Research on Optimization of Emergency Communication Transmission Mode in Mobile Communication System

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Abstract: In this paper, the optimization of emergency communication transmission mode in mobile communication system is discussed. Through multi-mode selective coupling or dynamic switching of SISO mode, MIMO mode and mixed mode, the anti-interference ability and emergency communication ability of mine mobile communication system are realized. After all the equipment is cut off and the network is destroyed after the disaster, it can be carried by the rescue team members and deployed quickly, which can realize the normal transmission of real-time video, wireless communication, personnel positioning, safety monitoring and other data, thus solving the problems of communication interruption, underground real-time environmental status and unclear rescue situation after the disaster that could not be overcome in the past. Adapt to the fast and convenient transmission of video, image, voice and data services needed in emergency rescue.

1. Introduction

The service objects of emergency communication system generally include ordinary personnel and special groups dealing with emergency situations, such as police, firefighters, military and so on. Emergency communication system not only provides general one-to-one communication services for ordinary people, but also needs to provide group communication services for special groups to realize one-to-many and many-to-many communication within groups [1]. China has been deeply affected by natural disasters for a long time. In the emergency work of emergency rescue and disaster relief, satellite communication system is the most convenient communication tool which is not affected by the region, and it has played a great role in all kinds of major natural disasters. Most of the existing mine mobile communication systems use cell-based cellular networks, and one antenna is used at the sending end and the receiving end respectively. For the mine limited non-free space environment, the traditional underground single transmitting antenna and single receiving antenna channel system (i.e. single input and single output, SISO) has small channel capacity, serious multipath interference and great influence of environmental noise, which is difficult to meet the needs of mine mobile emergency rescue communication and mobile monitoring [2]. How to integrate the dynamic and static diagram equipment with the positioning mobile phone equipment and realize the rapidity of emergency communication is an urgent technical problem to be solved.

2. Wireless Relay Transmission Mode Communication System

2.1. Opportunistic Source Transmission Scheme

In multi-user communication system, opportunistic source (user) transmission scheme is adopted, which enables users with the best channel quality to participate in communication to develop multi-user diversity, share system resources in an efficient way, and optimize system performance. Users of emergency mobile encrypted communication service first encrypt the data to be transmitted by using the encryption module and store it in their own computers. Then connect to the Internet by dialing with mobile phone, which solves the problem of how to obtain network service quickly and

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conveniently without wired network. Generally, the ground communication base station is connected with the underground communication base station by wire (using reinforced temporary optical fiber or other communication cables). This communication link has strong communication capability, large bandwidth and stable transmission. There can be multiple sink ports with the same address, but only one source port, that is, the same process data frame may be received by multiple devices. Therefore, the relay link for transmitting data packets is not interfered by other links. At the same time, each hop link adopts demodulation and forwarding protocol to encode, transmit and decode independently. Therefore, the signal-to-noise ratio of different hop links is independent of each other.

2.2. Opportunistic Relay Transmission Scheme

With the increasing demand for communication, such as emergency communication, measurement data transmission, monitoring and monitoring, satellite communication, as an effective supplement to conventional communication on the ground, has become a key technology that has an effect on such emergencies and special communication needs [3]. Opportunistic relay transmission scheme helps communication by selecting one or more relays among multiple relays, which effectively overcomes the above problems on the premise of realizing full diversity. The reduction of line size often leads to the deterioration of bandwidth and efficiency. Therefore, designers have been trying to achieve a better balance among antenna size, efficiency and bandwidth [4]. In the system, optical signals are used as carriers, radio frequency signals are used as modulation signals, and WDM optical transceiver units are built in optical line terminals and MIMO communication gateways, which can realize bidirectional transmission of radio frequency signals through wavelength division multiplexing of different wavelengths of a single optical fiber. The functions of the server mainly include the generation, distribution, update and destruction of the whole system key, as well as user identity authentication and authority distribution. In addition, when a user's key is leaked, the key can be updated in time to minimize the loss. At the same time, the server also has all the functions that the client has.

