Case study

China Mobile landslide monitoring and alarm system with IMPACT IoT platform

NOKIA

中国移动
China Mobile

As landslides and other destructive geological events increase in frequency around the world, densely populated areas such as China are at especially high risk. When landslides happen in areas like these, the potential for massive loss of life and extensive property damage is staggering. This makes early warning of these events critical so authorities can take action to protect people and property.

Nokia partnered with China Mobile to develop a landslide monitoring and alarm system (LMAS) built on Nokia's IMPACT IoT platform. This system enables the BGIGC Group, a Chinese highway operations management company, to detect and respond more effectively to landslides along their roadways.

Business benefits

For CSPs

Flexible, easy deployment of landslide monitoring solution across large areas

Minimal maintenance requirements

Ultra-low power consumption

For infrastructure operators

Accurate, reliable, cost-effective landslide detection

Early warning of events in time to take action

Saving lives with faster, more accurate landslide detection

The vision

CMCC Guangxi, a subsidiary of China Mobile, is the leading communication service provider (CSP) in China's Guangxi Zhuang Autonomous Region. Among its more than 30 million customers is the BGIGC Group, a state-owned enterprise that manages and operates trade and transportation infrastructure, including more than 500 km of expressway.

Studies have shown that nearly 20% of China's land area, including hundreds of cities and thousands of villages, is at risk from landslides or other geological disasters. Several kinds of landslide monitoring systems are being used today, but they all have drawbacks that make it difficult to effectively detect events and provide early warning:

- **Precision leveling** uses highly precise physical instruments to measure soil behavior, including vertical/horizontal displacement. While it's one of the easiest methods to implement and provides accurate results, adverse weather conditions and harsh terrain can limit its effectiveness.
- **Close-range photogrammetry** calculates displacement based on inputs from strategically placed cameras. It does not require onsite monitoring and can continue to record even in unstable conditions, but its accuracy is low, especially during poor weather.
- Solutions based on **global navigation satellite system (GNSS)** data are not affected by the weather. However, they are dependent on satellite signals, which can be blocked in the mountainous regions where they're most critical.
- **Time domain reflectometry** measures displacement based on deformation of electronic cables buried in monitoring holes. While this method comes with a low cost and delivers information rapidly, it can't determine the direction of the displacement — and can completely miss the signs of landslides if the cables themselves are not disturbed.

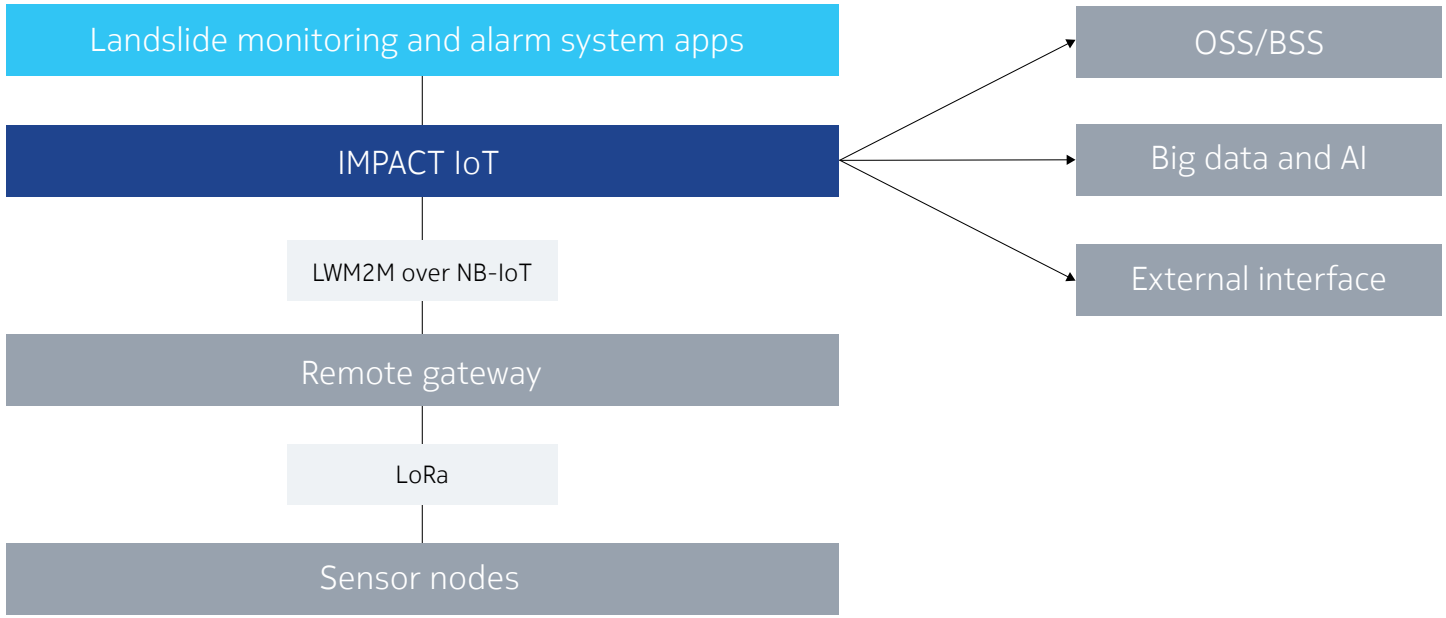
All these solutions also require specialized technology that can be challenging and expensive to install, power and maintain. To help the BGIGC Group prevent property damage and save lives, China Mobile needed to deliver an IoT-based landslide monitoring and alarm system (LMAS) that could accurately and cost-effectively detect landslides and provide alerts in a timely manner.

