China’s Geospatial information industry fights against COVID-19

By Prosper Washaya & Minyi Li, Deqing iSpatial Co., Ltd (a subsidiary of Beijing iSpatial Co., Ltd, FIG Corporate Member)

The world is fighting to contain the COVID-19 epidemic, caused by the SARS-CoV-2 virus and people are becoming more and more anxious as the virus hits over 70 countries with numbers of confirmed cases of infected people on the rise. The World Health Organization (WHO) has emphasized on the need for countries to “strengthen preparedness for all possible scenarios and ensure early containment measures.”

In China, however, the number of confirmed cases has been on decline. WHO has praised “China’s aggressive efforts to wrest the epidemic under control” attributing this to the efforts that are being made by the government, institutions and residents.

As the majority of the population in China are staying indoors and taking preventative measures to help prevent the spread of the virus, front line workers, doctors, nurses, law enforcement etc., are risking their lives by exposing themselves to potential infection.

At the same time, people from other professions are doing their part; construction workers worked around the clock to build Wuhan's 2500-bed makeshift hospitals in record time to admit patients being treated for the virus.

China’s Secretary General Xi Jinping has said that the fast spreading crisis is “a major test for China” and encouraged people to work together to prevent and control the epidemic. The crisis has indeed proved to be a major test for what China’s technology can do.

As global technology leaders, major Chinese corporations like Alibaba, Tencent, and Huawei have harnessed the power of technology by using high-tech equipment like Drones, Disinfecting robots, high tech thermometers and Smart City Technologies.

Smart City technologies such as Geographic information systems, Big Data, Artificial Intelligence and Internet of Things (IoT), have played an essential role in the prevention and control of COVID-19.

A smart city is a concept that uses technology to improve governance, planning, management, and livability of a city by gathering real-world, real-time data.

According to Academician Li Deren from Wuhan University, smart city technologies are crucial in the fight against the virus. The ability for institutions to collect, store and analyze spatial information is vital if the prevention and control of the COVD-19 is to be achieved.

In Zhejiang Province, in a geographic information industry park that was started from scratch about ten years ago, and where the Inaugural United Nations Geographic Information Congress was successfully held in 2018, companies and institutions are currently implementing the smart city concept to fight the virus.

Through the Smart City concept, geographic information companies and institutions in China, working together with the public, are making efforts to ensure the defeat of the virus through Mapping, Navigation, Location-Based Service, and Remote Sensing. Government departments and professional institutions have used this to provide services such as epidemic monitoring and analysis and early warning, population migration analysis, material security etc.

Mapping, Location Based Services (LBS) and positioning

During the crisis, mapping data associated with the epidemic has been crucial, not only for institutions and decision makers, but also for the general public. Maps showing locations of confirmed COVD-19 cases are helping people understand the scale of the epidemic in their locations.

Here are some efforts that have been made by using mapping tools:

- In February, Baidu maps introduced an “epidemic map" feature for its Baidu Map app, which shows suspected and confirmed corona virus cases in real time. Baidu’s “epidemic map” feature also shows epidemic control measures, risk levels and latest news on travel situations.

