Boreal Ecosystem Recovery & Assessment
An NSERC Collaborative Research & Development Program

SENSOR NETWORK TEAM FALL 2017: *AN OGC OPEN STANDARD-BASED INTERNET OF THINGS PROTOTYPE FOR VEGETATION RECOVERY MONITORING*

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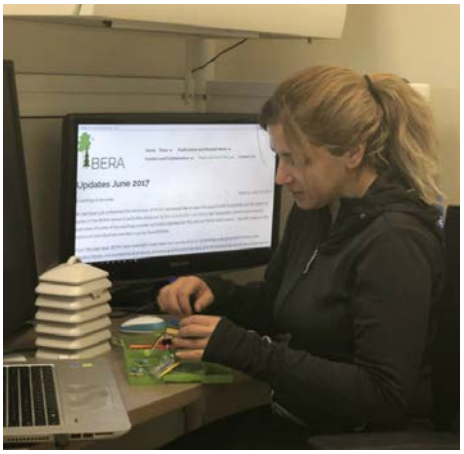

Project summary
The boreal forest ecosystem of Alberta is increasingly affected by the human footprint related to natural-resource extraction, pipelines, roads and seismic lines. To evaluate the efficiency of restoration treatments, this project aims at the monitoring of physical conditions and human/wildlife presence on a recovered seismic lines ecosystem. For environmental monitoring, an Internet of Things (IoTs) prototype system is developed using low-cost ground sensors. One of the major challenge in IoT is the interoperability as different manufacturers follow heterogeneous proprietary protocols to communicate with each other. This research demonstrates that OGC SensorThings standard and Application Programming Interface (API) significantly improves the interoperability between sensors, networks and data. It also simplifies and accelerates the development of a sensor network, to collect large and accurate datasets while vastly decreasing the time and cost of gathering such data. Another important issues tackling IoT systems which survive in a harsh deployment environment are the power and data transmission efficiency. Therefore, we used the solar power to help recharging the batteries and Low Power Wide Area Network (LoRaWAN) to stablish a low power and stable network over a wide area.

Progress to date
IoT devises were developed based on these four components: sensor device, communication network, cloud server and application user interface. Eleven IoT devices (with temperature, humidity, and pressure sensors) were deployed in three boreal forest regions of northern Alberta in 2016 for one week. The devices were able to upload sensor data to the OGC SensorThings API cloud server via 2.5G mobile networks and the preliminary results showed that the prototypes can survive in a severe development environment. Moreover, users can access, analyse and visualize data from any sensor at any time. In the next phase, accelerometer, ultrasonic ranger, and passive infrared motion sensors were deployed in Calgary to test the hardware units, communication reliability, algorithms, and requirements. Based on the promising results, we are going to deploy IoT devices in the Boreal forest area in spring 2018 to evaluate the physical condition and human/animal presence in different situations (e.g. summer, winter, various location and orientation).

Management implications
The IoT platform provides online access to the physical condition of boreal ecosystem for the stakeholders, managers and public policy makers to make informed management decisions. This information can be used in an active management system to visualize various sensor data on a map, compare them from different locations (seismic lines or deep forest areas), and provide relevant analysis to maintain forest recovery and health.

Geographic location
Currently Calgary City