Department of Electrical Engineering and Computer Science

University of Central Florida

Group G

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Project Narrative:

The goal of this project is to use wireless mesh network to improve water management strategy. Water management is crucial for irrigated agricultural system, because of spatial variability the land field can be under-irrigated or over-irrigated which lead to loss of production or results in a poor plant health, to mitigate this problem, ecological variable in the field must be monitored by using sensors which communicate wirelessly and forward their data to gateway. Wireless Sensor network is a cost effective, power-efficient and scalable solution.

Requirement Specifications:

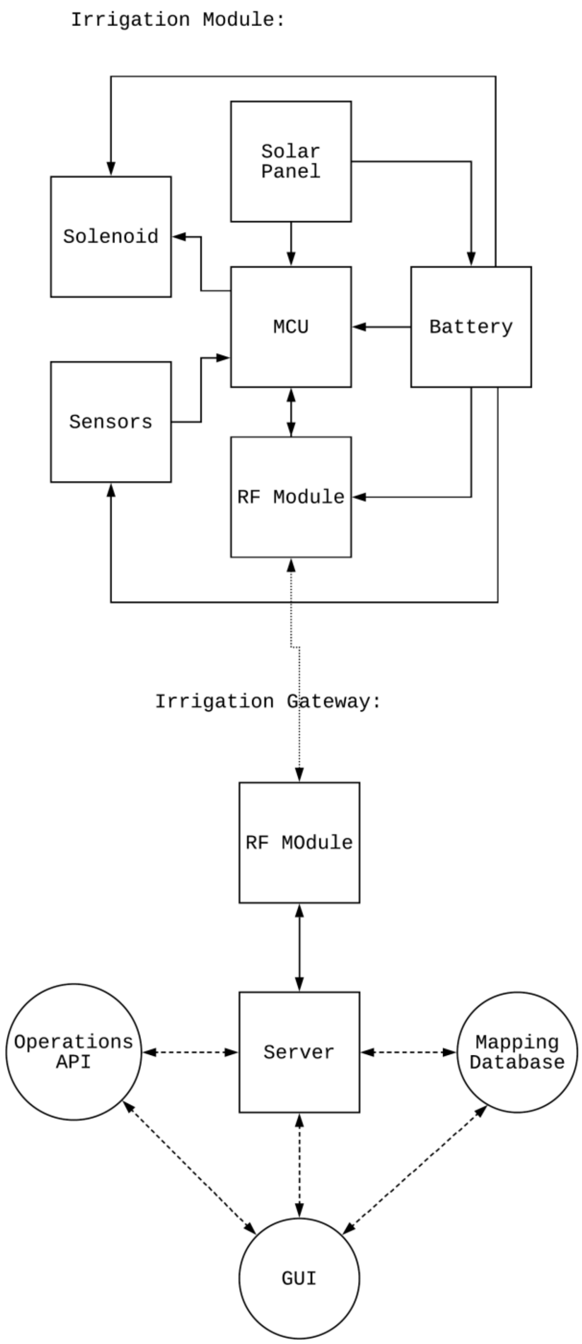
Quantitative measurements for the preliminary requirements for the hardware in this project are estimates based on research that are likely to change as this project is further delved into. Sprinklers should require no more than 15 W to operate. System should be able to be remotely operated via web app.

The minimum range between two communicating nodes should be no less than 15 ft. Max soil moisture that sensors can detect before sprinklers are engaged is 20%. Range of each sprinkler should be no less than 10 ft. The irrigation system should be able to control the duration of the watering. Minimum span of ground that the irrigation system should cover is 30 square feet. The irrigation node should be self-powered with minimum maintenance. The web-app should be able to map all nodes and display them in a GUI. The gateway should support the database of nodes and send signals for override control. The GUI should be able to display status of selected node.