China Mobile is delivering an IoT-based LMAS that accurately and cost-effectively detects landslides and provides alerts in a timely manner.

How Nokia helped

In 2019, Nokia and China Mobile deployed an LMAS solution built on the **Nokia IMPACT IoT platform** along a vulnerable stretch of highway in Guangxi province. The solution includes high-precision sensor nodes that measure 3D tilt angle, vibration and shock data. These nodes are connected by a wireless network that delivers exceptional reliability even in complex outdoor environments. The data acquired by the sensors is fed into an edge computing system, which provides local management and real-time data analysis of the sensor data over the cloud to accurately detect landslides and predict their paths. If a landslide is detected, the system sends alerts to BGIGC Group highway operations staff, who can then close the affected parts of the highway to keep drivers safe.

A key benefit of the solution is that the sensors can be quickly integrated into both the Nokia IMPACT IoT platform and China Mobile's OneNET platform. As a result, China Mobile benefits from greater flexibility in deployment options and can quickly cover very large areas. The sensors also require very little maintenance after they've been deployed, and their ultra-low power consumption means they can run long-term on battery power alone.



The results

Based on the success of the initial deployment in Guangxi province, China Mobile has since expanded the LMAS into additional provinces across the country. The company now has 11 sites in Guangxi and two in Zhejiang. The solution has also been deployed by another Chinese CSP in Hunan and Fujian provinces — and there are plans to expand even further, including setting up sensors along a new expressway project in Hunan set to launch by the end of 2021.

Since deployment in 2019, the project has shown great results. As of October 2021, it has **successfully detected and identified two landslide events**: one in Hunan and one in Guangxi. Thanks to the early warnings delivered by the LMAS, BGIGC Group staff were able to shut down the highways and avoid any loss of life.

In addition, by implementing its LMAS on the Nokia IMPACT IoT platform, China Mobile has been able to deliver a solution that consumes very little power and requires minimal on-site maintenance, making the total cost of ownership much lower than other landslide monitoring options.

The Nokia/China Mobile LMAS project was honored with a 2019 Innovation Award from China's Ministry of Transportation Safety Committee and was listed as one of the committee's 30 excellent recommendation cases for 2019.

“Immediately upon deployment, the Nokia IMPACT IoT solution demonstrated the value it can deliver. We are highly committed to using 5G technology to enhance expressway safety for all road users, and this project is a major step forward in that goal.”

Yang Jirong, Enterprise Applications Expert
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