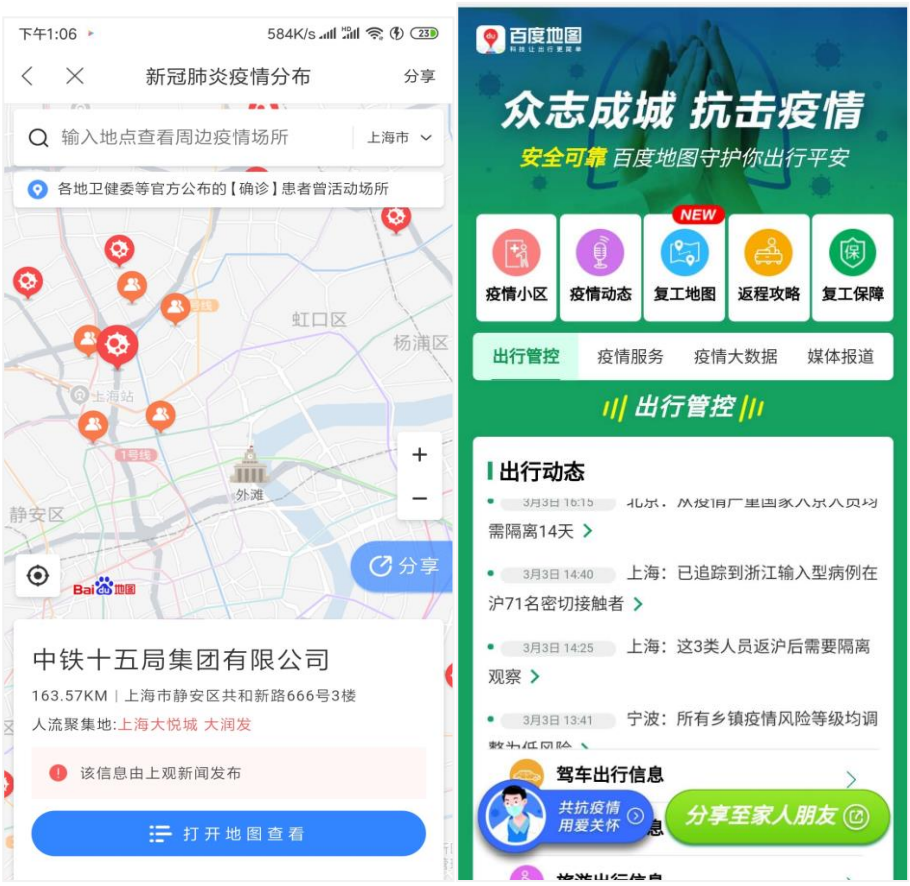

Fig. 1 Baidu maps “epidemic map” showing Corona virus cases in real Time

- The National Basic Geographic Information Center, together with Skymap, developed a COVID-19 thematic map providing national epidemic information, through interactive statistical charts, visual maps and statistical charts together with a dynamic timeline of changes of the situation.

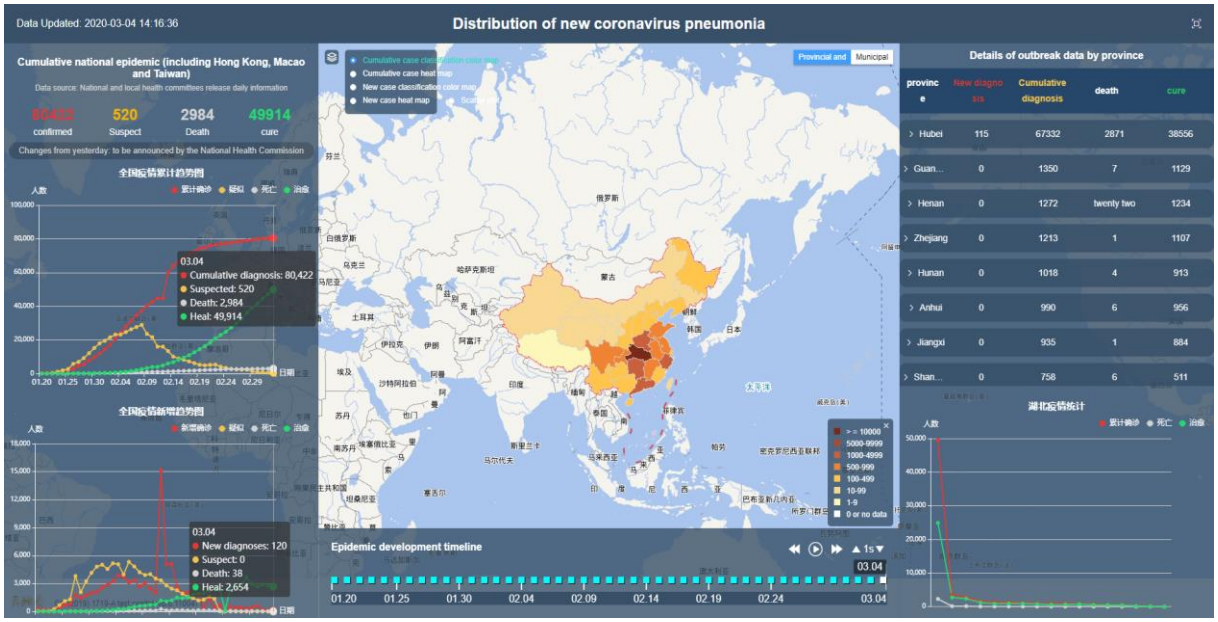

Fig. 2 COVID-19 thematic map developed by Skymap and the National Basic Geographic Information Center

Cross-infections are major risk to, not only frontline workers, but also members of the public. Therefore, geo-information technology companies are using location-based services to minimize the movement of workers collecting information relevant to combating the virus.

