[Awesome Smart Irrigation Project Title]

*Title subject to change

UNIVERSITY OF CENTRAL FLORIDA

Department of Electrical Engineering and Computer Science

Dr. Samuel Richie
EEL4914: Senior Design I - Summer 2021

Initial Project and Group Identification Document
(Divide and Conquer, Version 1.0)

Group 10
Elliott Gray - Computer Engineering
Patricia Mae Luzano - Computer Engineering
Kevin Rodriguez - Electrical Engineering
Angelica Vargas Martinez - Electrical Engineering

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1. Project Narrative Description

1.1 Motivation

Currently, about a third of the global population lacks access to potable water. As the global human population continues to increase, the availability of water could become an alarming situation. Another important fact to highlight is that an outstanding amount of water and land is consumed by agriculture. In the United States only, agriculture accounts for about 80 percent of the consumptive water use while in many Western States it accounts for over 90 percent[1]. This is where the greatest waste of this resource occurs being that a large concentration of the water utilized for irrigation purposes is constantly lost due to events such as water overflow, inefficiency resulting from the use of outdated tools and/or equipment, etc.

In hopes of attempting to better this situation, our team has decided to design a smart irrigation system using the Internet of Things technology, or IoT. A smart irrigation system could be of great help in managing water utilization around the world and increasing productivity in fields. We have chosen to implement a more local approach with our project, giving individuals the chance to help not only their own communities, but also the global population from the comfort of their home.

1.2 Goals and Objectives

The goal of this project is to create an easy-to-use, portable smart irrigation system using IoT that will allow users to monitor and irrigate herbs and/or produce remotely, making the gardening process hassle-free. Once programmed, the system will work independently to optimize irrigation with smart gardening tools, resulting in savings on water consumption compared to manual watering. Our system will be time and resource saving, and will reduce the workload of the user. Given that our system will utilize IoT, it must be connected to a Wi-Fi network to successfully perform its duties.

The strategy to accomplish this project is to acquire the necessary equipment to put together a smart irrigation system using IoT. Parts from different distributors will be compared to obtain the best prices for each component needed. Once the parts are obtained, the necessary PCB will be constructed. Either a mobile or web app that tracks the plant information, watering times, and soil information will also be constructed. The application, which the user can access comfortably from anywhere, would be available on mobile device's app stores or through the use of a link, depending on whether the application is mobile or web based.

1.3 Function of Project

Using our software, the user can water their plant automatically through their mobile device or voice, and will also present/read out loud information regarding the plant. Through the use of a mobile or web app, the user will be able to tap on their screen to either select automatic watering or water manually their plants. The user will also be able to ask the system to do either option through the use of their voice thanks to Alexa/Google Home integration. An audio module with a microphone and speaker will be included for this purpose. Additional Alexa/Google Home commands will also work with an LCD display, where the user can observe data such as soil moisture levels, whether the plant was watered by rain or not, and temperature and humidity information.

Using our hardware, the user will be able to acquire information regarding the watering levels, soil dampness, and humidity through the use of our designed microcontroller. Soil moisture, temperature and humidity, and rain sensors, which will be placed in the planter, will send real-time data to the microcontroller. Depending on the plant, a humidity range will be indicated and whenever the values are outside of the specified range, the microcontroller will automatically turn on/off the water pump.

2. Requirement Specifications

2.1 Requirements

As seen in section 1.3, we combine knowledge obtained from electrical and computer engineering and apply it to this project. Our design will utilize a BOLT IoT module, which allows users to develop and create IoT projects. The module will be used to develop a cloud interface for saving information online that the user can access wirelessly. The user will be able to send commands to the BOLT module and transmit data to the cloud interface for analyzing. The BOLT IoT module will be connected with an Atmega328P microcontroller that, once programmed, will be able to take input from the soil moisture measurement sensor and rain sensor as well as control the other electrical components of the system that will be connected to it. For our soil sensor, we plan on utilizing the FC-28 while for our rain sensor, we plan on utilizing the MH-RD. The rain sensor will detect if the plant has been watered by water droplets, and if it has not been, the soil sensor will communicate to the system, letting it know to deposit water to the plants. For our temperature and humidity sensor, we will utilize one that is already owned by one of our team members, the DHT-11. We will also be utilizing an LCD already owned by one of our team members, the LCD1602. The LCD will be connected to the microcontroller unit and through it the user will be able to cycle through to observe data on soil

moisture, the required range of moisture for the specific plant, whether the plant was watered by rain or not that day, and temperature and humidity information within the air.

