# CS/EE 120B Custom Laboratory Project Report

## Plant Saver

Angelica Simityan

June 9, 2022

## Introduction

The purpose of the “Plant Saver” is to have a system that ensures that your plant is watered the perfect amount; not too much and not too little so that your plant does not die. When you go to water your plant, there will be a humidity sensor that can tell how humid the environment around your plant is so it will know how much you just watered your plant. There will be a display screen that will show/tell you the amount of humidity in the environment as well as tell you if you need to water your plant more if the humidity levels are too low; but, if the humidity levels are too high, it will tell you and it will immediately turn on the fan that will decrease the humidity in the plant’s environment. There will also be LED strip lights that will turn on when your plant is there to ensure your plant is getting some form of light. The system with the humidity sensor, fan, and the one with the lighting will all be running only if there is a plant in the environment; which there will be another ultrasonic sensor that will be able to tell if there is a plant in the environment and then it will turn on the switch to run all these systems if there is and turn off the switch if there is not. In short, the “Plant Saver” will make sure your plant gets lighting and the right amount of humidity and water so that your plant will survive and thrive.

The baseline version of “Plant Saver” will have to include the complexities in order for the project to work. There will be a foam box where you would place your plant so that it can be in its own environment and have all the systems running for it, which are the lighting, watering, and humidity systems. When you go to water your plant, there will be a humidity sensor that can tell how humid the environment around your plant is so it will know how much you just watered your plant. This will be done by using the DHT11 Temperature/Humidity Sensor, which will be placed near the plant to do its detection (complexity 1). There will be a display screen that will show/tell you the amount of humidity in the environment as well as tell you if you need to water your plant more if the humidity levels are too low; but, if the humidity levels are too high, it will tell you and it will immediately turn on the fan that will decrease the humidity in the plant’s environment. This means that the humidity sensor will do its detection and send its results to display them on the screen for the results and it will have it written in words to output the saying of whether more water is needed, less is needed and the fan will turn on, as well as display the humidity amount. The fan will be spinning due to the 3-6V

motor and the motor will be controlled by the L293D motor controller (complexity 2). The fan will spin until the humidity levels go down to the normal amount, which will be detected by the humidity sensor. There will also be LED strip lights above the plant's environment that will turn on when your plant is there to ensure your plant is getting some form of light. The system with the humidity sensor, fan, and the one with the lighting will all be running only if there is a plant in the environment; which there will be another ultrasonic sensor that will be able to tell if there is a plant in the environment and then it will turn on the switch to run all these systems if there is and turn off the switch if there is not. Ultrasonic sensor HCSR04 will detect if there is a plant in the environment because it will detect if there is a plant in the box due to its distance detection of something being there (complexity 3). This will then tell the systems to work. The relay will turn the systems on when the ultrasonic sensor detects that there is a plant in the environment.

The only thing I was not able to use that was not a major component of this project and it was not a complexity was the 5V relay because I realized I had to sauter in order to connect it to the breadboard or wires and I did not have the tools nor the experience for that. I instead used a 9V battery 6F22.

# Complexities

1. 3-6V motor controlled by the L293D motor controller that will control the fan and spin it to reduce the humidity if the humidity in the environment is too high for the plant
2. Ultrasonic sensor HCSR04 that will sense if there is a plant in the environment to then know if it should turn on the systems or if the plant is not there to have teh system off
3. Humidity sensor DHT11 that will detect the humidity in the plant's environment and know to have the fan turn on if needed and what humidity to display on the screen for the user

All 3 complexities were successfully completed. The fan turned on and worked/spun when it was supposed to. The ultrasonic sensor detected if the plant was there and ran the system and it turned off the system when the plant was not there. The humidity sensor would accurately detect the humidity of the plant's environment and it would increase when I watered the plant and decrease when the fan was on.

