Development of IoT Modules to Monitor Rural Roads

Status: Available

Group Members:

Sponsor(s):   Intelligent Sensing Laboratory and SFU's Centre for Natural Hazards Research

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<u>Project Description</u>

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Rockfalls pose serious hazards when the communities and industries that use rural roads. With increasing variations in precipitation and temperatures, rocky slopes in mountainous regions have become less stable, increasing the frequency of such events. Presently, the locations most prone to these hazards are predetermined through modelling and simulations. In most cases, however, the rockfall incidents are reported by field observations of the users or inspectors after the fact.

This project aims to develop sensor modules that:

- x Can detect a significant rockfall incident with a long detection range: This requires the inclusion of proper sensors (such as geophones, infrasound signals, or microphones) to pick up rockfall signals and the use of machine learning algorithms to identify the source of the signal (e.g., rockfall versus passerby) and potentially, its location.
- x Is low-power or self-powered: The system is to be installed in remote areas where frequent battery changes are not possible. Ideally, the module needs to operate autonomously using a local energy source (e.g., a small solar cell). If battery-powered, it should be able to operate for 3-6 months in outdoor conditions without a need for battery replacement.
- x Can send incident reports to authorities: Once a rockfall incident is detected, authorities need to be notified. The module should be equipped with a low-power radio module (e.g., based on LoRa) for module-to-module communications until the data can be handed over to an existing communication network.

The team will have access to the test and development tools within the Intelligent Sensing Lab as well as tools and expertise within the Centre for Natural Hazards Research. By the end of the project, we plan to have installed a network of such sensors at test sites within the lower mainland.

Desired skill sets
- • Experience with embedded systems development

- Understanding of analog and digital signal processing
- Design of circuits and printed circuit boards
- Microcontroller programming

Primary deliverables
- Sensor module (sensors + electronics)
- Fully documented codes for the signal acquisition, detection, and transmission
- Full project documentation, including design, assembly, calibration, and test steps