CAD drawing and laser cutting

In the project's housing design, the CAD software is used to learn to draw the required 2D drawings and use laser cutting technology to achieve the shape. Laser cutting technology is a rapid prototyping technology that can create model works in a short time, as shown in Figure 5.

2.3.3. Bluetooth master-slave communication

The roles of BLE Bluetooth are as follows: Broadcaster, Scanner, Slave, Master, Initiator, where the Master is converted from the Initiator and Scanner and the Slave is converted from the Broadcaster. Bluetooth module communication is the communication between two Bluetooth modules or Bluetooth devices, and the two parties that carry out data communication are a host and a slave.

3. Conclusion



Figure 6: Finished picture of the real thing

The following skills are mainly used in this project:

- Embedded systems control and Arduino programming.
- Knowledge of hardware circuits.
- CAD drawing and laser cutting of mechanical models.
- Basic knowledge of Linux operating systems.

The final project realizes the effect as expected. MR technology can enable people to comprehend the road information more effective than before, as shown in Figure 6.

With the continuous improvement of the level of intelligence and the development of artificial intelligence technology, technology is changing our way of life, more intelligent and faster. The device also has very wide application, and development prospects can add deep learning algorithms to identify the marker system signs. Sensors can monitor the human body to prevent fatigue driving, etc. Also, an open-sourced system means that more developers can come in the game and thus can cooperate to develop new solutions to the problems while riding on the road.

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