Some companies have combined mapping with Location Based Services to help reduce some of these setbacks:

- Zhejiang Baijia Information Technology Co., Ltd adopted Location Based Services through WEBGIS, cloud storage, mobile Internet in the fight against the spread of COVID-19.According to the general manager of the company "The platform system has enabled interconnection and sharing of information between command agencies, emergency response forces and relevant disease control departments."

Fig. 3 Zhejiang Baijia Information COVID-19 Webmap platform

- China TOPRS Technology Co. Ltd, recently developed a mini-program based on GIS mapping and positioning technology. Mini-programs are lightweight apps that run inside another app and don't need to be downloaded or uploaded through an Appstore. The company's mini-program is meant for employees to report daily basic information such as their current location, physical condition of them and their family, their residential address during the Chinese New Year, and their travel activities in the past 15 days. According to the branch general manager, Liao Ming, this information can be accessed and viewed by the employer in real time. Liao Ming added that the software is set to expand nationally.

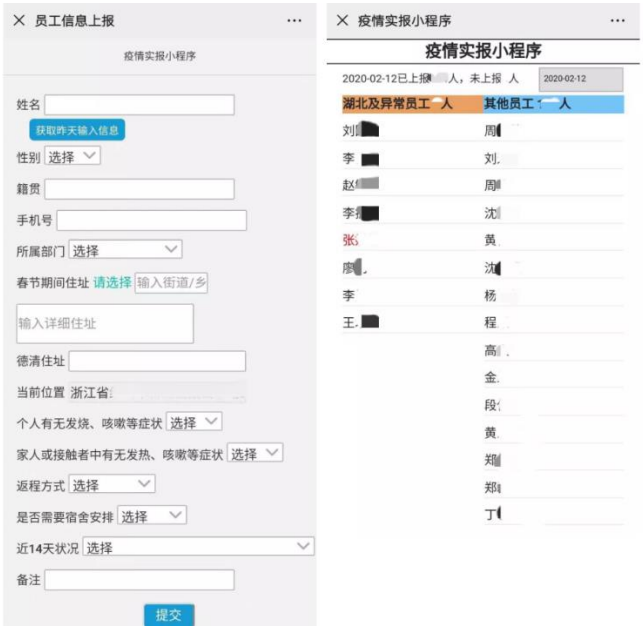

Fig. 4 Interface of China TOPRS Technology Co. Ltd mini program for employee information

- Shenzhen Center for Disease Control and Prevention and Yizhirui Guangzhou Branch developed a GIS based system that is responsible for dynamically displaying and updating if information about the epidemic in Shenzhen. Other cities and provinces in China have also adopted similar systems.

