Divide and Conquer, Version 1

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Group 1

OUC Flooded Transformer

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1. Project Narrative

1.1. Motivation

Due to the recent weather disaster Hurricane Ian flooding has become a highlighted issue when it comes to electrocution hazards. Flooding causes electrocution risk for both overhead and underground circuits which could cause harm to unaware people passing by. For this project the focus will be on the underground circuits in relation to the pad-mounted transformers. It's possible for the flood waters to rise high enough to reach the bus-bars inside the pad-mounted transformer. Metal plated bus-bars can become corroded due to the thermal changes and electrolytic reactions from the flood waters. It is important that the power to the transformer should be shut off for the safety of the surrounding passers-by. This project will address flood sensing for the pad-mounted transformers.

1.2 Project Goals

The goal of our project is to detect flooding as early as possible, and to ensure public safety by preventing electrocution hazards associated with water flooding coming into contact with electrical components of pad-mounted transformers. Design a proof-of-concept system that can be integrated smoothly into an existing infrastructure. Provide a reliable and efficient solution for detecting flood conditions within and around the pad-mounted transformer. Enable an automatic disconnection of the primary circuit to reduce risk of electrocution in case of flooding. Implement a wireless transmission to an external switch to improve the speed and accuracy of circuit disconnection. Allow the option for a manual reset of the circuit following an in-person inspection of the site, to provide a proper maintenance and functionality of the system.

1.3 Project Functions

Functions	Descriptions
Flood Detection	The sensor device will be housed inside the transformer and will be able to detect when an area is flooded
Wireless Transmission	The system will transmit the flood detection signal wirelessly to an external switch.

Circuit Disconnection	The system will open up a primary circuit automatically when flooding is detected to reduce electrocution risk.
Manual Reset	The circuit should be manually resettable after an in-person inspection of the site.
Integration	The system should be smoothly integrated into existing infrastructures with minimal distribution to existing processes.
Testing	The proof-of-concept design will be tested for effectiveness and reliability.

2. Requirement Specifications

The following section lists necessary requirements such that the project is realizable in the accorded schedule. It is important to note that these requirements might change as the project advances to future stages in development.

Specifications	**Description**
Dimensions	89”-W x 57”-D x 64”-H
Type	Three phase, 50 or 60 Hz, 65° Rise.
Size	45 - 10,000 kVA.
Coil configuration	2-windings or 4-winding or 3-winding (Low-High-Low).
Primary voltage	2,400-10,000 kVA.
Secondary voltage	208Y/120 V
Water Level threshold	About 4 ft, threshold might change once the actual transformer is visited at OUC.
Water level sensor (tentative)	Radar transducer which measures the time interval between transmitting and receiving

	the signal and converts that into a distance measurement.
Wireless communication range	Short range [35-50 ft]
Power consumption range	Low power [14.29 µ - 2.5W]

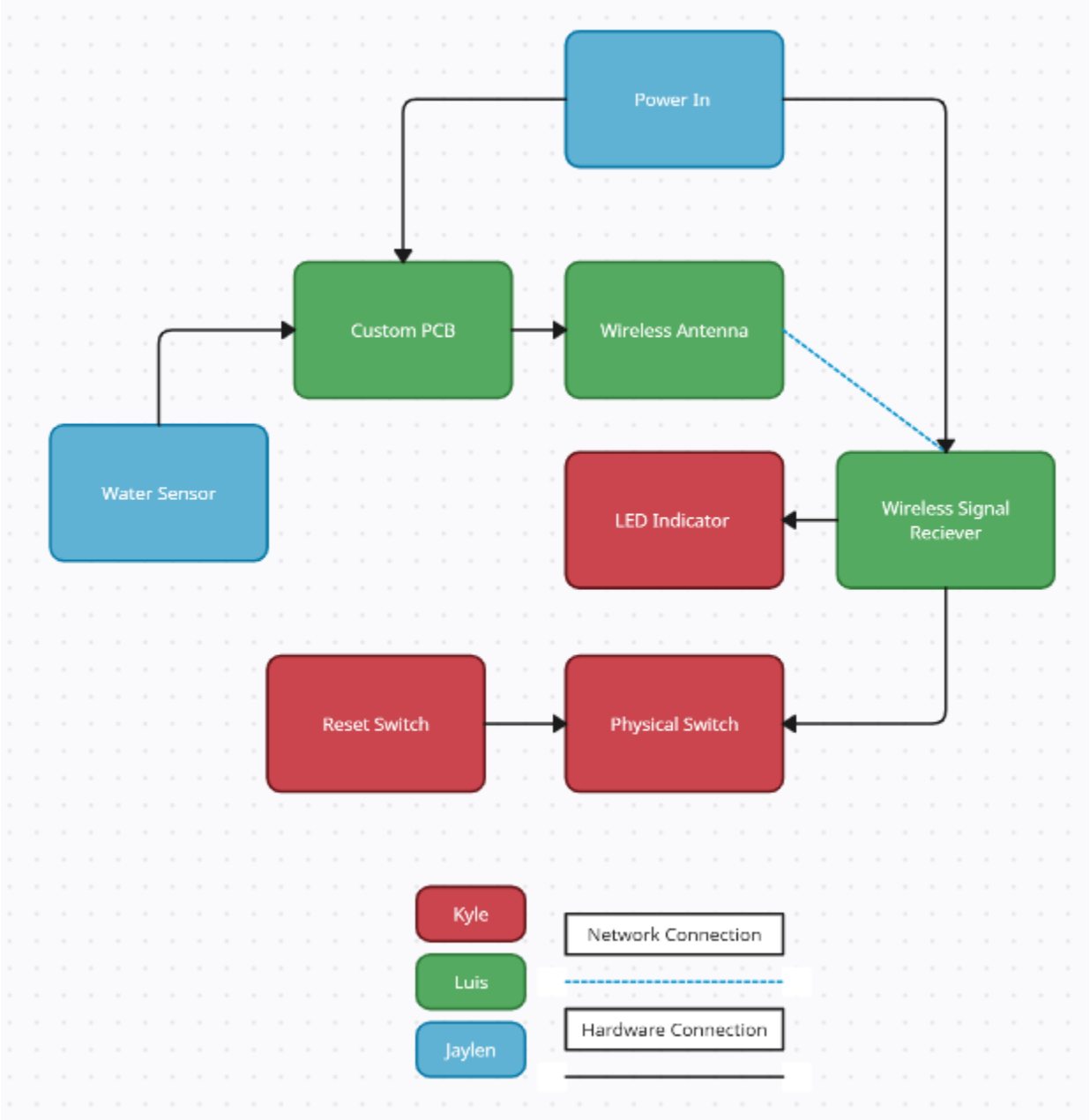
Note: It is important to highlight that the project will not be conducted while this voltage is live in the primary windings for safety purposes. Nevertheless, the transformer's primary windings are able to operate at these voltages ranges. Additionally, the water sensing technology is not fixed since we are in the early stages of research, therefore, other water sensor technologies will be considered depending on the progress.

