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

INTERNET OF THINGS TEAM FALL 2018: *OPEN STANDARD IOT PROTOTYPE FOR VEGETATION RECOVERY MONITORING*

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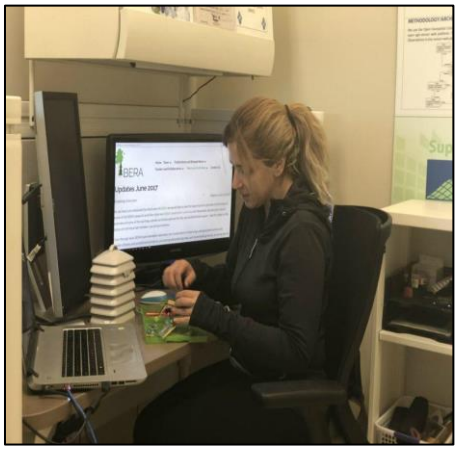

Project summary

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. In this project, different Internet of Things (IoT) prototypes are developed using low-cost ground sensors. This research significantly contributes to improving the interoperability between sensors, networks and data streams using OGC SensorThings standard. 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 issue tackling IoT systems which survive in a harsh deployment environment is the power and data transmission efficiency. Therefore, we used the solar power to help to recharge the batteries and Low Power Wide Area Network (LoRaWAN) to establish a low power and stable network over a wide area.

Progress to date

In the first year, 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 in a severe development environment. For the second year, the cloud data management, user access, basic data operation, and visualization was investigated at any time. Then, accelerometer, ultrasonic ranger, and passive infrared motion sensors were deployed in Calgary to test the hardware units and communication reliability for monitoring human/animal footprint. In the third year, we basically focused on the requirements for spatiotemporal pattern mining and finding suitable algorithms for physical condition and human/animal presence monitoring. Also, we are going to deploy IoT devices using LoRaWAN in different situations (e.g. summer, winter, various location, and orientation), implement and evaluate appropriate spatiotemporal analytics to classify the data, find useful patterns and detects anomalies.

Management implications

Establishing a useful active management system to include field data collection, essential analytics and visualization is an important management implication in making informed decisions for managers, analysts, stakeholders, and public policymakers. The IoT platform provides an online access to the physical condition of the boreal ecosystem at any time and anywhere. 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), detect similar patterns, plan different scenarios and provide relevant analytics to maintain forest recovery and health.

Geographic location

The field location of this research will take place in Kananaskis Barrier Lake Field Station which is located in the Kananaskis Valley, 80 kilometers west of Calgary.