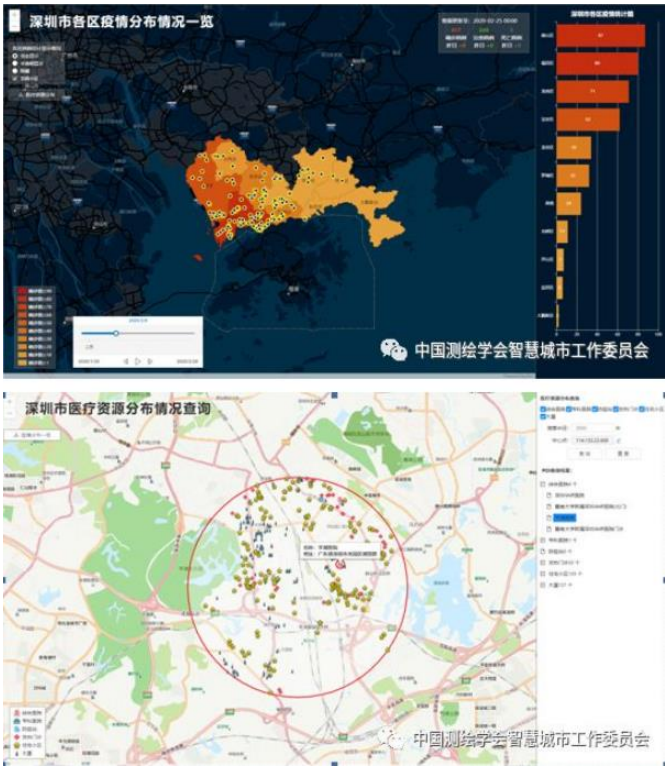

Fig. 5 Shenzhen Center for Disease Control and Prevention's GIS base system to display information about the virus

- Cangqiong Digital launched an Epidemic Prevention Management Information System combining Geoinformation Technologies and IoTs. The system has since been linked to Huairou District's management system in Beijing.
- E-commerce giant Alibaba through its Alipay services, introduced the Alipay Health Code. The Alipay health code system is being adopted nationally and assisting authorities to allow people to engage in day to day activities without risking the spread of the virus.

Fig. 6 Alipay's Health Code system showing Grenn and Red Codes respectively

- Qianxun Location Network (Zhejiang) Co., Ltd. provided Beidou high-precision positioning technology for Wuhan Vulcan Mountain Hospital construction project, greatly improving the efficiency of line measurement, and helped the Vulcan Mountain Hospital's early completion.

Artificial Intelligence and Big Data

In the information age, Big data and Artificial intelligence have become ever the more important in situations similar to the current COVID-19 outbreak. Here some institutions and companies at the forefront of applying these technologies in the battle against the virus:

- Qianxun Location Network (Zhejiang) Co., Ltd. combined geographic information, the Internet of Things and Big data to adopt a warning alarm system. The system alerts officials when a quarantined individual steps out of the quarantine zone.
- Zhejiang Zhongdao Beidou Navigation Technology Co., Ltd is using geographic information, AI and IOT to measure temperature of residents at building complex entrances by installing sensors such as infrared cameras making it possible to take daily temperature readings for residents going in and out of premises.
- Deqing Xidian Smart Technology Co., Ltd has adopted facial recognition and verificationtechnologies through Big Data and Artificial Intelligence technology. This has eased the work load for workers collecting information by reducing the need for manual work.

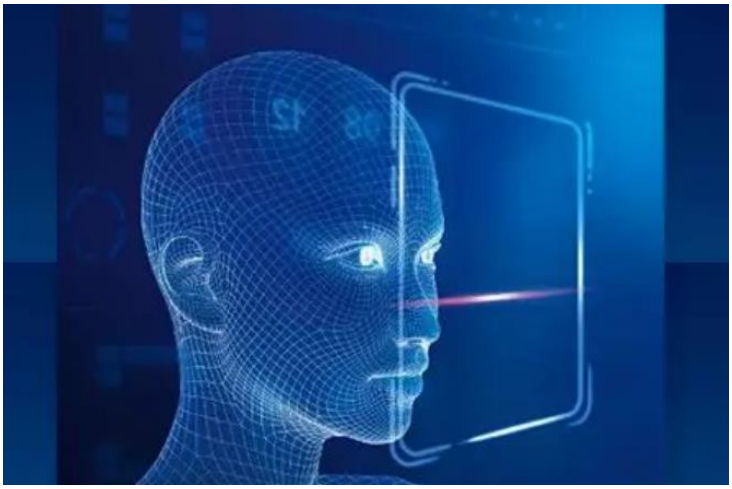

Fig. 7 Deqing Xidian Smart technology is using facial recognition technology

- Deqing iSpatial Co., Ltd (a subsidiary of Beijing iSpatial Co., Ltd, FIG Corporate Member) developed the Information Management System for people in public places. The system was originally developed for tourism experience by allowing people to add their personal information using NFC technology and their ID cards to view tourist places. Now it has been upgraded to help fight the epidemic by collecting Big Data and tracking people's movements. The system is installed in public places like shopping malls, supermarkets, stations, cinemas, attractions, financial institutions and other public places with large population mobility this has greatly reduced the work load for community volunteers working during the outbreak and avoid cross-infections. The system will be upgraded and perform more functions in the post-epidemic period.

