ECE 1000 Final Report: Automatic Plant Watering System

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Abstract

The Automatic Plant Watering System outlined in this report is meant to represent A combination of techniques. Ranging from mechanical engineering to physical electronics, and microcontroller programming to help create a more sustainable watering system. We start off with a Raspberry Pi Pico kit that serves to determine what we need to happen and when by storing our code onto the board. First off, we must determine our moisture level which is done by a moisture probe which will then determine if we need to get water to the soil. The water is then transferred using a DC water pump located separately from the soil but connected by a water tube. When the soil reaches the preferred stopping point the water will then cease to transfer. An LED can be found on a relay connected to the DC water pump which is meant to show if the system is on, which is helpful to its user. This report is meant to explain the design of this system, show its design, and go over how this can be implemented into agricultural fields.

Index Terms

Raspberry Pi Pico, Soil Moisture Probe, Relay, DC Water Pump, Tubes.

Introduction

The process of water distribution to plants can be difficult in cases with large quantities, but in the development process of the watering system, I looked for a way to help automate the plant watering process in a practical way. The project not only serves to help fix real world problems but also to promote the advancement towards a more sustainable world. The process and development of this project was conducted by Brian Mejia-Reyes.

Materials

1. Raberry Pi Pico: Is the main part of our circuit, it conducts the data processing and decides what occurs with the system.
2. Soil Moisture Probe: Is the component that determines how much moisture the soil has every interval, though the use of electrical conductivity.
3. Relay: Holds the current in the circuit that is meant to power the DC Water Pump. It does so by opening and closing the circuit electromagnetically, determined by the moisture reading.
4. DC Water Pump: Sends water though the tubes to help with the distribution process.
5. Tubes: Are the means of transportation for the water, which is sent by the water pump.

Diagram:

The diagram below is what depicts the similar setup I used to start the process of development. But the original creator had his Raspberry Pi Pico W while I used a Rasberry Pi Pico WH. This doesn't change much, however the diagram depicts the Raspberry Pi Pico attached to a breadboard, while mine was located separately.

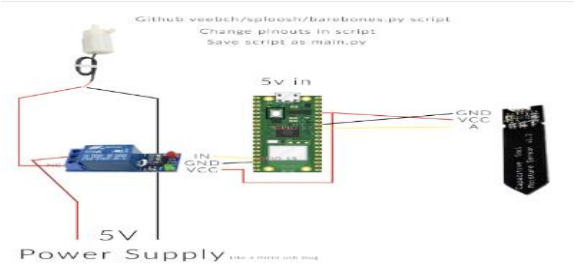

Figure 1: The physical circuit simplified

Full System:

The figure below shows my complete circuit, with one cup filled with cry soil, and the other filled with water and the DC Water Pump. One minor difference between my circuit and the one from Figure 1 is that I used a 9-volt battery, while they used a 5-volt power supply. Which only changes the rate at which the water is delivered.

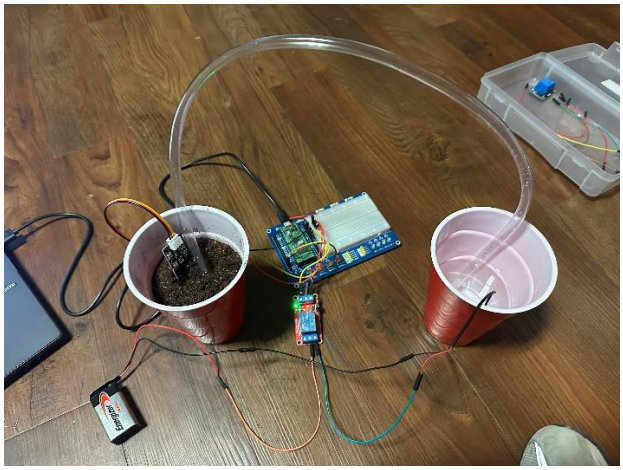

Figure 2: My complete circuit

Functionality

The Raspberry Pi Pico serves its purpose by communicating to component what it needs to do and when to do so. Each component has its separate pins that are connected to the pins. For example, the ADC pin is an analog to digital converter, that has the moisture sensor converted to a certain signal for the other components to read.

When the moisture sensors output is received, the Raspberry Pi Pico determines whether if it falls below the determined moisture. In my case if the moisture sensor detected anything below 30 percent dryness the water pump would be told to deliver water to the soil until the desired level was reached. Even after the water has been delivered the moisture sensor will continue to show the output values of the moisture and will continue to add water if it again falls below the threshold, the user doesn't have to restart and run the program again.

Discussion and Results

The automatic plant watering system showed successful results, as the water would continue to be delivered to the soil even without stopping the program. However, this can still be progressed to be even better by waterproofing all the wires to avoid any problems if any wires to be splashed by any water.

Conclusion

Through the use of the Raspberry Pi Pico, a DC Water Pump, Tubes, Moisture Sensor, and python code the Raspberry Pi Pico was able to connect all the components and create a system that creates a sustainable and efficient hydration system for plants.

References

[1] Collin Chidiac (2024) Automatic Raspberry Pico W watering System Automatic Raspberry Pico W Watering System : 7 Steps - Instructables

[2] JCWilliam1003 (2024) ECE 1000 Soil Moisture Sensor Example JC Williams GH