Our mobile/web app will contain the plant's daily statistics from the soil moisture sensors and an on/off button to control the system. The plant's data will be updated often, preferably after the plant is watered. Alexa/Google Home will be integrated to the system so that users can water their plant, access its statistics through voice commands, and turn on/off the system. We will accomplish this by including a sound sensor module, the SOUND-01, which includes an LM386, and pair it with a small speaker, the a15080600ux0275. The sound sensor will recognize key words from the user and convert them to text, allowing the system to perform actions as specified.

2.2 Specifications

Attribute	Description
Size	The system will be built on a breadboard and extra components will be placed accordingly. PCB will be incorporated later. Estimated overall dimensions are 24" x 24" x 24".
Weight	The system will be as portable as possible considering components' restrictions. Estimated weight cap is 50 lbs.
Power Supply	The system will be powered with AA batteries (1.5 V) and with a 20000mAh portable solar power battery as a backup.
Microcontroller	A microcontroller will be used for taking input from the sensors.
Breadboard	A breadboard will be utilized to prototype and refine the system and its components.
LCD	The system will include an LCD where the user can observe and cycle through relevant information regarding the specified plant.
Wires	Male to Male and Female to Female wires will be utilized as necessary to connect components.
Sensors	The system will have a soil moisture sensor, a rain sensor, and a temperature and humidity to

	monitor the condition of the plants and to alert the system when to water the plants.
Sound Module	The system will include a sound module to amplify voice commands for the speaker.
Speaker	A speaker will be utilized so that the user can utilize Alexa/Google Home commands
Water Source	The system will have a 2.5 gallon water container and will release the specified amount of water to the plant when its moisture level reaches a specific value.
Water Pump	A submersible water pump will be used to supply water.
Communication	The communication will be wireless through the use of an app as well as smart integration.
Interface	The system must be compatible with a web application and/or a mobile application. This will allow users to control the system and to access the data of their plants.
Database	The information about the plants will be stored in a cloud database.
IoT Module	An IoT module will allow the hardware to connect with the hardware wirelessly.

