

Innovative Edge Computing Technology for Autonomous Monitoring Systems

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SUMMARY

The need for permanent 24/7 monitoring has been rapidly growing in the last decade. Be it in developing urban areas, open pit mines or areas with possible natural hazards, today, more than ever, safety comes first. Deformation monitoring provides information about movements and allows immediate informed decisions based on data.

Every automatic monitoring system consists of four components: (1) monitoring sensors (e.g. total stations), which are measuring with defined intervals; (2) power supply (e.g. mains electricity), which constantly provides power to on-site equipment; (3) communication device (e.g. router), which enables instant data transfer between the field and the office; (4) monitoring software, which processes the measured data and provides near real-time information about the movements.

The biggest threat to permanent monitoring systems is missing data or data losses. This means if any of the system's components malfunction, data would not be gathered and there would be no information about the monitored object during the downtime, which can pose a severe safety threat. The most frequent causes of data loss are communication or power failure, data server failure and environmental effect on the measurements. Therefore, to ensure the utmost reliability of the monitoring system, the field components, especially sensors and communication, must operate intelligently and autonomously, and retain the biggest possible resilience to all threats.

This paper will present how the latest technological advancements in Leica Geosystems' monitoring solution ensure continuous and uninterrupted dataflow. The new Leica Nova TM60 is a self-learning monitoring total station using the ATRplus technology, that can adapt to environmental conditions and measure targets up to 3,000 m away. It is a total station specifically built for 24/7 monitoring purpose. Due to its robustness, it also has the longest maintenance

intervals, thus providing longest continuous operation in the field. The TM60 is controlled by Leica GeoMoS Edge, the new monitoring software component embedded on communication devices in the field. The functionality of GeoMoS Edge is to perform the configured measurement cycle, compute the raw measurement data quality and, based on it, trigger the repeated measurements and finally, to deliver the measured data to the monitoring office software – Leica GeoMoS Monitor. Data transfer is realised by using the EdgeConnect technology, powered by Xalt, which enables secure cloud IoT connectivity between the field and the office. In case of communication failure, data acquisition will persist autonomously, based on the last available configuration and measurements will be stored locally until the communication with the server (GeoMoS Monitor) is restored. This means that data gaps due to communication failure are eliminated.

Robustness and resilience of the highest quality monitoring solutions lay in reliable edge computing technology. Monitoring sensors and software must cooperate and be able to adapt to any change in the environment to achieve the ultimate goal of preventing data loss. Only when data is available, the safety of the monitored object can be ascertained.