3. Budget

This project is being sponsored by OUC (Orlando Utilities Commission), therefore, the float and wireless communication should not exceed $250 in overall components. Also, the external switch and receiver's cost should not exceed $150 according to OUC. The items listed here are subject to change as the project advances in its developing stages while keeping the budget limit into consideration.

Item	**Cost**
Microcontroller	~$45
Electrical components (estimated)	~$20
Water Sensor	~$5
Wires (different AWG)	~$8
Breaker switch	~$17
Fuses	~$10
Bluetooth antenna	~$11

4. Block Diagram



5. Milestones

It is important to highlight that this project will be conducted with another group composed of MAE students, therefore, a milestone table for senior design II will not be included until this project advances in the development stages. For senior design I, it is important as well as convenient for each member to follow these dates in order for the project to be successfully developed. Meetings with MAE students will be held every Sunday until the objectives are met which are discussed in the meetings itself. For the research milestone, two weeks are required such that each member gathers as much information as possible, and in the course of one week, the paper draft is to be written extensively while putting all the information together while maintaining cohesion. While research is conducted, PCB design software *Altium* is to be learned such that all the tools and skills are at hand when it comes to designing schematics. The following table shows a general view of the milestone, these dates and even milestones are subject to change as the project advances in development stages:

Milestone	**Due Date**	**Status**
Ideas	1/14/2023	Done
OUC meeting	1/20/2023	Done
Initial broad research	1/23/2023	Done
Meeting with MAE group	1/27/2023	Done
Divide and Conquer (10 page)	2/03/2023	In progress
Group meeting for DC	2/07/2023	Not Done
MAE meeting	2/12/2023	Not Done
OUC's transformer actual site visit	2/14/2023	Not Done
MAE meeting to discuss their design approach	2/16/2023	Not Done
Updated DC to website	2/17/2023	Not Done
Technology (sensor) extensive research	2/19/2023	Not Done
Compatible MCU research	2/26/2023	Not Done

Starting on 45-page draft	3/01/2023	Not Done
Procurement of parts	3/05/2023	Not Done
Software packages	3/12/2023	Not Done
Finish 45 Page draft	3/24/2023	Not Done
Schematic design	3/27/2023	Not Done
Circuit simulation	4/02/2023	Not Done
120 page final report	4/25/2023	Not Done

6. Team Organization

This project will be conducted together as a whole in a group, however, there are specific tasks that each individual must meet in order for the project to be successfully developed throughout all the stages including research. The responsibilities for each group member are assigned as follows:

Electrical Engineer	**Tasks**
Luis Marquez	Research Sensor Technologies
	Design Printed Circuit Board
	Test PCB traces
	Verify component selectivity
	Solder components
	Help design schematics

Electrical Engineer	Tasks
Jaylen Richardson	Research sensor technologies
	Design Schematics
	Ensure connectivity of primary (transformer to switch/breaker
	Help with Printed Circuit Board design
	Simulate appropriate schematics
	Search components and ensure availability (cost effectiveness)

Computer Engineer	Tasks
Kyle Silvera	Research on different MCUs
	Develop wireless communication
	Program devices for communication
	Develop/ensure security between selected devices

7. References

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2. https://www.fluidswitch.com/2015/10/16/how-do-optical-level-sensors-work/
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