Plenty of project constraints will be discovered as more research and hands-on implementations are conducted. The constraints for the irrigation system will vary depending on what hardware and software is ultimately used in the end. For now, the project constraints include the signal strength and speed of the hardware used to allow the sprinklers to communicate with the central gateway. Also, what measurements can be taken by the sensors used to analyze the sprinklers' actions.

Diagrams:

Block Diagram



MCU: Central programmable unit used to manage all internal operations

Battery: Internal recharagble battery used to hold energy and distribute power to all components

Solar Panel: Panel used to collect and store charge to the battery

RF Module: Wireless communication module used to connect the node to the mesh network

Sensors: Series of sensors used to measure environment and relay data back to MCU

Solenoid: Output electromagnet driver used to turn on/off the sprinkler

Server: Dedicated computer used to run all the APIs and connect to modules

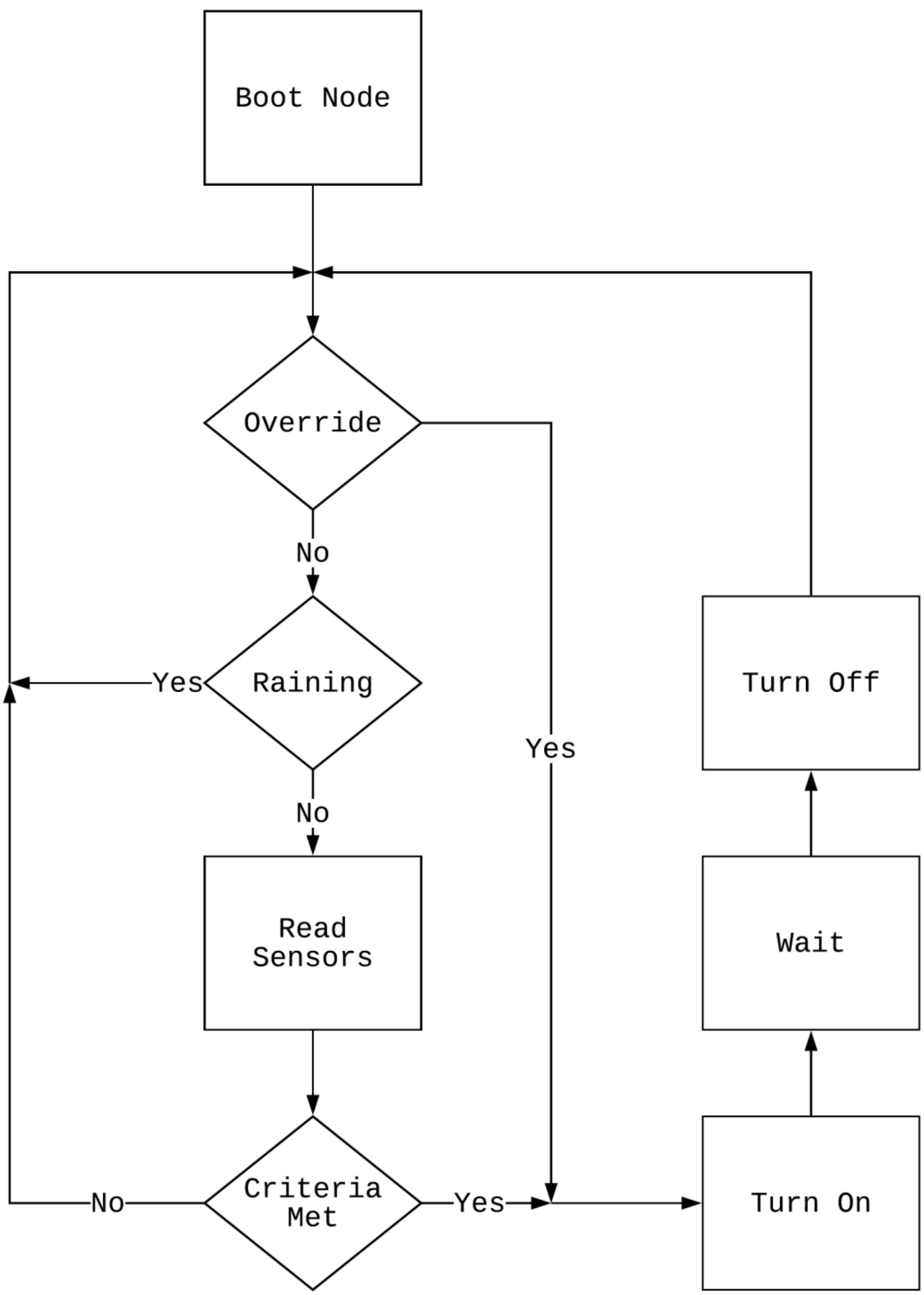
RF Module: Wireless communication module used to connect the Gateway to the mesh network