2.3. Opportunistic Antenna Transmission Scheme

A system using transmission rate as the system performance index is suitable for continuous services, such as video streams [5-6]. The transmission rate determines the quality of video stream. In one-dimensional relay network, data flow passes through multi-hop relay links. By selecting antennas or antenna combinations with good transmission performance to participate in transmission, the complexity and energy consumption of multi-antenna system can be reduced; While ensuring the performance of the system. Through calculation, the system parameters can be designed reasonably, such as modulation and spread spectrum mode, antenna type and gain, etc., so as to ensure that the system indexes can run normally and meet international standards. Therefore, the link budget of S-band satellite emergency communication system is a necessary condition when designing satellite communication system. The centralized MIMO system adopts the traditional cellular structure, and multiple antennas based on MIMO technology are deployed centrally. Only by requiring the distance between antennas to be equal to or greater than half a wavelength of signals, the receiving and transmitting antennas are irrelevant to small-scale fading and obtain corresponding gains [7]. Therefore, the resonant length of the antenna is reduced to half of the original and the size of the antenna is greatly reduced. However, this method will lead to strict requirements on the size of the feeding structure and higher processing requirements.

3. Optimization Analysis of Emergency Communication Transmission Mode

3.1. Software Architecture of Emergency Communication System

Communication access unit is the core equipment of the system terminal, which mainly realizes the access of each channel interface. The main functions of the communication access unit are as follows: establish on-site WIFI coverage for various types of intelligent terminals, and access to the

emergency center through the communication access unit. Having a unique key pair between each pair of users ensures the smooth progress of file encryption and decryption between the two parties, and makes it unnecessary to exchange keys in a safe way before each communication; For FDD air interface, the radio channel uses multiplexer/duplexer to process uplink signals and downlink signals. The RF down-converter can amplify the received signal from the multiplexer and set the center frequency of the signal inside the passband of the A/D converter. In the general voice system, the frame length of the general vocoder is 20-30ms, but the frame length of the vocoder we use is 75ms, and the real-time requirement of voice communication is high, so the time of voice capture and tracking should be shortened as much as possible. Optimal base station deployment maximizes the minimum signal-to-noise ratio in polygon area, which can be simplified as optimal base station deployment maximizes the minimum signal-to-noise ratio at polygon vertex. The optimal base station position is the center of the smallest circle covering the vertex of the polygon and located on the edge or outside of the polygon. When the wired link fails to communicate, the platform transmits data through the wireless network to ensure real-time data uploading in case of sudden disaster.

3.2. Network Bandwidth Optimization Solution

From the perspective of information transmission methods, three information transmission methods need to be established: First, the wired transmission method mainly transmits long-distance information and some short-distance information; The second is wireless information transmission, which mainly transmits short-distance language information, and can also transmit long-distance text and language information; The third is the way of information expansion, which mainly transmits the commander's instruction information and spiritual agitation information. In order to avoid multiple users accessing the communication equipment data on the wireless communication link at the same time and occupying bandwidth resources repeatedly, combined with the communication characteristics of the system link, we use the proxy server forwarding scheme in the underground command center to solve this problem, as shown in Figure 1.

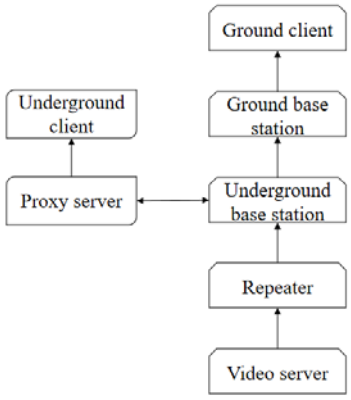

Figure 1 Video data stream in proxy case

In fact, the length of process variables representing train status information such as speed, motor current and voltage and train control commands is relatively short. In order to improve transmission efficiency, process variables with the same period sent to the same equipment are usually packaged in a process data frame for transmission. The multifunctional base station realizes the integration of personnel positioning, wireless voice communication, data communication and other functions, and solves the problem that data islands of a single system and a single network and communication cannot be shared by the network. In this way, the baseband module not only includes signal tracking tasks such as despreading and demodulation, but also realizes a series of tasks such as bit synchronization and frame synchronization. Therefore, synchronization technology is the key part of the whole communication system.