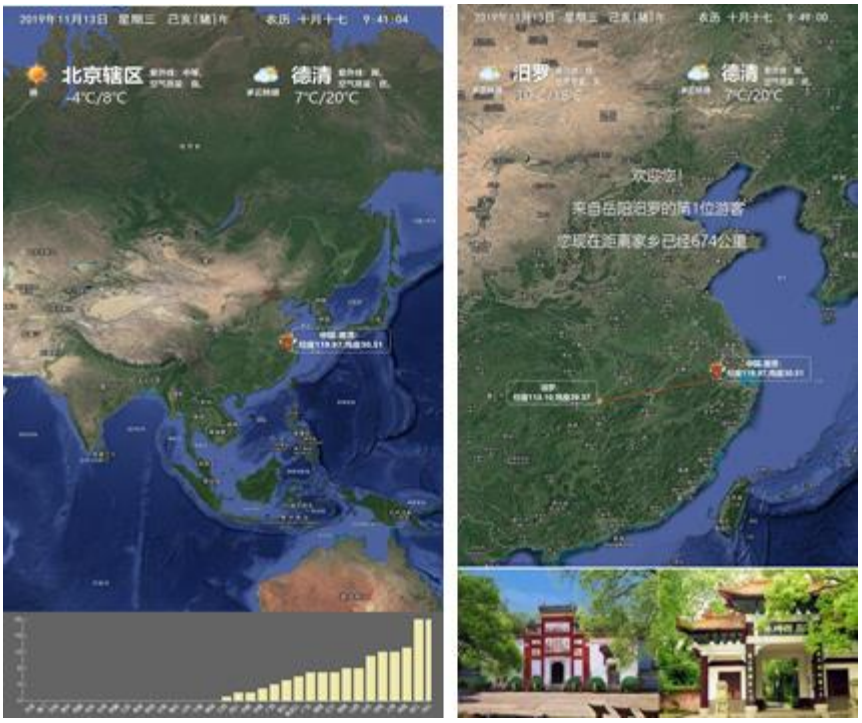

Fig. 8 iSpatial's Information Management System interface

Remote sensing

Remote sensing has proved to be an important tool in the current fight against the virus. Remote sensing is a component of Geoinformation technologies that involves obtaining information about the dynamics of the earth using ground based, airborne and spaceborne platforms, for example, cars, drones and satellites.

Some companies and institutions in China have adopted remote sensing in monitoring the six-day construction of the Huoshenshan and Leishenshan Hospitals in Wuhan:

- The Gaofen-2 satellite was used to monitor the construction of Huoshenshan hospital using multispectral imagery. Changguang used the Jilin-2 multispectral Satellite for the same purpose.
- Zhuhai Orbita used the Zhuhai-1 hyperspectral Satellite imagery to analyze the water environment around Leishenshan Hospital
- Changguang used Night-time remote Sensing from the Jilin-1 satellite to confirm the construction of the Huoshenshan and Leishenshan Hospitals in Wuhan.

Fig. 9 Goafen-2 and Jilin-1 multisperctral satellite images showing the construction site of the Houshenshan hospital before and after construction.

Drone Technology

During the epidemic prevention and control campaign, drones have become irreplaceable weapons and are playing a crucial role in the fight through geographic mapping, logistics for distribution of vital goods like food, face masks, medication etc., disinfecting communities, and information publicity.

Companies such as Tencent, JD.com, ZhongtuXintu, China AOPA, China Civil Aviation Emergency Rescue Alliance, Shenzhen Keweitai, Chaotu Group, Tianjin Wanmao, Hebei Tianhai Surveying and Mapping, Xi'an Geodetic Surveying and Mapping, etc, are members of China Geographic Information Industry Association's drone application and management

committee and are currently taking advantage of drone technology in the fight against COVID-19.

China's geographic information industry association, states that as of February 12, 285 teams and more than 2,000 agricultural drones have participated in “disinfection operations”, and disinfection of a total of 677 million square meters been completed in 14,903 villages and communities in 20 provinces across the country.

