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Research on Key Technology of Real-time Video Transmission Based on Mobile Terminal

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Abstract: In order to solve the problems existing in real-time video transmission of mobile terminals, this paper proposes the encapsulation method which is suitable for H.263 and H.264 video coding, and re- duces the extra waste of real-time transmission proto- col packets and to improve the transmission efficien- cy of the video. Experimental results show that the peak signal to noise ratio (PSNR) in H.263 and H.264 video coding mode is above 30 dB at the lowest frame rate and resolution, and the minimum requirement of video transmission has been satisfied. Rate of 24 Hz, the two encoding PSNR are more than 40 dB, video transmission quality ideal. In addition, the two packet loss rate of about 10% maximum, the maximum delay of 400 ms or less, have reached the requirements of real-time video transmission.

Key words: Mobile terminal; video real-time trans- mission; H.263; H.264

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Introductin

In recent years, intelligent mobile terminals as easy tocarry, powerful and rapid development of the Android system as the representative of the intelligent terminal has gradually become an indispensable application for daily life in the case of access to the network, people focus through the mobile terminal on the video soft- ware for video playback. With the development and popularization of wireless WIFI, wireless network in people's daily life more and more widely used in thetraditional sense of the video viewing has been una- ble to meet people's entertainment needs, people for real-time video transmission based on live programs have more the demand [1-5].

At present in the mobile terminal video real-time transmission still has many problems. First of all, the encoding of different forms of the video when the basic use of the same package, not according to each code has the characteristics of the form to take the ap- propriate package to carry out network transmission, resulting in real-time transmission of video signifi- cantly reduced. Secondly, the traditional code migra- tion between the mobile terminal and the server side has been unable to provide better video transmission real-time [6-8]. Based on the characteristics of H.263 and H.264 video coding, this paper puts forward the encapsulation method, reduces the extra waste of the real-time transmission protocol packet, improves the transmission efficiency of the video, and realizes the video transmission through the real-time transmis- sion protocol packet Packaged, the use of WIFI wire- less network transmission, so that the video can be real-time display on the server side.

1. System architecture design

Based on the mobile terminal video real-time trans-mission systemis divided into video transmitter,transmission network and video receiver three parts,as shown in Figure 1. In the real-time video transmis- sion before the video must be pre-recorded, encod- ed and packet encapsulation, and then set the video frame rate and resolution, which are completed in the video sender. The video receiver analyzes and decodes the received video information and enables the video to be displayed on the screen of the server in real time.

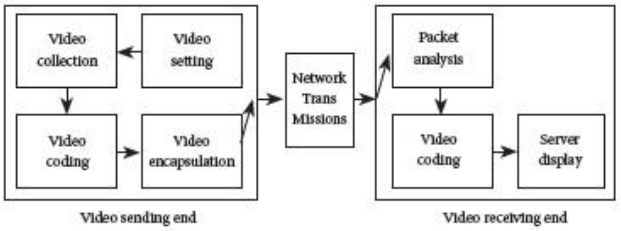

Figure 1 System frame diagram

2. Different encoding of the video stream package

2.1 H.264 video stream encapsulation

H.263 is a more commonly used for video encoding. The encoding speed faster than other video encoding method, while the code rate is lower, the unit bit rate can be less than 64 K, but does not reduce the quality of the video, which makes it applicable in the network stability and high speed requirements of the occasion, such as network video phone and remote video surveillance. For the char- acteristics of H.263 video stream, this paper presents a package, the process shown in Figure 2.

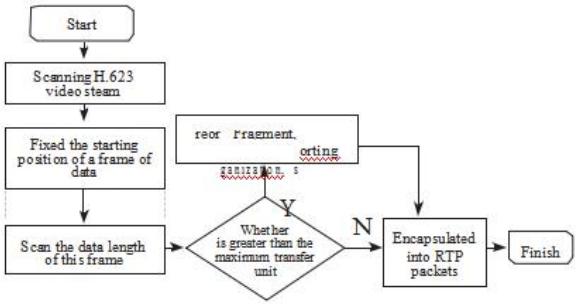

Figure 2 a frame H. 263 video stream encapsulation process

(1) Scan the H.263 video stream and search for relevant information such as the image start code of the video stream sequence and the sequence termination code.

(2) Positioning the location of one frame of data to the ad- dress of the first image frame, and then sending the data of the frame to the temporary buffer to read the relevant information of the image. Then positions the first block and reads the relevant information of the macroblock and fixes the position at the position of the first macroblock.