3.3. Signal Transmission

The mobile client is connected to the Internet through configured GPRS card dialing, while the fixed client and KMC center can connect to the Internet in many ways, including LAN and ADSL dialing, and can also dial through GPRS card like the client. CSI is fed back to SISO/MIMO transmitting terminal through MIMO communication gateway, SISO/MIMO base station allocates power at each remote antenna port according to received CSI information, and selects antenna according to power allocation result. Use the intelligent terminal to shoot the emergency scene video, and transmit the video to the emergency center server in real time through the communication link established between the emergency communication access unit and the emergency center. When the dielectric constant of the medium is increased, surface waves will be introduced, which will reduce the efficiency of the antenna, thus reducing the gain and narrowing the bandwidth of the antenna. The method of short circuit technology will worsen the cross polarization of antenna; According to the synchronous relationship between data bits and spreading codes, it can be judged that when the data bits with a duration of 1ms completely coincide with the spreading code period with the same duration, their starting edges will also coincide. It enables wired telephone, wireless telephone and emergency broadcast to realize intercommunication, interconnection and unified dispatch under the same platform.

The modulation module of S-band low-rate satellite communication system is used to transmit positioning data, while the radio frequency part adopts the same L1 band (1575.41MHz) as GPS, which can realize seamless docking with outdoor navigation signals. As shown in Figure 2:

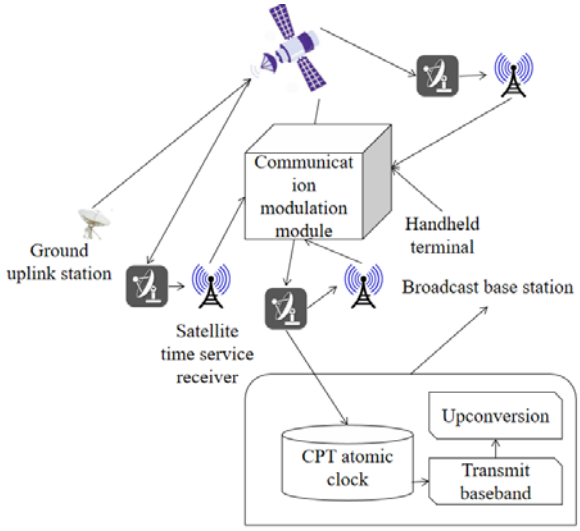

Figure 2 Schematic diagram of auxiliary positioning of communication modulation module

After convolution coding modulation and serial/parallel conversion, the information bit stream from the source is transmitted after power loading through the selected antenna subset. Because only the statistical characteristics of the channel estimation matrix and estimation error are known, the channel estimation matrix is used for antenna selection and power allocation [8]. Make a vertical line from the optimal base station position to this side, and the intersection point is shown as a square symbol. Since the distance from any vertex of polygon to square symbol is less than the distance to asterisk, it is better to place the base station in square symbol than in asterisk position. Only when the high-priority event tour is completed and there are no more suspended high-priority events, the master device starts the low-priority event tour; To the user, the proxy server can be regarded as an actual server, and the user does not need to know the source and transfer process of its data, and the actual video server is invisible to the user. When the underground mobile terminal moves in the wireless signal coverage area of the mine distributed antenna system, the underground SISO base station or MIMO base station configures the antenna transmission power better through the MIMO communication gateway according to the wireless signal strength of the mobile terminal received by each antenna, thus realizing the rapid antenna selection process.

4. Conclusion

Aiming at one-dimensional relay network in application scenarios such as mine disaster or tunnel accident, this paper systematically studies the optimal relay deployment and resource allocation to minimize interruption probability or maximize transmission rate when the distance between sending and receiving terminals is known. Multi-mode mine mobile communication system based on distributed MIMO antenna can improve the probability of successful network switching in underground multipath fading environment, overcome the multipath interference of underground roadway, eliminate the near-far effect of underground mobile terminals and enhance the robustness of the system. The optimized emergency communication system has been synchronized with the technological progress of society. Using the most popular mixed programming technology to develop mobile terminal APP software, the dynamic and static diagram collection, information input and transmission of emergency site are realized, which ensures the simplicity and ease of use of development and maintenance, and provides security for the rapid development of coal mining.

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