# User Guide

The user would first have to place a plant in the allocated location on top of the white box so the ultrasonic sensor would sense that the plant is there in the environment so it can run the entire system for it. The ultrasonic sensor would be an input. When the plant was not there the display screen would say “Plant not there”. The display screen is an output. Then, when the ultrasonic sensor senses that the plant is in the environment in its spot, it will turn on the LED strip lights so that the plant can get the light it needs to flourish and for the user to be able to see everything in the environment. The 9V LED strip lights would be an output. The humidity sensor senses the humidity of the plant’s environment and will display on the screen the humidity in the environment. The humidity sensor is an input. The humidity sensor, based on the humidity it detects in the environment, will tell the user to water the plant by displaying “Water me” on the display screen when the humidity level is too low in the environment for the plant to thrive. The user will then know to water the plant. If the user waters the plant too much, the humidity sensor will detect that the humidity is too high in the environment for the plant, so it will display “Too wet” on the screen and it will turn on the fan so that it can lessen the humidity in the environment for the plant. The fan/motor/motor controller are outputs. The fan will run until the humidity is at a regular humidity level in the environment and the humidity sensor will sense that the humidity level is good and normal for the plant so it will display “Regular” on the screen so the user will know to not water the plant or do anything and that the plant is in a good thriving environment.

The whole system/project is for the user to be as hands off as possible. All the user has to do is water the plant, but the system will tell it when to and it will take care of the plant if it was watered too much by lowering the humidity in the environment with the fan. The system is made to create and keep a good environment for the plant to survive and thrive in and so that the user does not have to worry about the plant as much when they are busy.

# Hardware Components Used

Computing
- Elegoo UNO R3 microcontroller

Inputs
- Ultrasonic sensor HCSR04
- Humidity sensor DHT11

Outputs
- Fan blade
- 3-6V motor
- L293D motor controller

- 9V battery 6F22 (Piscell brand)
- Display screen
- Led strip lights 9V

# Software Libraries Used

- https://www.brainy-bits.com/post/how-to-use-the-dht11-temperature-and-humidity-sensor-with-an-arduino

I downloaded the DHT_Library.zip from the above website. I needed this library so that the DHT11 Humidity Sensor would function and work since there was no Humidity sensor DHT11 library so it did  not recognize any of the code or was able to accurately run or read the humidity of the plant's environment so I would know if the plant needed to be watered, or if the environment was regular, or if the environment was too wet so the fan could turn on to lower the humidity of the environment for the plant.

- https://create.arduino.cc/projecthub/abdularbi17/ultrasonic-sensor-hc-sr04-with-arduino-tutorial-327ff6

I used this website to understand how to make the ultrasonic sensor's code work and how it functioned, but this is not a library. I used it to understand and be able to write my code for my project specifically to do what I needed.

# Wiring Diagram

I also have the pin numbers for each complexity written in the image that is found under the section called "SynchSm Diagrams".

Sharp Lines
SURFACE
#2090
Ultra S
MULT

#209
98 Ultra S/
MULT
20

PKCELL
9V
6F22

Ultra Sharp
#209
Ultra Sharp
Ultra Sharp

9V
6F22
Extra heavy duty
PKCELL
Green energy, easy life
MERCURY & CADMIUM FREE

ELEGOO
UNO R3
DIGITAL (PWM~)
POWER
ANALOG IN
www.elegoo.com

VSS VDD V0 RS RW E D0 D1 D2 D3 D4 D5 D6 D7 A K
1
16

40
45
45
50
60
60
+ −
a b c d e f g h i j
+ −

Ultra S
MUL
VSS VDD VO RS RW E D0 D1 D2 D3 D4 D5 D6 D7 A K
a b c d e

# Task Diagram

# SynchSM Diagrams

The period is 500ms for everything/ the entire project and system.

While working on my project, I made a couple SynchSM diagrams for the tasks, which was for each complexity. I made a SynchSM diagram that combined the functionality of the ultrasonic sensor, display screen, fan/motor, and humidity sensor. The smaller SynchSM diagram is for the LED strip lights.

When I made these diagrams, I did not write the code intricately for each SynchSM diagram. I just wrote it to get an understanding of my project and how I wanted everything to work and how I wanted everything to work together and when I wanted it to do a certain thing.