(3) The length of the frame data can be determined by scanning the frame data and then determining whether it is greater than the upper limit of the real-time transport protocol packet, that is, whether the data length of the frame exceeds the maximum transmission unit.

(4) If the data length of this frame is greater than the max- imum transmission unit, the frame data is divided into several parts, each part is assigned a sequence number according to the division order, and these divided parts are encapsulated into real-time transmission The protocol packets are transmitted over the network, and the server side reorders the segments according to the serial number after receiving the data.

(5) If the data length of this frame is less than the maxi- mum transmission unit, the frame data is directly encap- sulated as a real-time transport protocol packet.

(6) Sends the encapsulated real-time transport protocol packet to the buffer, and sends the real-time transport protocol packet of the buffer to the server. At this point, a frame of H.263 video stream can be completed.

2.2 H.264 video stream encapsulation

H.264 divides the video stream into Video Coding Layer (VCL) and Network Abstraction Layer (NAL). The VCL layer is responsible for encoding the video, and the NAL layer encapsulates and transmits the video according to network conditions. NAL makes the video stream data makes the video stream data can be transmitted in different networks. For H.264, the real-time transport protocol packet encapsulation mode is determined by the structural characteristics of NAL.

At present, many video real-time transmission system is only according to the size of the NAL transmission unit to separate or split the package, and for the small size of the NAL unit is only a separate package and not re-use package. For H.264, most of the internal NAL unit size is smaller, a separate package caused by real-time trans-mission protocol packet waste, resulting in video stream-ing data transmission efficiency is low. In this paper, we propose an encapsulation method based on the length of NAL unit for the characteristics of H.264 video coding. The process is shown in Fig. 3.

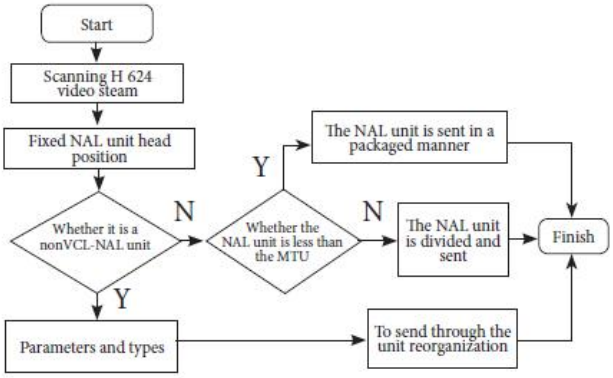

Figure 2 a frame H. 263 video stream encapsulation process

(1) Scan H.264 video stream sequence, access to NAL re-lated information.

(2) The starting position of the fixed NAL unit, that is, the position at which data starts.

(3) To determine whether the NAL unit carries the VCL data. It can be judged by whether the NAL unit contains the video sequence or the image parameters. If the above information is included, the NAL unit does not carry the VCL data.

(4) If the NAL unit does not carry VCL data, it is smaller in size and much smaller than the maximum transmis-sion unit size. All NAL units that do not carry VCL data can be reassembled and packaged.

(5) For the NAL unit carrying the VCL data, it is deter-mined whether the size is greater than the maximum transmission unit.

(6) If it is larger than the maximum transmission unit, it is divided into multiple parts and assigned a serial number, and encapsulated into a real-time transmission protocol packets transmitted through the network, the server will receive the data according to the serial number will be part of the split Sorting.

(7) Is smaller than the maximum transmission unit, it is fixed directly to the head of the real-time transport pro-tocol packet.

(8) Sends the encapsulated real-time transport protocol packet to the buffer, and sends the real-time transport protocol packet of the buffer to the server. At this point, a frame of H.264 video stream can be completed.

3. Experimental test and analysis

3.1 Experimental program

In this paper, through the experiment, from the video quality, packet loss rate and delay to verify the proposed H.263 and H.234, respectively, the advantages of packag-ing. In the video quality evaluation, it is more common-ly used to characterize the PSNR (Peak Signal to Noise Ratio) and Mean Square Error [10-11]. The unit of PSNR is dB (dB). If the larger the value which means the small-er the video transmission distortion, the better the video display. Therefore, the video transmission can be judged by the PSNR value of the video.

Packet loss rate is a measure of the correct rate of vid-eo transmission, when the packet loss rate is too large, it will affect the video transmission efficiency, and delay is to determine whether the video transmission to achieve real-time transmission requirements.

