

Abstract

Florida Power and Light (FPL) provides power to over ten million people in Florida through the use of millions of utility poles that transfer power to homes. Linemen are tasked with inspecting these poles using the hammer test. This test is performed by taping the pole with a hammer and listening for differences in pitch. The goal of this project is to automate and simplify FPL's pole inspection process.

The team has developed a pole testing approach that uses ground penetrating radar (GPR) to improve testing efficiency and reduce testing error.

Project Scope

- Improve safety and reliability
- Reduce resources needed to inspect poles
- Increase inspection efficiency
- Automate and simplify pole health inspection process

Selected Design

- Sensor: Ground Penetrating Radar (GPR)
- Power: Hilti Li-ion Battery
- Controller: Phone Application
- Robot: Triangular Climber

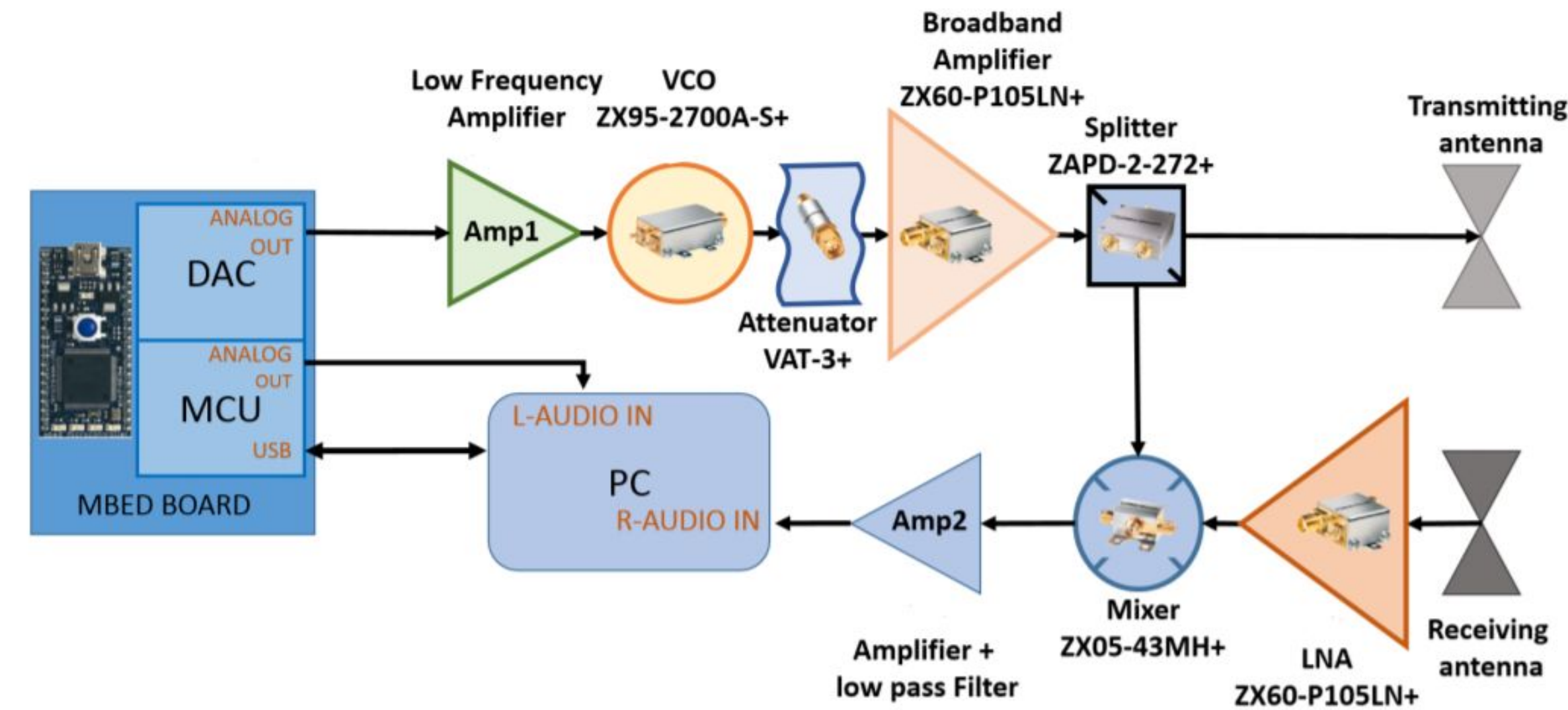


Figure 1: Block diagram of GPR sensor

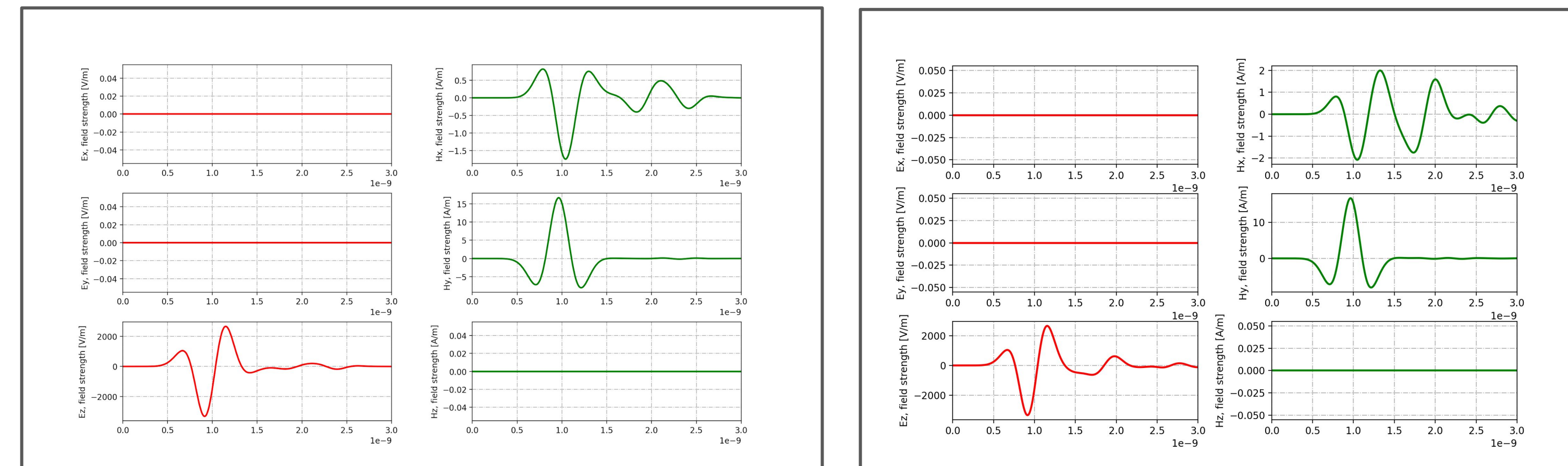


Figure 2: Control pole (left) and unhealthy pole (right) simulation outputs

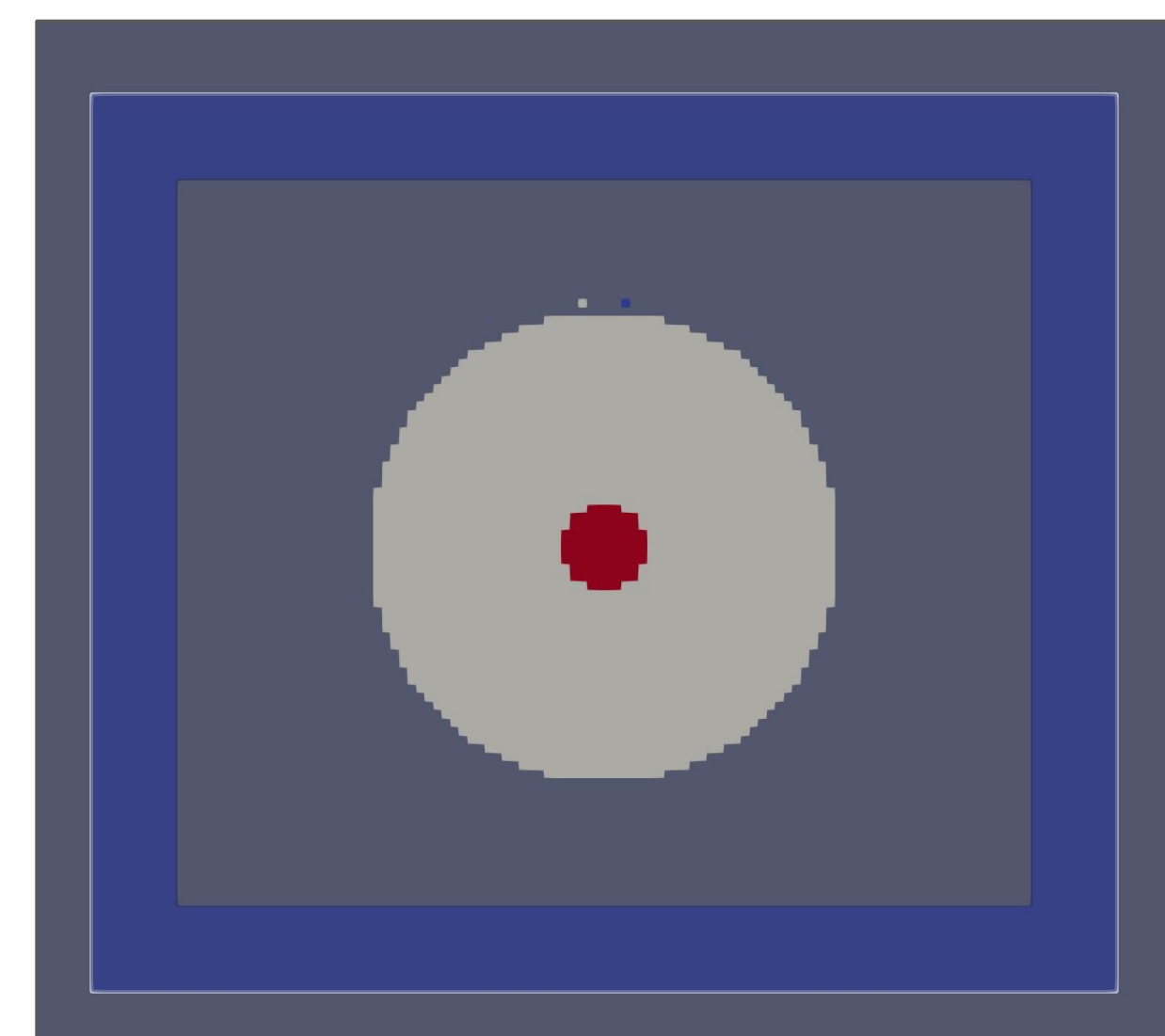


Figure 3: Simulated model; cross-section of unhealthy pole

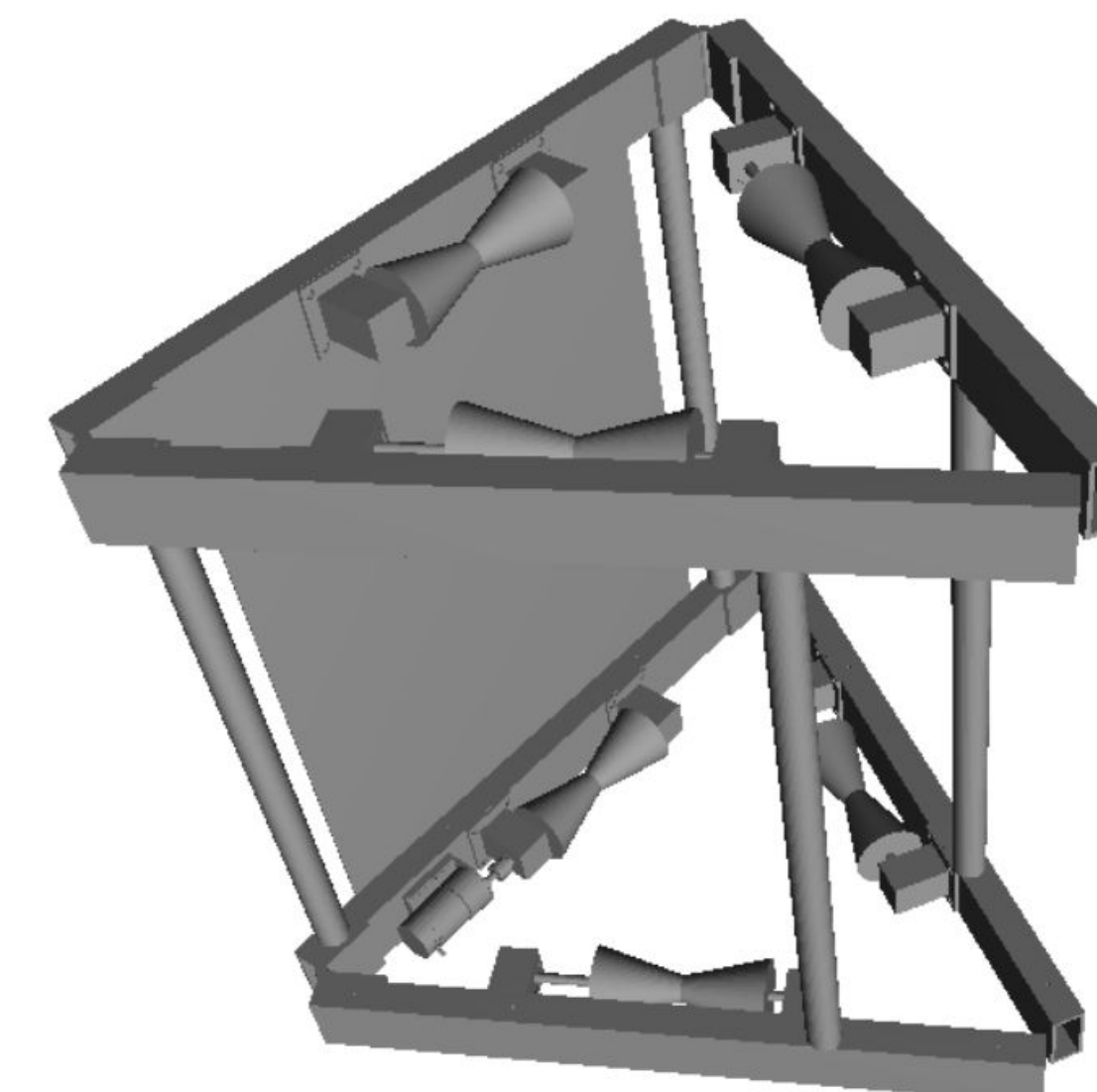


Figure 4: Robot model

GPR Sensor

Ground penetrating radar (GPR) provides linemen with a more accurate and non-invasive way to check the structural integrity of a utility pole. This method has been proven to be efficient and accurate using the GPR modeling software, gprMax. Additionally, an image classification AI program has been developed and trained to recognize the different signal waveforms from a healthy and unhealthy pole.

Conclusion

The goal of this project is to automate and simplify the pole health inspection process. This will improve safety and reliability, reduce the amount of resources needed to inspect the poles, and increase inspection efficiency. Working alongside a team of mechanical engineers, the team was able to produce a pole climbing robot with a GPR sensor. This device is able to non-invasively and more accurately access the structural integrity of FPL's utility poles.

Future Work

To further improve this project, an IOS application could be developed for iPhones and iPads to give the user more control over the sensor and robot. This may include allowing the user to view and manipulate the sensor output and giving the user additional controls over the robot.

Further research could be performed to add additional functions to the robot. The sensor developed through this project