Mapping Database: Database used to record and recall the coordinates of the indivdual Irrigation Module

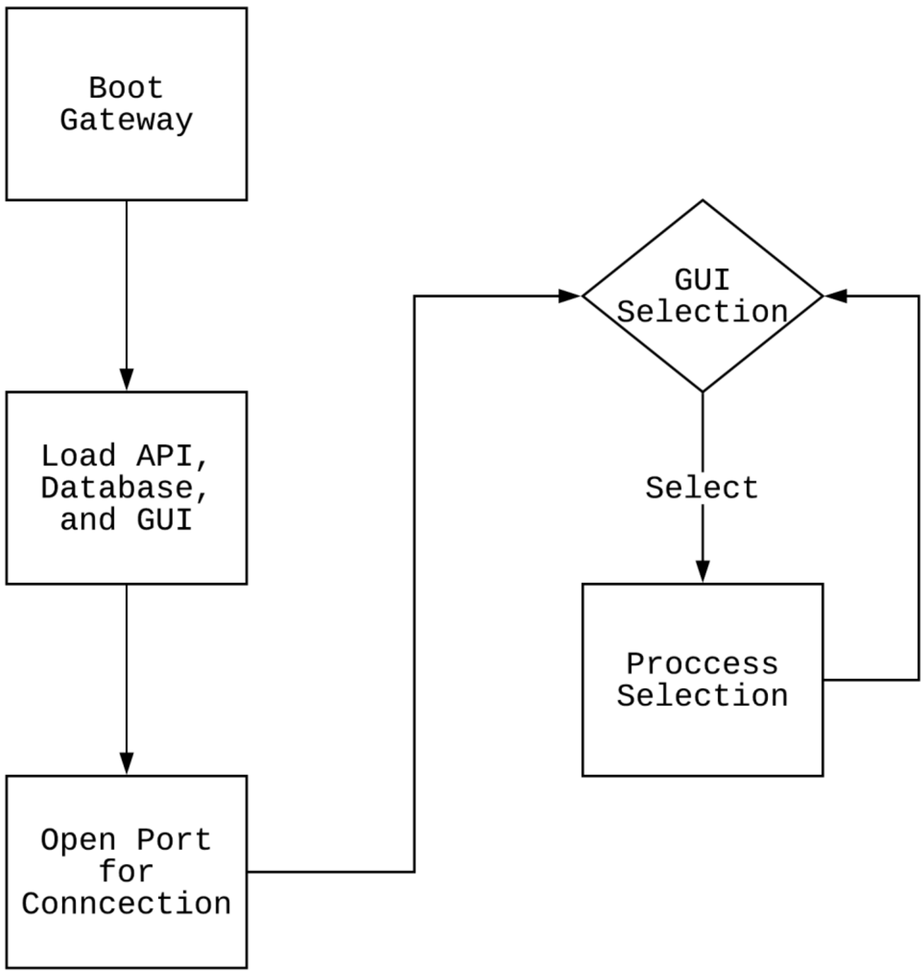
Operations API: API used to collect and display the status of all Irrigation Module and send an override command to manually turn on a sprinkler

