UNC CHARLOTTE
The WILLIAM STATES LEE COLLEGE *of* ENGINEERING

Senior Design Project Description

Company Name	EPRI	**Date Submitted**	June 30, 2017
Project Title	Thermal Fatigue Monitoring using Network Infrared Cameras (EPRI_THER2)	**Planned Starting Semester**	Fall, 2017

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project. 250 hours are expected per person. Complete the following table if this information is known, otherwise the Senior Design Committee will develop based on the project scope:

Discipline	Number	Discipline	Number
Mechanical	1	Electrical	1
Computer	2	Systems	
Other ( )			

Project Overview:

As many of the nuclear power plants in the United States near their initial forty (40) year lifecycle, concerns for the plant's integrity begin to rise as engineers now have plans to upgrade in order to allow the older plants to run for another twenty (20) to thirty (30) years. This increase in fueling cycles elevates the need for constant automatic monitoring to help prevent major disasters and meltdowns in worrisome regions which experience high number of thermal cycling. The regions which experience the most thermal cycling are the T junctions, where hot and cold fluids mix. Uneven thermal distributions in these regions create stress within the pipes. Due to the relatively large increase in lifecycle of the plants, the stress created inside the piping material begins to enter the fatigue failure of the pipes. The dangers of this happening promote a tremendous impact on the effectiveness and safety of power plants nationwide due to pressure water reactors (PWR) and boiling water reactors (BWR) operating at extreme pressure and temperatures, as any kind of fatigue cracks put operators and workers into seriously danger. If these cracks go unnoticed for prolong periods of time, the risk of serious ruptures within the pipes could lead to loss of main coolant to the reactors, leading to plant shut down and possibly other potential dangers to the plant itself and to the public.

The objective of this project is to develop a thermal fatigue monitoring interface for an operating power plant using networked infrared (IR) cameras, and to partner with EPRI to implement and evaluate the monitoring system within actual on-site pipes at a power plant or mock-up piping system at an EPRI location.

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Initial Project Requirements:

The thermal fatigue monitoring system will enable communications among networked IR cameras, enable multiple computers (e.g., PCs, tablets, or similar devices) to monitor multiple sectors simultaneously, and allow the user to discern which cameras are gathering critical information and orient and focus the cameras to such locations and gather the most useful information.

Most modern nondestructive evaluation (NDE) or monitoring techniques are expensive and require constant upgrades. Therefore, a more cost effective way to monitor thermal cycling is needed if engineers desire it to become a widespread NDE technique to monitor thermal fatigue problems inside pipes. The developed user interface should allow for the monitoring of thermal cycling in power plant piping systems. The software can, by a push of a button, monitor thermal cycling, average maximum and minimum temperatures, filter unwanted environmental factors, and then graph the results in a user friendly manner.

Expected Deliverables/Results:

- A working software (PC based) for the thermal fatigue monitoring system
- A working networked low-cost IR cameras
- Results of the implementation and evaluation of the system (hardware and software)

Disposition of Deliverables at the End of the Project:

N.A.

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

Skills and knowledge in: computer networks, internet of things, heat transfer analysis, MATLAB and C+, IR cameras, and imaging analysis.