NSERC SMART MICROGRID NETWORK

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Project 3.3

Distribution Automation: Sensors and Condition Monitoring

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Framework

- Develop technology-agnostic topology for intelligent sensor networks for micro-grid applications – initial focus -> electric substations.

- Assess **cost-effective** technologies for intelligent sensor networks.

- Develop a real-time operating system (RTOS) to support the sensor network stack and enable access through the micro-grid communications network.

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Progress highlights achieved to date

- XBee series 2 transceivers (ZigBee compliant) have been tested. **Strengths:** open specification, low cost, low power consumption, 100 m range and OTA configuration.

- Cost-effective design has been completed and built around the ember EM357 ZigBee compliant System-on-Chip platform. Software has been developed for data acquisition from:
  - Current transformers
  - Atmospheric sensors (temperature, humidity, pressure)
  - Accelerometer for measuring shock
  - Occupancy Sensors

- Initial XBee testing against noise jammers in a controlled lab environment. Plus Matlab simulations to augment lab testing.

Milestones

Previous Year

- Literature Review
- Selection of a sensor platform and the initial architecture has been completed
- Software development for sensor data acquisition
- Initial ZigBee hardware testing
- Initial ZigBee physical layer simulation and noise assessment

This Year

- Implementation of a prototype sensor node
- Further testing of the ZigBee hardware and its resilience to partial discharge events (i.e. impulse noise) and development of sensor web for noise profiles
- Deployment of sensor nodes in an outdoor environment and perform a reliability assessment
- Begin RTOS development
- Development of intelligent algorithms for data acquisition and power savings
- Initial work on GOOSE VVO/CVR project 3.4 and ground fault detection project 1.3

Milestones

The Next Year

- Completion of the network stack and RTOS
- Deployment of sensor nodes in an actual electric substation for data collection.
- Initial integration of sensor network through access protocols (project 3.2) and data transmission over communications infrastructure (project 3.1)
- Design of nodes to satisfy project 3.4 and 1.3 requirements

The Final Year

- Refinement of node design based on empirical measurements on performance and reliability
- Assessing noise profiles collected from electric substations.
- Deployment of sensors for GOOSE VVO/CVR and ground fault projects.
- Demonstration project: electric substations, VVO/CVR, and ground fault data collection from sensor networks through access point via protocols (project 3.2) over communications layer (project 3.1) for data analysis (project 3.4)

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Partnerships with Canadian industry

- NB Power
- Saint John Energy

Links to other Projects:

- Project 3.1 Universal Communications Infrastructure
- Project 3.2 Protocols, Integration, Standards
- Project 3.4 Data management and VVO/CVR project
- Project 1.3 Status monitoring
- Also a liaison has begun with the WiSense team of the University of Ottawa. Collaborations may be possible.

Gaps and Challenges

- Access to real environments, safety issues. Need utility access.
- Continued focus on network collaborations

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Thank You

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Questions?

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