



CPS:TTP Option: Synergy: Collaborative: Internet of self-powered sensors - Towards a scalable long-term condition-based monitoring and maintenance of civil infrastructure

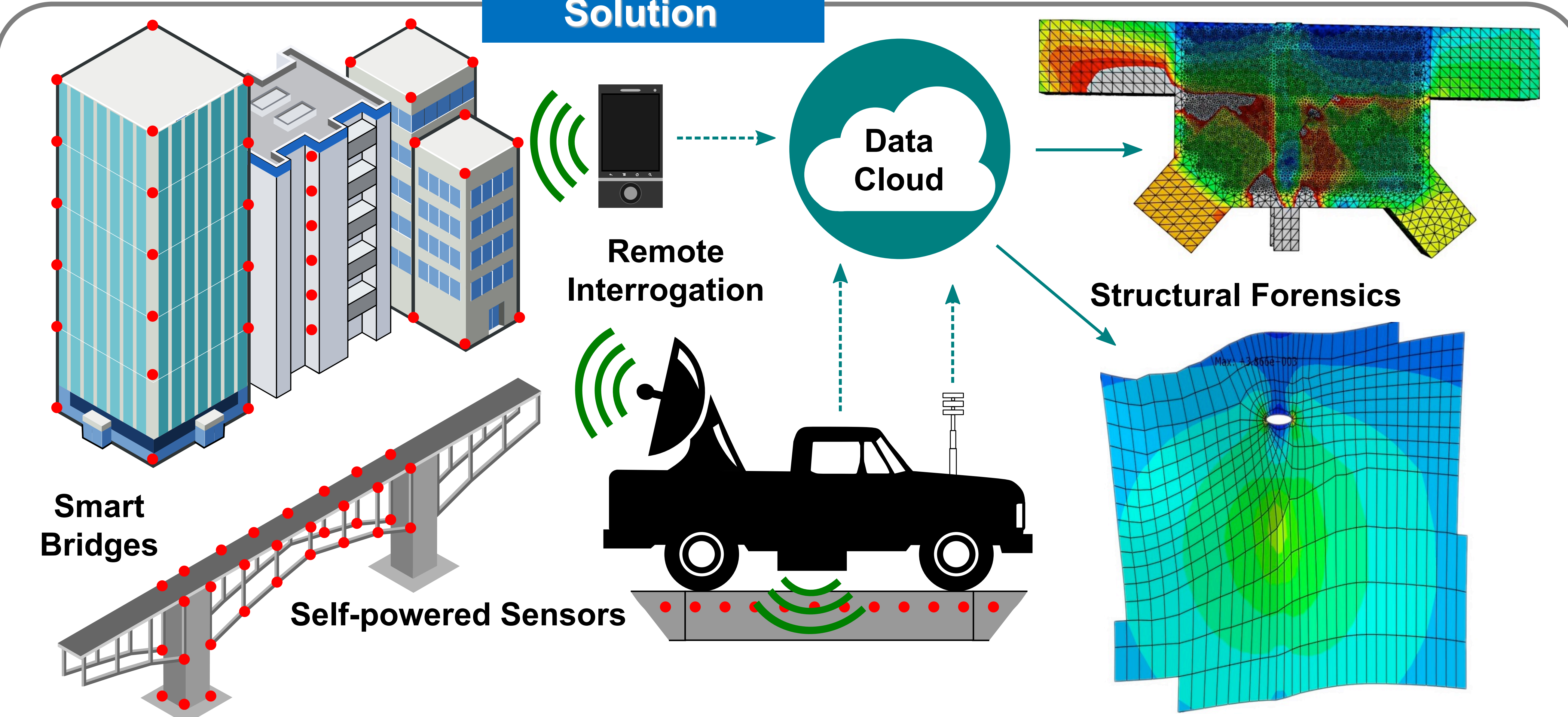


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Challenge

- **Smart civil infrastructure** that can predict any impending failures and in the cases of extreme events diagnose itself.
- **Continuous monitoring using embedded sensors** that do not require any maintenance and can monitor rare events.
- **Actionable intelligence** from sensor data to prioritize structural areas for immediate maintenance.