GUI: User accessable API via interent used to display all options of the system

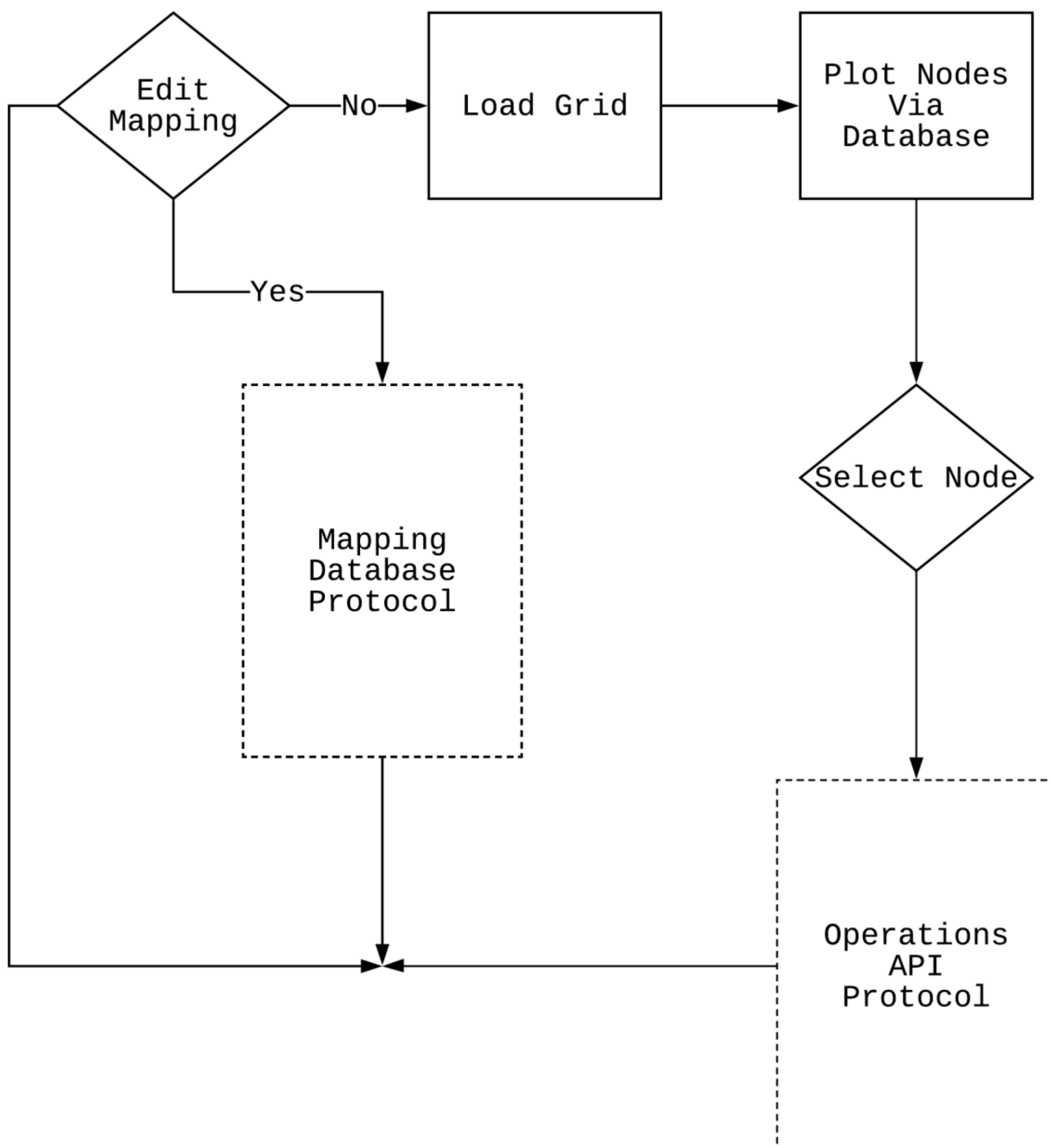
Hardware Flowchart: Node



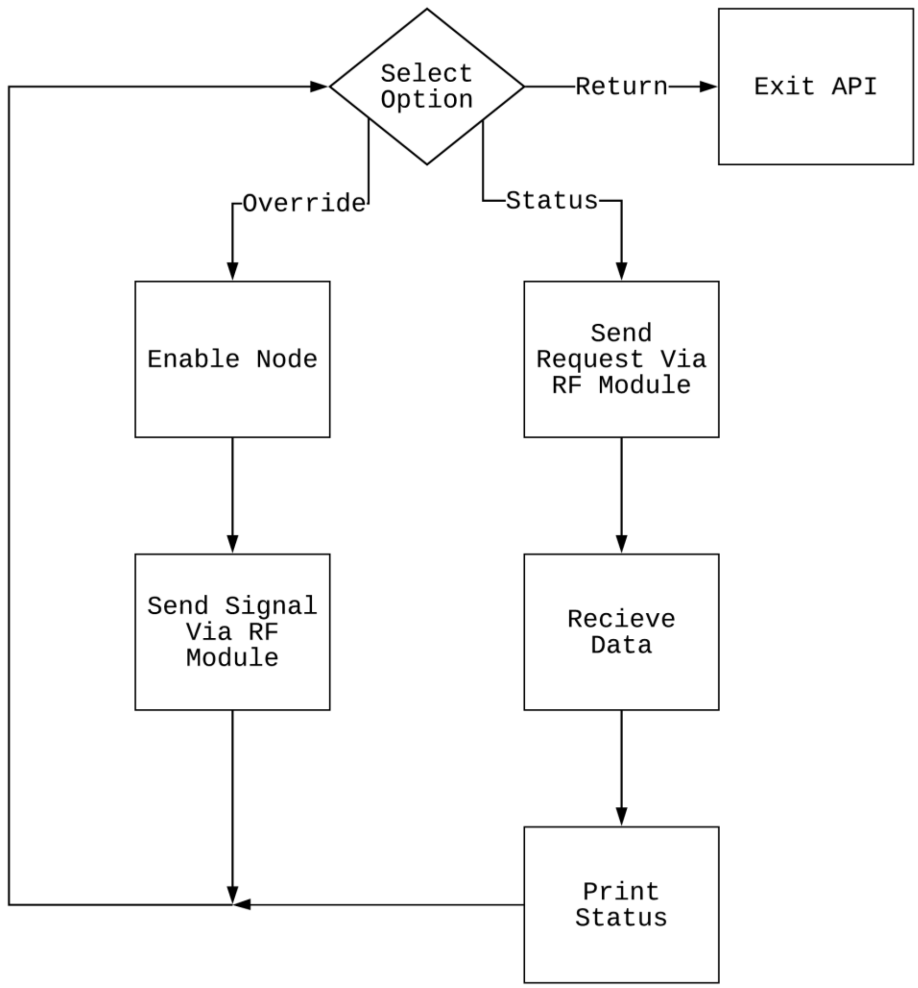
Hardware Flowchart: Gateway



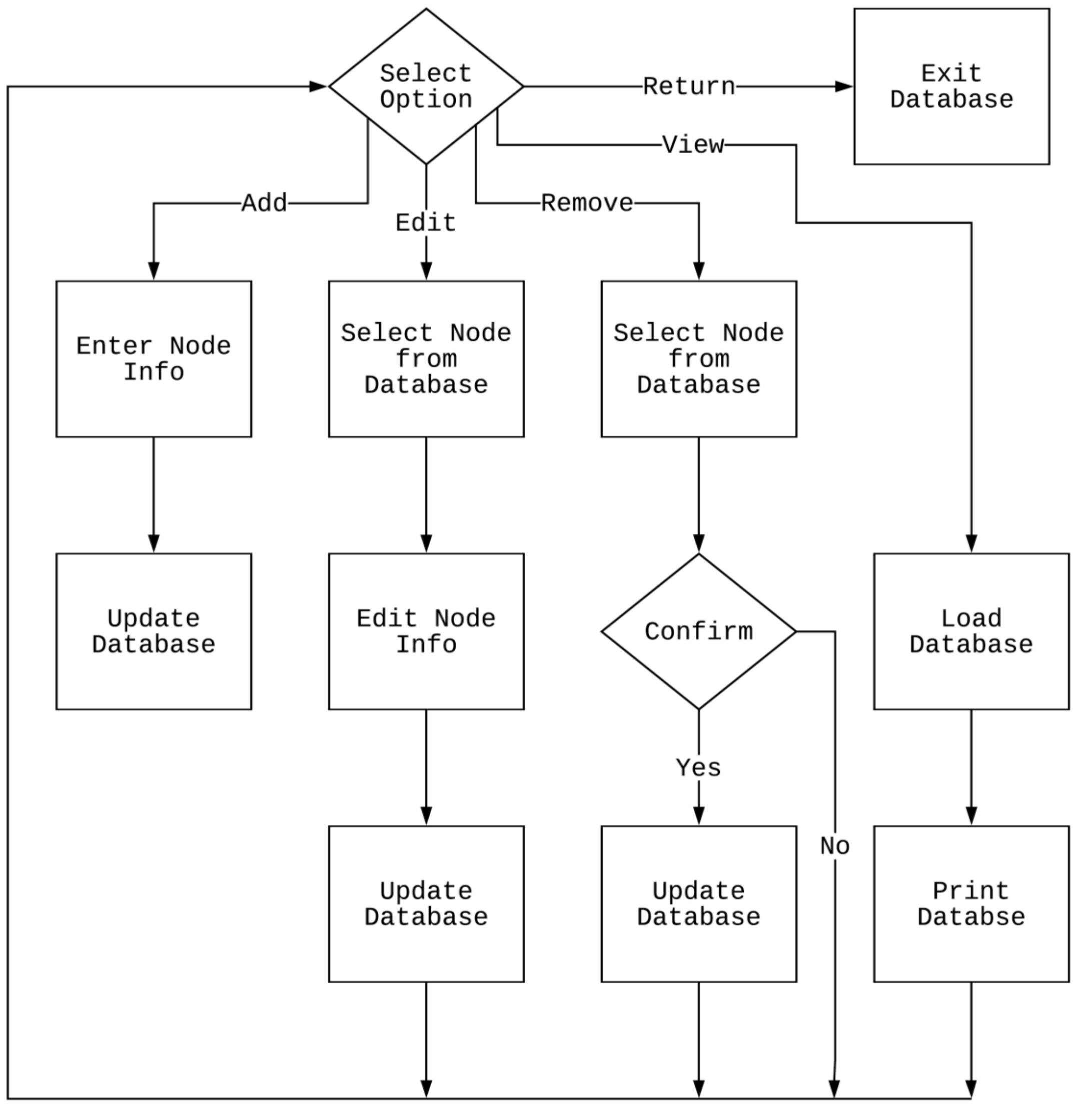
Software Flowchart: GUI



Software Flowchart: Operations API



Software Flowchart: Mapping Database



Budget:

AVR Chip	$4.00
ZigBee Module	$15.00
Temperature Sensor	$3.00
Soil Moisture Sensor	$3.00
Humidity	$3.00
Rain Gauge	$15.00
Enclosure	$45.00
Solar Panel	$15.00
Battery	$9.00
pH Sensor	$12.00
Solenoid	$10.00
Sprinkler Head	$9.00

Milestone:

Our first milestone for the end of Senior Design I is to have a ready documentation that explains our objective, research, design process, and cost. Our second milestone is to have a prototype built for further experimentation, research, and redesign.

Our milestone for Senior Design II is to build a final project that meets the requirements and satisfies our objective.