

Design and Application of Emergency Communication System for Social Safety

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Abstract: Social security is related to all aspects of people's production and life, and is the basis for the orderly development of society. The wide and narrow AD hoc network of the whole airspace emergency communication command system for social security is a kind of emergency command and dispatch system. It integrates wireless wide and narrow band AD hoc network technology and cross-platform no-center command and dispatch technology to design and develop, solve the mobile positioning and safe communication guarantee of locomotive, individual soldier, and other objects under emergency conditions, and realize efficient command and dispatch. The system fully studies the characteristics of the emergency rescue market, and solves the problems in the market such as data sharing, interconnection, unified command, and cooperative scheduling. An application system with full-space mobile location service, full-duplex audio and video communication, mobile intercom, short message and short message, multi-system integration and other features has been developed.

1. Current Situation Analysis

An emergency communication system is a system used to guarantee communication in an emergency. It can provide a reliable and effective means of communication in emergencies such as natural disasters, accidents, and wars, helping people obtain and transmit important information in a timely manner, and assisting in emergency rescue and decision-making. Since 2004, China has officially launched the research on emergency communication standards, including the integrated system and standards of emergency communication, the requirements of public communication network to support emergency communication, and emergency special service calls. At the same time, many domestic enterprises are also actively developing emergency communications-related products, such as ZTE's GT800, Huawei's GOTA and Mi WAVE of the Chinese Academy of Sciences, but compared with advanced countries, the backwardness of emergency communication technology means is obvious, mainly in the following aspects.

(1) The scientific and technological content is not high

In recent years, although China pays attention to improving the level of emergency equipment, but

due to the weak industrial base in China, the emergency industry started late, most of the emergency products have not got rid of low technology content, low added value of the situation, especially large, critical emergency equipment, difficult to meet the emergency needs, directly affecting the emergency response effect [1].

(2) The independent innovation ability is not strong

The technology research and development of emergency products is not enough, the lack of core competitiveness, and the market is in a disadvantageous position. Some domestic equipment that looks more advanced is the integration of foreign spare parts, basically in the "crowded machine" stage.

(3) The key equipment depends on imports

Such as aviation emergency rescue, mine underground critical rescue, risk aversion, emergency communication, information communication security, medical testing, biochemical, nuclear radiation protection and other equipment, equipment production fields are heavily dependent on imports. Dependence will have constraints, give others a handle, will lose the initiative [2].

2. Research Content

2.1 Fusion Emergency Communication Terminal Design

The wide and narrow band AD hoc network is integrated and developed to realize the integrated communication between portable individual soldier terminal and vehicle terminal. The command center adopts the operation mode of service terminal + tablet for dispatching and commanding, and the wireless connection between the terminal and tablet is adopted to facilitate mobile dispatching. Through the converged communication dispatching platform, the collaborative command and dispatching of locomotives and individual soldier personnel is realized [3].

2.2 Design of Vehicle-Mounted Communication Terminal

Realize automatic networking between vehicles, and can also communicate with portable terminals. Customized design AD hoc network board card, positioning and short message, industrial control motherboard; Through the standardized interface to achieve board integration. The vehicle terminal is embedded in the autonomous communication scheduling platform to realize communication scheduling between vehicles. The overall design of the terminal meets the requirements of water resistance, earthquake resistance, salt spray resistance and electromagnetic compatibility.

2.3 Portable Handheld Terminal Design

Based on the broadband AD hoc network technology, the design can realize the mutual networking communication between individual personnel, and can also communicate with the vehicle terminal. It sets the full space positioning, voice, video, message, and other scheduling functions as one, and adopts the intelligent handheld terminal structure for high integration and design. Based on narrowband AD hoc network technology design, to achieve individual personnel mutual networking communication, but also can communicate with the vehicle terminal, positioning, voice, and other scheduling functions, the use of intercom structure for design and integration. The specific environmental requirements are different, and different portable individual soldier terminals are used.

2.4 Integrated Communication Dispatching Platform

Build a human-vehicle coordination command system to realize unified vehicle and personnel scheduling in a mobile environment, and integrate indoor and outdoor positioning technology to achieve seamless connection and positioning; The platform mainly includes positioning, voice intercom, voice call, video conference, monitoring, message, transaction management and other functions.

2.5 Vehicle Command and Dispatch Platform

Based on the Linux architecture design of vehicle terminal, GIS, multimedia, Baidu and other technologies are adopted to realize the development and design of positioning, voice, video, monitoring, message and other communication scheduling functions, to realize the management of vehicles and personnel, and can carry out hierarchical scheduling.