Solution

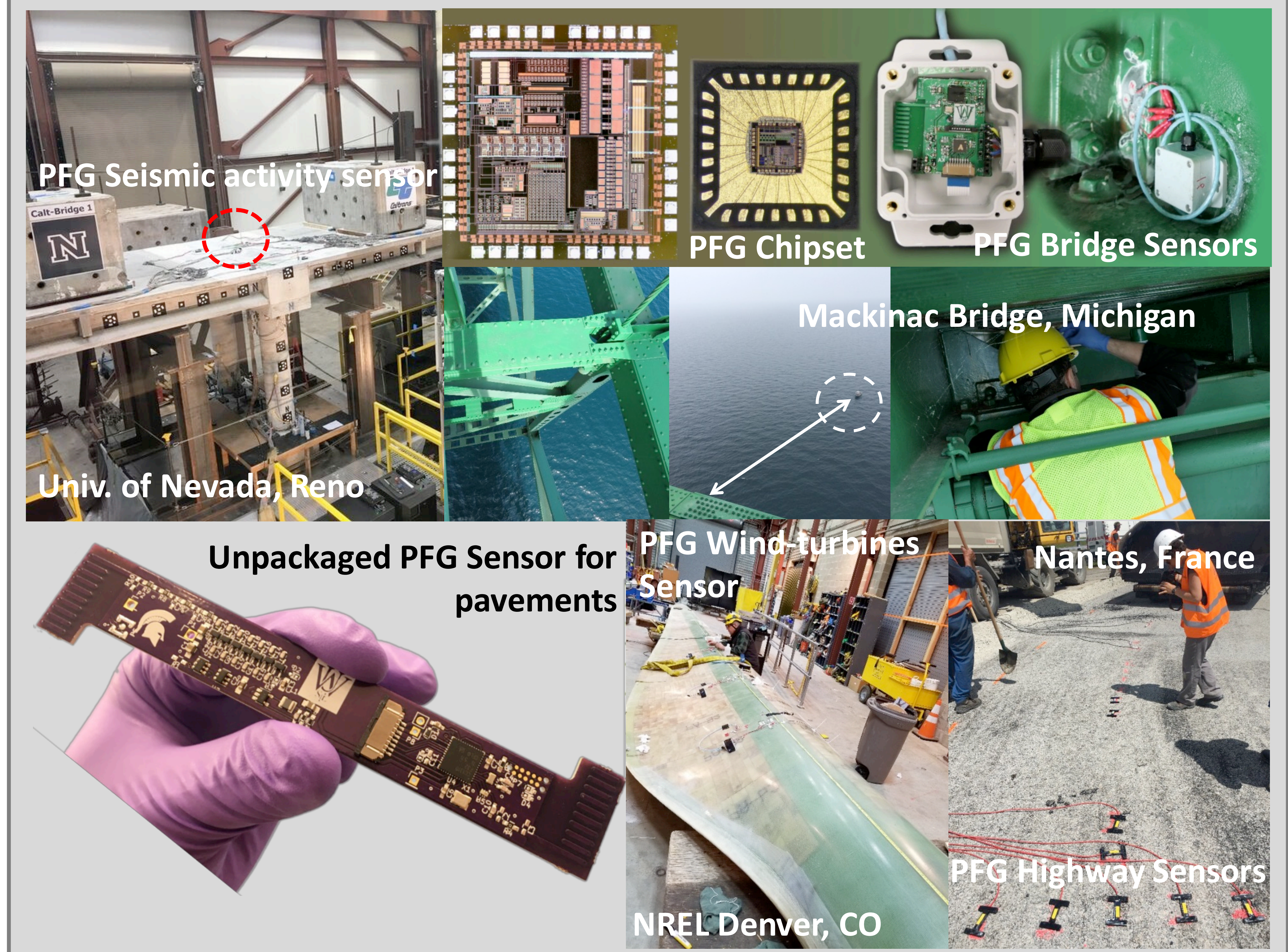


- A framework of infrastructural internet-of-things (i-IoT) using a network of self-powered, embedded health monitoring sensors.
- Novel variants of embedded self-powered piezo-floating-gate (PFG) sensors that provide accurate spatial resolution in structural imaging.
- Low-latency wireless interrogation using a novel variance based logic processor combining energy harvesting, memory, computation and communications on a single platform.
- Novel structural failure prediction and structural forensic algorithms based on historical data collected from self-powered sensors embedded at different spatial locations.

Scientific Impact

- **Multi-physics optimization** of energy scavenging, transduction, rectification and logic computation to improve the system's energy-efficiency and reduce the system latency.
- **Kernel based machine learning algorithms** that combine domain specific structural information with real-world sensor data to identify and localize anomalies signifying onset of failure or vulnerabilities.

Broader Impacts and TTP



- **Condition based maintenance** will lead to a significant reduction in costs for maintaining and upgrading civil infrastructure, like bridges and highways.
- **Post-disaster forensics** (for example earthquakes or hurricanes) of civil structures to quickly isolate vulnerable regions for repair.
- **Cross-disciplinary undergraduate and graduate student projects.** Outreach to stakeholders in the state and federal governments.
- **Deployed sensors:** Mackinac Bridge, Michigan, Earthquake Engineering Laboratory at UNR and Bio-pave European union test facility, NREL Denver CO.