The Project of 5G Emergency Visualization System in Lishui

Lishui is the prefecture level city with the largest land area in Zhejiang Province. With nearly 90% of forest coverage, 5% of water, and 5% of field areas, the city suffers from a wide range of disasters that occur frequently and cause great losses. A visualization system is the basis for quickly handling emergencies, as well as important guarantee for informed decision-making and command and scheduling. Lishui 5G emergency visualization system is a platform integrating cloud, management and terminal based on the requirement of the Bureau of Emergency Management for the benefit of people's livelihood. Powered by the 5G network, 5G mobile cabin, satellite communication system, visualised scheduling system, and other capabilities, the platform provides features such as disaster early warning, remote search and rescue, real-time command, 24/7 and all-weather protection. Early warnings and larger scope of search and rescue provide the possibility to minimize people's losses and the basis for major decision-making. The platform integrates automated monitoring and early warning of disasters and efficient rescue for disaster prevention and relief.

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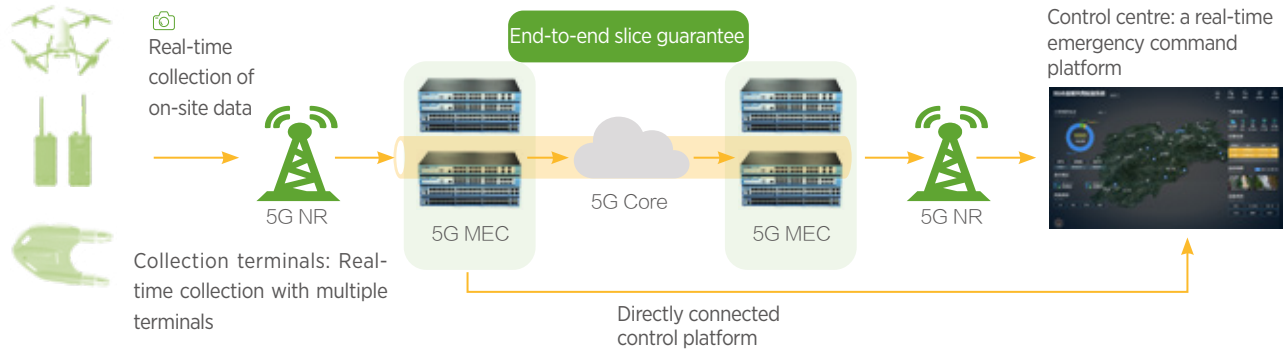
Case Overview

Lishui is in an area prone to frequent natural disasters. During the flood season, secondary disasters such as mountain torrents and geological disasters frequently occur in small basin areas. According to the "Statement of Work on Local Construction of a Video Scheduling System for Emergency Command" set forth by the Department of Emergency Management and based on the actual situation of emergency management in Zhejiang Province, China Mobile has worked with the Bureau of Big Data of Lishui, Institute of Mountain Hazards and Environment under CAS, the First Geology Group of Zhejiang Province, Ericsson, and Dinnovate Technology to create a dual-way visualized command and scheduling system for on-site disaster relief and emergency rescue at all levels of emergency management departments across the province by leveraging transmission resources such as 4G/5G wireless communication networks and satellite communications, on-site mobile visualization acquisition devices, and TeleEye video platform and Internet of Videos platform of China Mobile Zhejiang.

This project applies 5G capabilities to the monitoring and early warning of and emergency response to natural disasters in small basin areas. By empowering systems and equipment with 5G network, network slicing and edge computing, a 5G-based converged communication platform is built to connect the mobile visualization front-end devices such as IoT sensors, individual devices, monitoring balls, and drones with communication channels such as satellite communications and 5G cabins to monitor the progress of major disasters in small basin areas in real time. Based on 5G + AI big data analysis, as well as the early warning model of CAS for five types of disasters (mountain torrents, landslides, collapses, dam failures and debris flows) under small basin scenarios, accurate early warning of disasters in small basins throughout the city is realized. 5G RCS is used to broadcast messages and videos of emergency evasion routes to effectively avoid information delay. 5G drones are employed to post back panoramic videos, search and rescue persons with thermal infrared detection equipment, and broadcast in a high altitude. The drones, unmanned ships and unmanned lifebuoys form a life-saving system covering the space, air and ground for automated person search and rescue and a 5G-based closed-loop disaster management and control system to realize real-time disaster early warning and command.