*Size & weight are subject to change upon acquiring materials

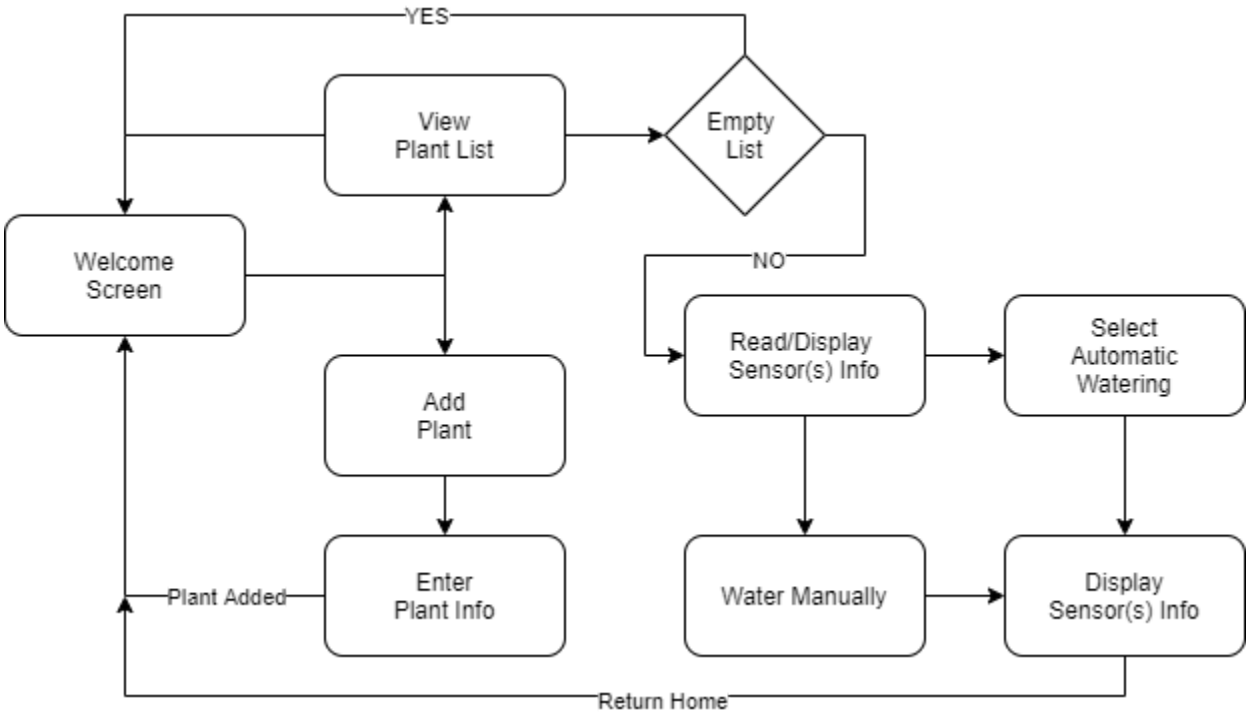
2.3 Project Constraints

Constraint	Description
Cost	The materials needed for the key features will be prioritized, but due to self-funding, components will be as cheap as possible.
Time	A dedicated time will be allotted every week to work on the project, but due to members' individual schedules, time will be crucial.
Product Availability	Due to COVID-19, many manufacturers are

	experiencing supply shortages and long delivery times.
Plant Parameters	Inputting the wrong parameters in our server could lead to flawed irrigation systems.