3. Key Technologies

3.1 Broadband and Narrow Converged Dual-Channel AD Hoc Networking Technology

From the aspect of communication bandwidth, AD hoc network technology can be divided into broadband AD hoc network and narrowband AD hoc network. Broadband AD hoc network has high communication bandwidth, high transmission rate, and large amount of service data that can be transmitted, but the transmission distance is limited; Narrowband AD hoc network has small communication bandwidth and low transmission rate, and can only transmit small data services, but the transmission distance is far, and demodulation can be carried out from the noise. The broadband and narrow fusion AD hoc network technology starts from the physical layer to build the fusion of two networking modes. There are two wireless transmission channels, one is a narrowband signaling transmission channel, which is used to transmit signaling or voice interaction between some nodes. The other is a broadband service transmission channel, used to transmit voice, video, message and other large data services.

3.2 Precise Positioning Technology

UWB (Ultra-Wideband) is a carrier-less communication technology that transmits data using narrow pulses of non-sinusoidal waves in the nanosecond to microsecond scale. By transmitting extremely low-power signals over a wide spectrum, UWB can achieve data transfer rates of hundreds of Mbit/s to several Gbit/s over a range of about 10 meters. The most basic working principle of UWB technology is to send and receive pulse interval strictly controlled single-period ultra-short pulse, ultra-short single-period pulse determines the signal bandwidth is very wide, the receiver directly uses a front-end cross-correlator to convert the pulse sequence into baseband signal, eliminating the traditional communication equipment in the intermediate frequency stage, greatly reducing the complexity of equipment [4].

3.3 Satellite-Ground Fusion Positioning Technology

Satellite-ground fusion positioning is mainly the deep integration of several major satellite positioning technologies and indoor wireless positioning technologies to achieve seamless integration and high-precision positioning in the whole space. The core of this technology is the fusion and analysis of data between each other, and the final formation of accurate positioning display.

The positioning of satellite system is to use a satellite positioning receiver to receive and measure the satellite signals of the Beidou system and other satellite navigation systems at the same time, so that a variety of satellite navigation systems can be comprehensively used to accurately measure the three-dimensional position, three-dimensional speed, time and attitude and other related parameters. Multi-mode combined positioning needs to combine a variety of positioning functions in one unit. Since BDS and GPS are basically the same or similar in system structure, navigation and positioning mechanism, working frequency band, modulation mode, signal, and ephemeris data structure, etc., they both launch spread spectrum ranging code and measure the pseudo-distance between the satellite and the user to complete navigation and positioning. And the GPS system construction is perfect, the positioning accuracy is high, so the BDS/GPS dual mode redundancy combination positioning is used.

3.4 Cross-Platform Centerless Instant Messaging Technology

The research and development of wide and narrow AD hoc network all-airspace emergency communication command device for social security is developed and applied by the integration of multiple terminals and multiple platforms. Android system and MCU embedded system are used in the portable handheld terminal, Linux system and Windows system are used in the vehicle-mounted terminal and fusion dispatching terminal. Therefore, the application of the whole system is to carry out deep development under the open multi-class platform to achieve instant communication. The system communication is dependent on the AD hoc network without a central node, so the application system also needs to adopt a non-central communication architecture. To sum up the technical characteristics, a cross-platform centerless instant communication technology is needed to meet the system application requirements in the process of development and application [5].

4. Features of System Innovation

(1) For the first time to achieve narrow-width dual-channel AD hoc network communication, according to different business needs, to build different communication bandwidth links to achieve the farthest data transmission efficiency. It overcomes the problem of mutual restriction between transmission rate and transmission distance in the existing AD hoc network technology.

(2) Develop cross-platform centerless instant messaging technology, build cross-platform mobile communication architecture, deeply integrate centerless communication services, maximize the utilization of node resources, and improve the stability, reliability, and practicability of the whole system.

(3) Break through the bottleneck of existing positioning technology, comprehensively design, and develop Baidu + AD lib + indoor positioning technology, expand the accuracy and stability of indoor positioning technology, build full-space mobile accurate positioning, and realize the seamless integration of indoor and outdoor positioning systems.

(4) For the first time, the centralized emergency rescue dispatching command of heaven and earth and man-machine coordination can be achieved, and the full space coverage can be carried out from high altitude to underground, and the accurate hierarchical scheduling can be carried out from individuals to motor vehicles and aircraft. In the future, the combination of satellite communications can also provide integrated command and communication support in the front and rear.

5. Conclusions

The emergency industry defined in China generally refers to the collection of activities formed to provide products and services for the prevention and disposal of emergencies. Divided by categories,

one is rescue and disposal equipment and technology, the second is monitoring and early warning diagnostic equipment and technology, the third is prevention and protection products and technology, and the fourth is emergency education and training consulting services [6]. The emergency industry has the attributes of multi-industry crossover and public safety service, is an emerging industry, the development of emergency industry, is conducive to the national disaster prevention and reduction and public safety, is conducive to the optimization of the industrial structure and social harmony and stability at the grass-roots level, is conducive to the market expansion and profit growth of enterprises, is conducive to the safety and health of the public.

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