Industry Challenges

China suffers from many kinds of natural disasters that bring economic losses of more than trillions of CNY per year. The prevention and control of natural disasters have the following pain points:

inaccurate disaster prediction

Although each business department has an early warning and disposal platform, the disaster early warning systems under the departments of water and land are deployed by district/county, which results in inaccurate early warning, lack of clear goals for disaster prevention and relief, and great challenges at work.

invisibility of disasters

When a natural disaster occurs, government disaster relief departments and leaders expect to know the current disaster situation as soon as possible. However, there is no flexible and effective rapid response tools that can send all the data on site back to the command centre for informed decision-making.

data silos

The departments of water, land, and air have their own monitoring and pre-warning systems, but these systems do not share data and are not connected.

untimely transfer and escape

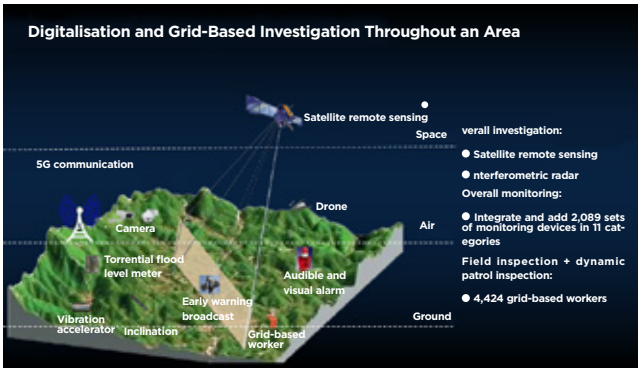
Natural disasters often occur suddenly and are accompanied by some secondary disasters. It is difficult for ordinary people to tell their occurrence in a timely and accurate manner. As a result, the affected people would not be able to immediately respond to and escape from sudden natural disasters.

Scene of forest fire

Screen of the 5G emergency visualization system cockpit

Solutions and Benefits

In view of the pain points in the country (excessive small basin areas, frequent occurrence of floods, untimely emergency evacuation, etc.), innovative solutions should be proposed to meet the requirements of the Ministry of Emergency Management of China for the construction of a visualization scheduling system for two-way interactive emergency control. Under the guidance of the Zhejiang Department of Emergency Management, China Mobile Lishui takes the lead in cooperating with Lishui Bureau of Emergency Management to ensure interactive, coordinated and efficient rescue and access at any time via the 5G visualization scheduling system and realize on-site video command, rapid scheduling and broadband and narrow bandwidth wireless communication and other functions. To meet the requirements of "targeted coverage, 24/7 availability and prioritized control", the 5G network featuring large bandwidth, high availability and low latency supports the management and use of the 5G emergency visualization command system.



Main technical applications in the project

01 5G network slicing

Through 5G end-to-end network slicing technology, network resources are flexibly allocated, network capabilities are combined as required, and multiple virtual logical subnetworks with different characteristics are generated based on a 5G network. This technology enables high reliability, high security and service SLA guarantee, ensuring the remote control of drones and unmanned lifeboats. The L4 slice level is used to ensure the over-the-horizon control of drones and unmanned lifebuoys for safe and stable control. This helps to achieve effective coverage of small basin areas.

02 Edge computing

In view of the ultra-low latency required for the remote control of drones and real-time processing of HD video backhaul, city-level edge computing provides strong support for the 5G-based closed-loop disaster management and control system deployed in the city. As edge computing supports local data processing, the offloading of large-traffic local services may reduce the burdens on backhaul and effectively reduce costs.

03 Various types of 5G terminals

These terminals include individual terminals, monitoring balls, 5G cameras, etc. After the monitoring devices of the project are installed, data is transmitted to the monitoring and control central system for centralised management through the 5G wireless network. The system has a multi-layer structure. It can operate efficiently and is easy to maintain and manage.

04 5G drones and unmanned lifebuoys for real-time rescue

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05 5G real-time 3D modelling emergency command platform

This is the first project in the province to adopt 5G drones and 3D panoramic map. The 5G network is applied to locate the disaster site; drones are adopted to conduct automated oblique photography in the front end; and 3D models are built in the back end. Monitoring information, early warning information, disaster information and resource information are combined for visualized marking and direct display of all the hidden danger points prior to any disaster and the conditions and situation of the affected villages in "one map" for emergency management. The system integrates the information collected in the front end for intelligent decision-making and display on the big screen in the provincial or municipal command centre. The centralized platform facilitates effective real-time guidance from the provincial leaders and experts for on-site prevention and control of disasters.

06 5G RCS for emergency communication

5G RCS is used to send messages about escape routes to trapped persons once the escape routes are found through intelligent big data analysis and the trapped persons are located with 5G. The affected people are notified timely for effective evacuation. In addition, "safety code" and intelligent analysis of the monitoring of disaster shelters are also used to get hold of the evacuation.