3.2 Experimental results

In this paper, we selected different types of mobile phones, as well as QVGA (320 * 240), VGA (640 * 480), 720P (1280 * 720) three kinds of resolution on the video real-time transmission, at different frame rate test differ-ent coding Of the video real-time transmission effects, respectively, as shown in Figure 4 and 5.

Figure 4 H.263 encoding form of video transmission effects

Figure 5 H.264-encoded video transmission

Figure 6 and 7 respectively, for different encoding mode real-time transmission of video PSNR map. It can be seen from the figure, the lowest frame rate and resolution, H.263 and H.264 video coding mode under the PSNR are more than 30 dB, has met the

minimum requirements for video transmission. And when the frame rate at 24 Hz, the two encoding PSNR are more than 40 dB, video trans-mission quality ideal.

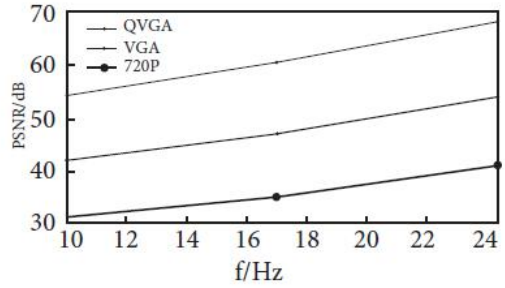

Figure 6 PSNR values in H.263 encoding mode

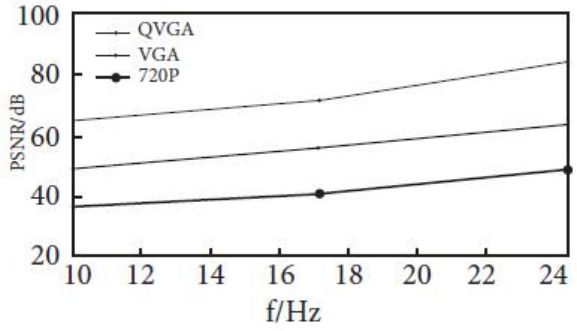

Figure 7 PSNR values in H.264 encoding mode

Figure 8 shows the PSNR comparison chart before and af-ter the improved encapsulation in H.264 encoding. It can be seen from the figure, this paper presents a clear way to improve the real-time transmission of video quality,

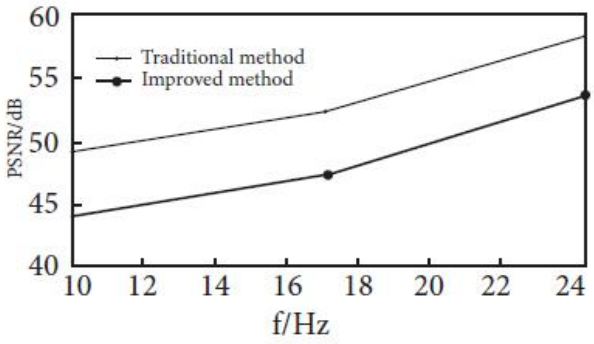

Figure 8 Comparison of PSNR in H.264 coding mode

In this paper, we use three different resolutions in two encoding modes to test the packet loss rate and delay of video transmission. The results are shown in Table 1. It can be seen from the table, the two coding methods, the packet loss rate and delay increases with the increase in resolution, but the maximum packet loss rate of 10%, the maximum delay of 400 ms or less, both achieved the re-al-time video transmission requirements.

Table 1 2 kinds of coding methods at different resolutions under the test results

Resolution	Rate of packet loss/%	Delay/ms
H. 264		
320*240	3.5 ~ 5.0	253
640*480	5.8 ~ 6.9	294
1280*720	7.9 ~ 9.0	335
H. 263		
320*240	3.9 ~ 5.3	270
640*480	6.6 ~ 8.3	314
1280*720	9.2 ~ 10.3	359

4. Conclusion

In order to solve the problems existing in real-time vid-eo transmission of mobile terminals, this paper propos-es the encapsulation method which is suitable for H.263 and H.264 video coding, and reduces the extra waste of real-time transmission protocol packets. The transmission efficiency of the video. Experiments show that the peak signal to noise ratio (PSNR) in H.263 and H.264 video coding mode is above 30 dB at the lowest frame rate and resolution, and the minimum requirement of video trans-mission has been satisfied. And when the frame rate at 24 Hz, the two encoding PSNR are more than 40 dB, video transmission quality ideal. In addition, the two packet loss rate of about 10% maximum, the maximum delay of 400 ms or less, have reached the requirements for real-time video transmission.

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