UNC CHARLOTTE
The WILLIAM STATES LEE COLLEGE *of* ENGINEERING

Senior Design Project Description

Company Name	*Framatome*	**Date Submitted**	*Oct/02/2018*
Project Title	*Development of sub-GHz Wireless Sensors for Industrial Environments* **(FRAM_WIRE)**	**Planned Starting Semester**	*Spring 2019*

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills:

Discipline	Number	Discipline	Number
Mechanical	1	Electrical	3
Computer	1	Systems	
Other ( )			

Company and Project Overview:

Framatome has a strong presence in the U.S. nuclear energy market, helping power 36 million American homes. As a reliable partner with a long history of proven performance, we focus on servicing and fueling the U.S. operating nuclear fleet as well as supporting new nuclear builds, and advancing the future of nuclear energy here and abroad. Framatome (formerly AREVA NP) has been serving the nuclear energy industry in the United States since the 1950s. Over time, we have serviced every nuclear energy facility in the United States.

The energy generation sector has substantial interest in the use of low-cost wireless sensor monitors to provide additional visibility into the process and to set the utilities up for data analytics initiatives. The objective for this project will be to develop a proof of concept prototype of a sensor device for utility applications.

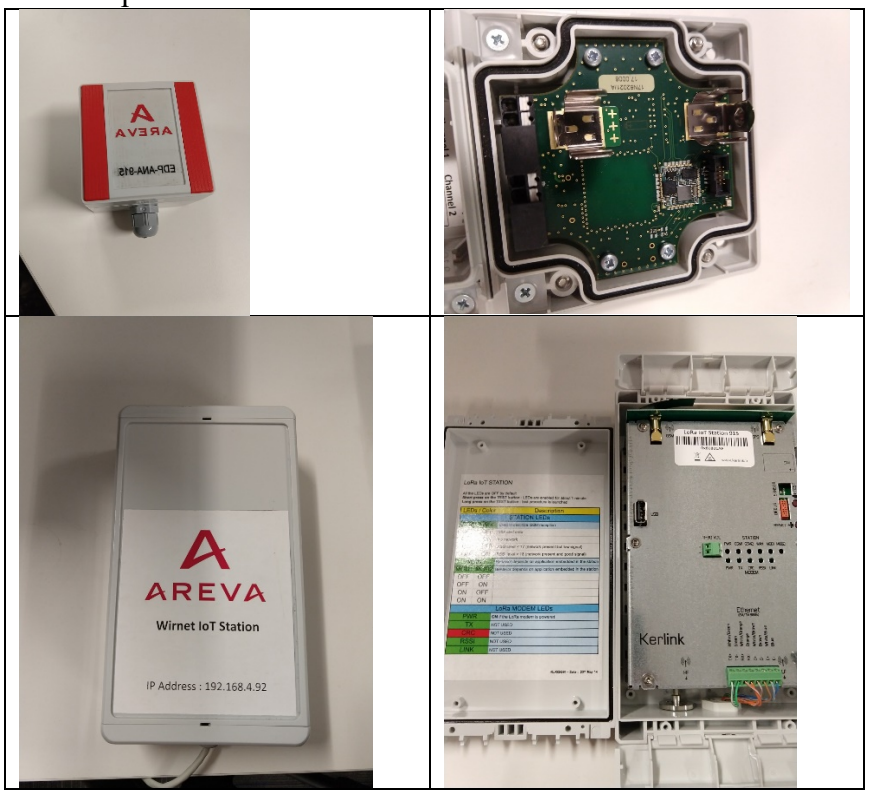
Project Requirements:

Sensor devices for utility applications need to be innovative because they are being placed in harsh environments (on turbine decks, near boilers, etc.). Framatome has a prototype wireless monitoring system developed in Europe. This project will take the European design and modify it to be used in the US energy fleet. During the design process, Framatome also has several improvements that it would like to be designed, prototyped and tested.

This prototype uses the 915 MHz LoRa radio frequency to communicate from endpoint sensors to a gateway and an interface computer. This frequency is part of the Industrial, Scientific and Medical (ISM) band that is approved for unlicensed use by the FCC in the United States. The design needs

to be modified to provide reliability (suitable for power generation environments) and additional capability to be a viable product. The current 3 prototypes in test have all failed in less than a year, so more robust design is desired. The reliability issues are related to firmware performance, not the hardware performance. It is assumed that a new PCB with an on-board microprocessor and firmware design would be required. Demonstration of the design is required and will be in a lab environment.

Here are photos of the current device:



There are three compnents to this system: Sensor Endpoints, LoRa Gateway (pictured above) and a PC/HMI application. A majority of the engineering effort is reverse engineering/redesigning the sensor endpoints, developing the PC/HMI application and communication pathway to the gateway and integration of a data collection server.

Expected Deliverables/Results:

1. Dialog with Framatome about the current capabilities of the existing European prototype and define improvements needed in the goal design, build SOW/Spec around the desired design from Framatome.
2. Add the capability for onboard data storage capability that can be collected and transmitted to the network.
3. Integrate into a Distributed Antenna System
4. Capture data in a non-proprietary backend format that can be imported into common applications in near-real time
5. Incorporate security into the sensors and communications

6. Address EMI/RFI requirements for this environment.
7. Working prototype of the IOT sensor, IOT station and PC/Human Machine Interface.

Disposition of Deliverables at the End of the Project:

The work product will be displayed at the last Expo then immediately handed over to the supporter unless arrangements have been made to deliver at a future date.

List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):

- Must have PCB design and microprocessor programming experience
- Microprocessor programming, SQL, desktop application development
- PCB design/development, radio communication (LoRa), network communication, reverse engineering