The design and Implementation of Image Transmission System for Mobile Devices Stabilizers

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Abstract. In view of the application of PTZ system in photographic equipment, we design a wireless image transmission system for photographic equipment and mobile equipment. Hi3516A is the main control chip of the system, and the second connection interface is connected with the photographic equipment to collect the relevant data that recorded by the photographic equipment, and the data is encoded and encapsulated by the processing module. The first connection interface adopts 2.4G wireless radio transceiver module, which connects with the mobile device wirelessly to transmit picture data information to the mobile device, and realizes wireless image transmission from the photographic device to the mobile device. The test of wireless picture transmission system shows that the picture transmission system has fast transmission rate, high real-time performance and wide application range.

1. Introduction
With the continuous development of handheld PTZ technology, it has gained popularity in recent years to use PTZ system-assisted photographic equipment for audio and video recording and photo shooting. To control the movement of the photographic apparatus, the user generally fixes the photographic apparatus on the stabilizer (PTZ system). In the process of photography, the user may not be able to see the photographic device screen due to the limitation of the photographic device screen, especially shooting at a low angle or a high angle. Therefore, we can't achieve the results we want. Many existing methods rely on external display device to mitigate this problem. However, this external display device can only be used as a monitor by connecting and fixing it on the stabilizer to preview the shooting picture, it cannot adjust camera parameters by touch control of the pan, and too expensive. In addition, a large body of wireless image transmission[1] use analog image transmission, the high-definition image needs to be transcoded, and then converted into a digital signal for transmission to the display screen, which has high technical requirements, is particularly sensitive to co-channel interference, and even the quality of the video picture is so poor that it affects the perception of shooting.

In this paper, we aim to address this limitation by designing a picture transmission system that connects photography equipment and mobile equipment, collecting and transmitting audio and video information. Firstly, the system connects the photographic equipment to the stabilizer (PTZ system) through the interface for transmits the audio and video information, and then installs the digital wireless radio transceiver module on the stabilizer for wireless transmission. Finally, the mobile
device is connected to the stabilizer through the WIFI, thereby it can realize the wireless image transmission between the photographic device and the mobile device, and the parameter adjustment of the photographic device is facilitated on the mobile device. The physical map of the wireless image transmission system is shown in figure 1. This design greatly simplifies the design process of the PTZ system, reduces the development cost, and provides favorable conditions for the stable operation of the photographic equipment on the PTZ system.

![Figure 1. The physical map of the wireless image transmission system.](image)

2. Overall design

Figure 2 illustrates the overall design of our paper. The design is used for data transmission between the photographic equipment and the mobile device[6]. The system is based on the stabilizer, and is composed of an electronic device, a PTZ power device and a PTZ handle. The electronic device uses the Hi3516A as the main control chip, and it consists of first and second connection interfaces, processing module, storage module, etc. The second connection interface is used for accessing the photographic device to collect picture information, and the processing module and the storage module are used for processing audio and video to obtain information. The first connection interface is used for wireless connection with the mobile device. The PTZ power unit can realize the angle adjustment or attitude control of the photographic equipment. The handle realizes the human-computer interaction function, and adjusts the stability parameter and the camera parameter by configuring the button and the OLED display screen.
3. Hardware design

3.1. Master chip Hi3516A
The Hi3516A chip is a high-end SOC chip developed by Hess semiconductor for processing high-definition audio and video and its encoding. It has excellent ISP and audio and video coding processing capabilities, high-performance intelligent acceleration engine, and many peripheral interfaces, excellent performance and other characteristics. In our paper’s design, the Hi3516A chip provides USB and BT1120 interface or I2S interface, etc., which provides the first and the second connection interfaces required by the electronic device, thereby controlling the access of the photographic device and collecting audio and video information. In addition, the audio and video or photos can be encoded and packaged, and then to be send mobile device.

