Detailed Design Documentation

Group 2

Team Name:
JTA Embedded Solutions

Project Description:
The purpose of this project is to explore the feasibility of using low priced, off the shelf sensors and an MCU to automatically detect when a plant needs water and provide it to the plant using a small water pump. Additionally, the system will monitor other key elements for plant growth, and send feedback to the user.

Problem Statement:
Average consumers who enjoy decorating their houses with indoor plants do not always have a solid understanding of the plant's need for water and light. Some consumers may over water the plant, where as some may forget to constantly water the plant. Plants tend to die when exposed to too much or too little light as well. Although the interest for growing plants may be there, plant maintenance can become quite difficult and tedious to an average consumer.

There are a few solutions that currently exists for this problem. An example is the Aero Garden by AeroGrow (Figure 1.1). This system grows plants using hydroponics method. The consumer can buy various seed pods and insert them into the garden and fill the tank with water and nutrients. The Aero Garden will then automatically provide correct amount of light and nutrients to the plant without consumer interference. In few weeks, the plants will sprout.

Figure 1.1: Aero Garden by AeroGrow

This system however does not provide feedback data to the consumer. Even though it automatically provides light and water to the plants, there is no way to monitor whether its enough or not. This system also only works best for Hydroponics gardening, where soil is not required (For Ex. Herb Garden). This specify system cannot be used on any plants. Most decorative plants are grown in soil.

The solution proposed by JTA Embedded solution provides a plug and play system that can be inserted into any potted plant grown in soil. Since the system monitors soil moisture, air humidity, temperature, and light exposure, all this data can be fed back to the consumer to provide helpful hints for good plant maintenance. If the consumer is unsure about the correct moisture level of the plant, the system will be able to determine the need for water based on the soil humidity sensor feedback.

Project Requirements:

The Automated plant watering system will need to monitor Soil moisture, Air Humidity, Temperature, and Light exposure. This will be done using the following sensors:

Soil Moisture: Soil Hygrometer ESP32 DHT11
Temperature & Humidity: DHT11
Light Exposure: GL12528 (Photo Light Sensitive Resistor)

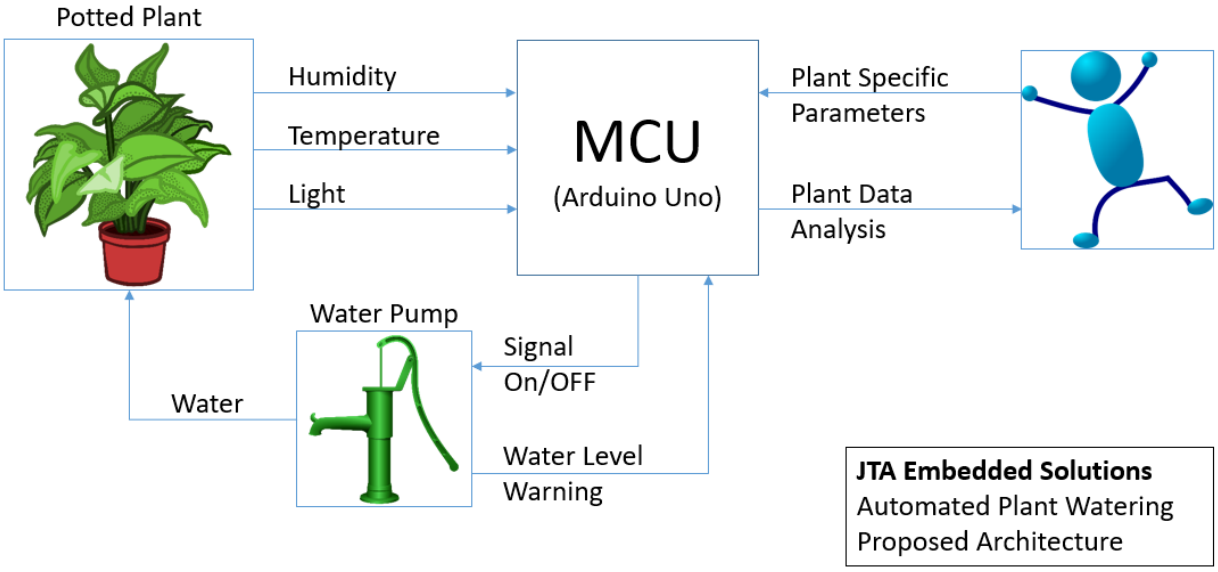
The soil moisture data will be fed back to the MCU (Arduino UNO), and it will determine when water is required. When water is required, the MCU will trigger the water pump to pump water to the plants. The water reservoir will have an ultrasonic sensor to determine water level. This will allow the MCU to warn the user when water needs to refilled.

Ultrasonic Sensor: HC – SR04

Air Humidity, Temperature, and Light exposure will be relayed to the user, to allow the user to determine if the plant is in an ideal environment.

Data feed back will be transmitted via Bluetooth to a mobile application which the user can access at any time.

Fig 1.2 – Proposed System Architecture



Proposed Task Timeline1:

Week & Date	Milestone	Task	Owner
1 – Sep 10	Kickoff – Sep 11 Part Selection – Sep 15	- Kick Off Documentation - Water Pump Hardware Research - Soil Humidity Sensor Research - Part Selection Documentation	T A , T J, T A, J, T
2 – Sep 17		- Raspberry Pi Research & Simple Program with GPIO - Get Previous Capstone Project Working - Display Water Pump Working	J, T J, T, A A, T
3 – Sep 24	Initial Software – Sep 25	- Create software to read Soil Humidity	J, T, A
4 – Oct 1		- Create software to read Temperature & Light - Water level sensor	J, T, A
5 – Oct 8		- Create software to control water pump & read water level sensor	J, T, A
6 – Oct 15	Low level software – Oct 16	- Output all sensor data	J, T, A
7 – Oct 22		- Calibrate all Sensors & integrate user specification data	J, T, A
8 – Oct 29		- Water flow control & report	J, T, A
9 – Nov 5		- GUI for data output	J, T, A
10 – Nov 12		- Testing & Debug	J, T, A
11 – Nov 19	Integration – Nov 20	- Full System Working & Testing	J, T, A
12 – Nov 26		- Final Testing & Deployment	J, T, A
13 - Dec 3	Project Completion – Dec 4	- Presentation Prep	J, T, A
14 - Dec 10	Presentation	Presentation	J, T, A