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Title: IoGET: Internet of Geophysical and Environmental Things

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IoGET: Internet of Geophysical and Environmental Things

Towards a low-cost, energy-efficient, and near real-time monitoring of earth and environmental processes

BACKGROUND & MOTIVATION

Current monitoring status:

- Manual, expensive, and
- High-power requirements



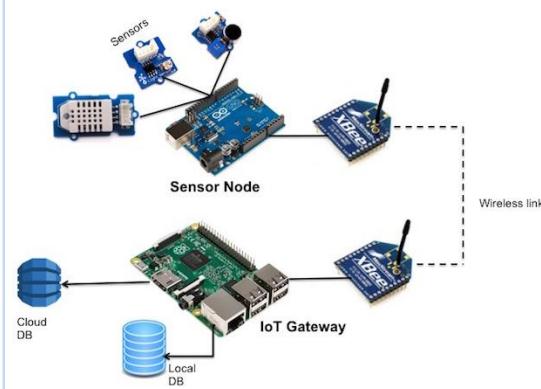
Messy/Manual data collection



Expert data analysis

INNOVATION

Automated and Smart Monitoring



- Improved monitoring with low-cost equipment
- High resolution of coverage areas
- Improved characterization based on fusing multiple data streams

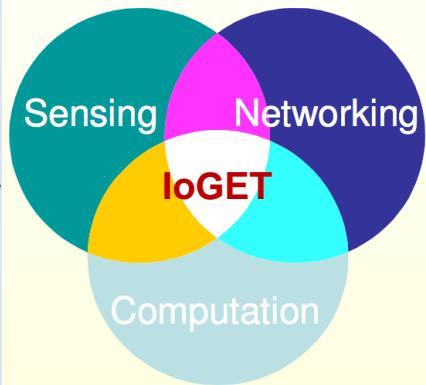
TRL 2: New and fast computing methods for real-time data analysis at sensor node are developed and proof-of-concept is demonstrated

DESCRIPTION

Novel and fast reduced-order models for onboard computation at sensor nodes for real-time analysis

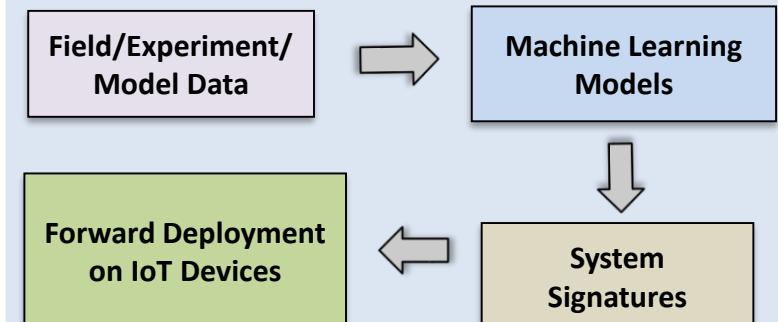
Approach (Computation Part):

- Perform high-fidelity numerical simulations
- Construct simple reduced-order models (ROMs) using machine learning and signal processing algorithms
- ROMs and compressive sensing at sensor nodes (Raspberry Pi, Arduino, etc) for real-time data analysis



Preliminary Computational Analytics (High-Fidelity Simulations):

- Regression Tests using LANL HPC simulator PFLOTRAN
- Laptop (16GB RAM, i7-dual core, 3.1GHz): Time taken 3 to 5 sec
- Raspberry Pi (1GB RAM, quad-core ARMv8, 1.2GHz): Time taken 35 to 40 sec



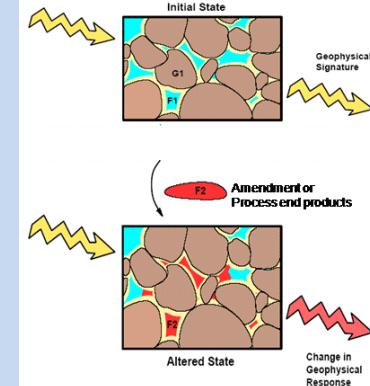
Current Progress and Path Forward:

- Testing and validating the machine learning models based on experimental data from MPA-11 collaborators.

TRL 2: New and fast computing methods for real-time data analysis at sensor node are developed and proof-of-concept is demonstrated

ANTICIPATED IMPACT

A real-time warning system to prevent and mitigate disasters



- Low-power, low-cost, scalable
- Smart and fast on-board computing
- Very fast risk assessment

PATH FORWARD

Investigations

- Test ROMs and data processing algorithms on Raspberry Pi Sensor node in real-time

Demonstrations

- Extend technology to dynamic sensing applications
- Prototype and develop a smart sensing system for government & commercial use

Potential End Users:

- Oil & Gas, Electrical Power/Grids, Structural Health Monitoring, and Nuclear Industries

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