3.2. The collection of picture information
The collection of picture information is equal to the access of the photographic device, and the photographic device is connected to the stabilizer by designing a second connection interface on the electronic device. The second connection interface comprises a multimedia connection interface and a control interface of the photographic device; the multimedia interface adopts an HDMI interface, which is bidirectional transmission port[4-5]. It connects with the multimedia interface of the photographic device to receive and transmit uncompressed audio and video signals, thereby collecting audio and video or photos captured by the photographic device in real time. The control interface of photographic device is a USB port that connects the photographic device to the stabilizer to receive photographic device parameters and control the operation of the photographic device.

3.3. Processing module and storage module
The processing of audio and video is mainly realized by the processing module and the storage module. The processing module collects image frame on the video from the photographic device according to a specific time interval, encodes and encapsulates the collected picture frame and its transmission time. Through the coding technology, the pictures are unified into a format that can be decoded by the external mobile device, and the size of original audio, video or photos can be reduced by re-encoding.
or compressing, so it makes the transmission of the audio, video or photos more efficient. Package processing is used to ensure the synchronization of audio and video or photo information and the stability of data transmission. The processing module can also receive the model information of the photographing device, send the model query information, and find the storage module according to the model information of the photographing device, obtain a control protocol corresponding to the model of the photographing device, and finally control the photographing device input by the user according to the obtained control protocol[2]. Finally, the control commands input by the user of the camera equipment is converted into the recognizable control commands.

The storage module mainly stores a control protocol corresponding to various types of photographic device models. When the processing module sends a command to the processing module, the information corresponding to the photographic device can be found in time, so as to quickly control the access and operation of the photographic device.

3.4. Communication design of Mobile device

The communication between the mobile device and the PTZ uses a wireless connection approach to receive audio and video signals. The first connection interface of the electronic device is a wireless radio frequency transceiver, which adopts a 2.4G wireless data transmission module[3]. The reason to choose 2.4G is that the electromagnetic wave in the 2.4GHZ frequency band is not easy to penetrate or diffract, there are few interferences, and the electromagnetic environment in the space is relatively clean, which can achieve high-speed transmission and meet the requirements for stable and fast communication of the data transmission from photographic equipment to mobile devices. The direct connection between the two is achieved by turning on the WIFI on the stabilizer and the mobile device, and the communication between them uses the UDP protocol. The UDP protocol is a connectionless protocol (the connection does not need to be established before the data is sent), and there is no delay required to establish a connection. UDP supports one-to-one, one-to-many, many-to-one and many-to-many interactive communication, which has high work efficiency but less requirements on system resources, and is suitable for high-speed transmission. Thereby, the picture frame in the photographic device is transmitted to the mobile device, and the mobile device parses the received data, and then decodes it, obtains the transmission time of the picture frame, and rearranges the received picture frame according to the transmission time, or discard some picture frames to better display and adjust the audio, video or photo files.

4. Software design

4.1. The implementation of wireless image transmission system

To begin with, the photographic device is connected to the stabilizer, the stabilizer is activated, the photographic device is turned on, the photographic device is connected to the multimedia interface, and the multimedia interface transmits the recorded audio, video or photo to the electronic device on the stabilizer. Then, the received information is encapsulated by the processing module of the electronic device, waiting to be transmitted to the mobile device, and the mobile device is placed on the stabilizer. Furthermore, the first connection interface of the electronic device on the stabilizer is a radio frequency transceiver, and the Bluetooth and WIFI of the stabilizer are turned on as well as the mobile device, and pairs between the two, thereby realizing the wireless connection between the stabilizer and the mobile device. Finally, the mobile device collects, displays, and adjusts related information on audio, video, or photo data. The schematic diagram of the picture transmission system is shown in figure. 3.
5. Conclusion
The image transmission system is designed based on the PTZ system. The Hi3516A is used as the main control chip. The photographic equipment is connected to the PTZ system through the multimedia interface. The processing module and the storage module encode the information collected by the multimedia, encapsulate the data stream format that can be decoded by the mobile device. Then the first connection interface (radio frequency transceiver) is connected with the mobile device wirelessly, so as to implement the wireless image transmission between the photographic equipment and the mobile device. The system is simple and reliable in design, high in stability and strong in real-time, wide in application range, easy to operate.

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