Example of 5G terminal in the project

Example of drone search and rescue in the project

This project is a one-stop solution from automated monitoring and early warning to efficient disaster prevention, management and rescue. If it is widely used in other areas where natural disasters pose a greater threat to the safety of people's lives and properties in the province, even the country, people's lives and properties will be effectively protected through active disaster relief and prevention. After a year of implementation, the project of the "5G emergency visualization system" has achieved its expected goals. According to different types of risks such as mountain torrents, landslides, debris flows and collapses, standardized packages of devices and their alternatives have been specified. Based on the "1 + 30 + 200 + X" distribution plan, a real-time monitoring network covering the whole city will be built in batches. Step by step, the plan will be implemented until all 973 small basin areas in the city are within the scope of monitoring and early warning.

Based on the characteristics of 5G communication network, the system is positioned to be one assisting in early warning of multiple types of natural disasters, collaborative decision-making and control and scheduling. Through the deployment of monitoring systems, analysis modelling and multi-channel early warnings in various forms, a small closed loop covering "monitoring, analysis, early warning and evaluation" is formed. The early warning information of a small basin area is used as a trigger to start the closed loop of emergency response, and eventually form a large closed loop consisting of "early warning and emergency response for small basins". In addition, the 3D content from oblique photography makes the decision-making more intuitive. The project significantly improves the efficiency of the disaster relief system, expand the scope of its application, and effectively reduce the personal and property losses caused by disasters, making it an inflexible demand for smart cities. By effectively utilizing the 5G communication network and the existing disaster relief resources, the intelligent early warning and disaster relief system allows customized plug-ins at module level depending on application scenarios and geographic conditions to satisfy the needs of typical users in the market in terms of product functions and prices.

Summary and Next-steps

The 5G emergency visualization system proposed in this project provides a product integrating both software and hardware. For the software, the mainstream modular software development method is adopted to develop server software and client software. The method also supports the customization of plug-ins at module level for different application scenarios, and is compatible with standard general-purpose servers and customized servers. The involved raw material market, logistics, process equipment, human resources, etc. already have mature business models. Therefore, the assessment shows that large-scale production is feasible. For the hardware, on the basis of field investigation of different application scenarios at different locations, devices are customized specifically for small basin areas. All the devices are purchased in bulk from major manufacturers in the industry to reduce costs. The involved raw material market, logistics, process equipment, human resources, etc. already have mature business models. Therefore, the assessment shows that large-scale production is feasible.

Based on the 5G technology, this project supports the customization of plug-ins at module level for different application scenarios, and can be deployed at standard general-purpose servers and customized servers. With the capacities of fast deployment and upgrading, the project adopts 5G network slicing technologies and sensors, and 5G sensor private network slices for disaster relief devices to effectively link all types of early warning with disaster relief devices in the covered areas. More intelligent products for faster response are suitable for wide application in the banks of the Yangtze River and areas where geological disasters occur frequently.

The innovative system integrates 5G into emergency disaster relief, featuring unique combination of devices. Unmanned boats and unmanned lifebuoys account for more than 80% of the domestic market shares, and stand out in battery life, volume, and 5G integration capability.

This project provides solutions to the problems in the emergency industry such as low degree of digitalization and automation and slow response, boasting promising prospects. It is also a competitive lightweight disaster relief system on the edge side constructed based on the 5G communication network and AI.

This system consists of an emergency control platform, dedicated front-end devices such as 5G drones, 5G unmanned lifebuoys and 5G cameras, which can not only be used for emergency disaster control in small basins, but also for other smart city emergency scenarios such as commanding in emergency response to fires, city monitoring and administration. These make the system expandable into new markets. This project has been widely promoted in other fields. In the field of public security, 5G visualization is adopted for the surveillance system on the cloud. The 5G network featuring large bandwidth, high speed and wide connection enables real-time backhaul of images from the 5G vehicle-mounted monitoring balls and HD videos from 5G high-altitude ball cameras, and deployment of the 5G network within five minutes at temporary sites. Additionally, 5G drones and 5G communication vehicles are also used to assist in security. The security visualization system at high, medium and low levels developed using the surveillance system on the cloud enables whole-process 5G visualization security in major events. So far, it has been used in two national conferences, the National Rural Improvement Conference in Jingning, Lishui, and the worship of Emperor Jinyun in Lishui. This project is the first in Zhejiang Province to be promoted for security in major events. In the field of firefighting, a 5G private network has been established for smart firefighting. With the support of the 5G network for fast backhaul, data are collected in the front end in real time and sent back to the back end for real-time analysis, intelligent early warning, and remote control. In this way, a smart firefighting platform is developed in Liandu District to effectively improve the capabilities for emergency rescue and fire prevention in high-rise residential buildings, reduce fire hazards, and protect the safety of people's lives and properties.