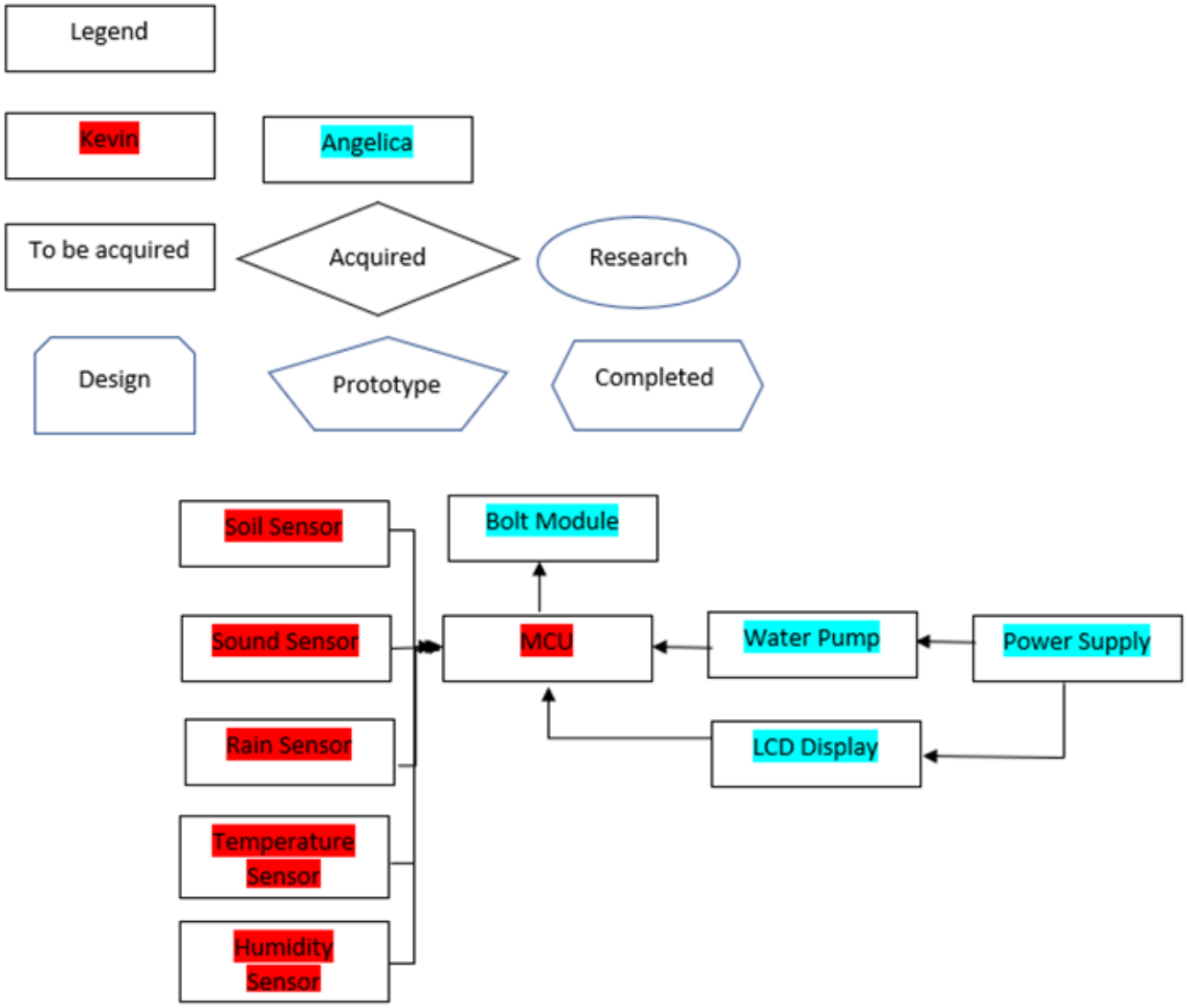
3. Project Block Diagrams

3.1 Project Software



*All information stored in cloud database
*Responsible for software blocks - Elliott
*All block statuses are in research (i.e. to be investigated)

3.2 Project Hardware



*Responsible for hardware blocks - Kevin

4. Estimated Project Budget and Financing

The [Awesome Smart Irrigation Project Title] will be financed by the members of Group 10. Throughout our research, we looked around for the most inexpensive items that would ultimately lead to the completion of our objectives. We have also decided to place a cap in our budget up to $500.00. The table shown below gives a rough estimate of how much money we intend to spend on the components we believe we need so far.

Item	Price	Quantity	Total
Power Supply - Batteries (AA, Pack of 4)	$1.00	1	$1.00
Power Supply - Portable Battery	$22.99	1	$22.99
Microcontroller - Atmega328P	$2.52	1	$2.52
Breadboard (already owned)	$0.00	1	$0.00
LCD - LCD1602 Module (already owned)	$0.00	1	$0.00
Wires - Male to Male and Female to Female	$0.00 (already owned)	30	$0.00
Soil Sensor - FC-28	$0.88	1	$0.88
Rain Sensor - MH-RD	$7.75	1	$7.75
Temperature and Humidity Sensor - DHT-11 (already owned)	$0.00	1	$0.00
Sound Sensor Module - SOUND-01	$7.95	1	$7.95
Speakers - a15080600ux0275 (Pack of 4)	$8.80	1	$8.80
Water Pump - Hygger 53GPH	$9.99	1	$9.99
IoT Module - BOLT Module	$150.00	1	$150.00
Final Total = $211.88			

*Components and their prices are subject to change as more investigation is performed

5. Initial Milestones

5.1 Senior Design 1

Milestone	Task	Completion Date
1	Finish initial project document (divide and conquer)	June
2	Start writing project report	June
3	Finish writing project report	July
4	Order Parts	July
5	Start testing project	August

5.2 Senior Design 2

Milestone	Task	Completion Date
1	Finish testing project	August
2	Get mobile app working	September
3	Connect mobile app to hardware	September
4	Refine project	October
5	Give final presentation	End of SD2

6. References

1 https://www.ers.usda.gov/topics/farm-practices-management/irrigation-water-use/#:~:text=Agriculture%20is%20a%20major%20user,percent%20in%20many%20Western%20States.