Other Institutions and companies have utilized drone technologies in the fight against the virus in different ways:

- XAG Co., Ltd. (one of the world's leading UAS (Unmanned Aerial System) R&D manufacturers and a smart agriculture solution provider) is using agricultural drones for epidemic prevention and disinfecting purposes. According to experts, a drone can spray and disinfect at least 1,800 acres of streets, communities, and farms every day, and the efficiency is more than 50 times that of manual spraying.

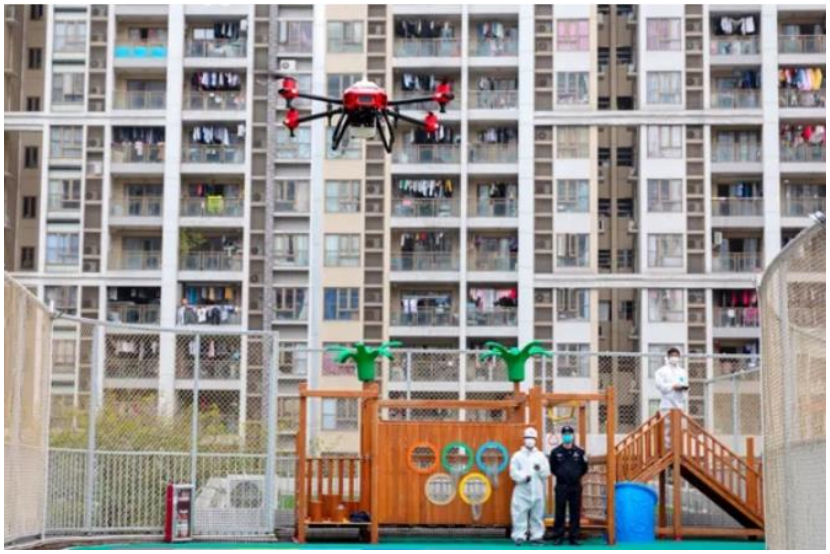

Fig. 10 Drone disinfecting a neighborhood. Source: Economic Daily

- DJI Agriculture are using drones for information dissemination by using loud speakers attached on the drones to communicate information to the public. The company equipped the Jingwei M210 drone with a self-developed MP130 high-power megaphone through the Payload SDK, with a volume as high as 130 decibels, enabling passengers 300 meters away to clearly hear the broadcast content.

Fig. 11 Drone disinfecting a neighborhood. Source: Economic Daily

- In Hangzhou, Xunyi Network Technology Co., Ltd., is focused on the transportation of medical supplies to hospitals. It has been found that this has decrease delivery time in half.
- Zhejiang Zhongzhihuiyun Information Technology Co. Ltd is using unmanned aerial vehicle high-definition videos to conduct a large-scale patrol of Deqing city. They are also using real-time image recognition to, accurately monitor and display the number of people in specific locations. Mr Li Peihong, the general manager of Zhongzhihuiyun, says that the technology has helped people working on the front-line by reducing the need for manpower, and thus reducing the risk of infection.

Fig. 12 Zhongzhihuiyun team carrying out monitoring flights around Deqing City

GIS companies and institutions

Apart from their expertise, GIS companies have also provided a helping hand to those affected by the epidemic. China's Ministry of Natural Resources reported that:

- China Geographic Information Industry Association donated to Hubei and waives annual membership fees in the province and
- Beijing Zeta Cloud Technology Co., Ltd., after learning that Xi'an Public Health Center urgently needed servers, switches and other information-based software and hardware

environments to support the hospital management system, immediately deployed resources to overcome difficulties and provide emergency support.

Organizations outside China

Outside China, Geoinformation Technology companies have also been involved in the epidemic fight. Here are some examples;

- Sentinel-1 imagery from the European Space Agency (ESA) was adopted to perform deformation analysis of the Leishenshan Hospital foundation using INSAR technology.
- Imagery from the French Satellite, Pléiades, was used to monitor work on the construction sites of the hospitals
- The Johns Hopkins University is currently maintaining a website that tracks and maps the epidemic by gathering information from multiple data sources.
- ESRI, a leading organization in the geoinformation industry is providing tutorials on how to responsibly map the SARS-CoV-2

In one word, Geospatial information technology is able to greatly contribute to flight against COVID-19.

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