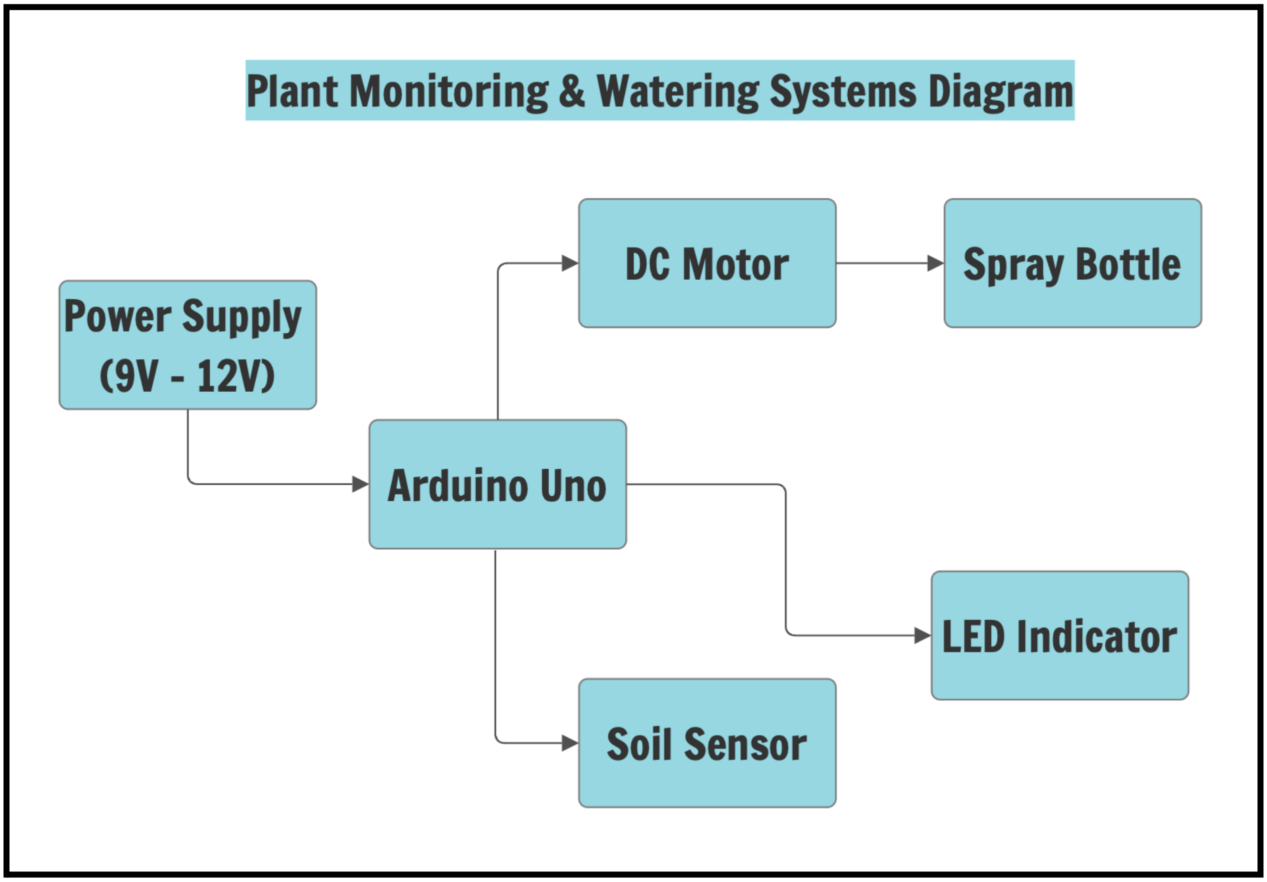
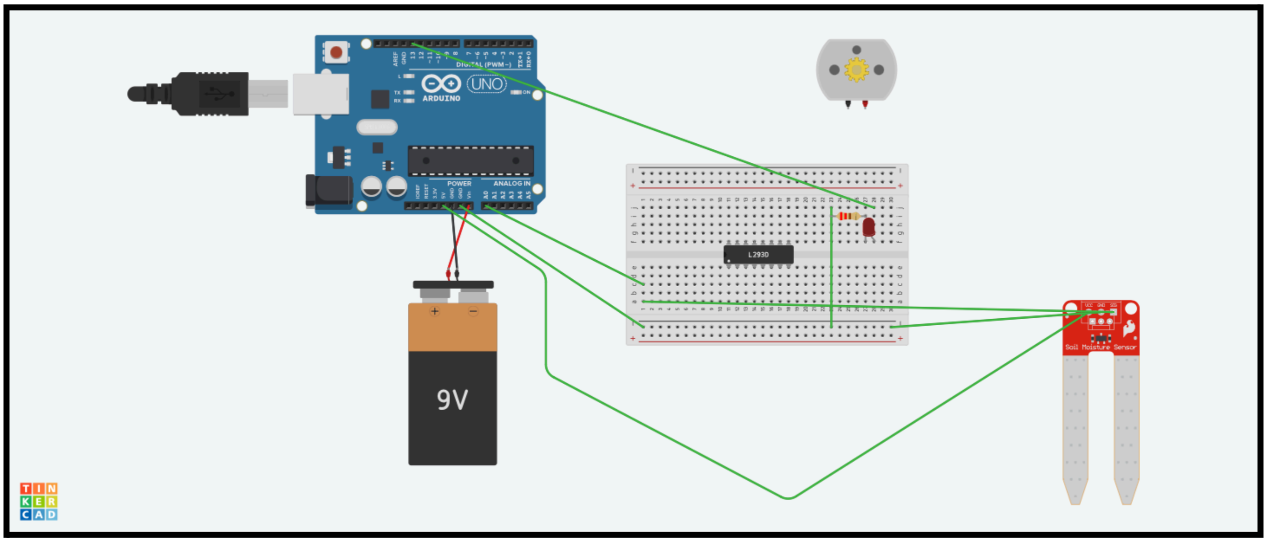
Homework 1: EECS Prompt

Systems Diagram



The power supply is 9-12V because of what is required to power the Arduino, Motor, Sensor, etc. as well as the voltage that comes from the adapter connected to the wall. I chose to connect the Arduino to a DC motor because it is sufficient to move the spray bottle when needed. This motor can be attached to a lever to push the spray bottle and should be easy to integrate with Arduino. Then, I chose a soil moisture sensor to directly solve our problem. This sensor will be connected to the Arduino and can tell when the soil is too moist or too dry. This is important information that will determine whether the spray bottle needs to be pushed. Lastly, I simply added a connection to an LED Indicator to tell when the system is ON/OFF. Some other considerations may be temperature sensors etc.. this would probably be an overkill for this specific project.

TinkerCAD Simulation



**Note: I tried to figure out how to connect the DC Motor properly and found an H-bridge motor driver on TinkerCAD. I think that could be useful in connecting the motor, but could not figure out how to integrate it. Would love to discuss this further sometime to learn about it.

In the above image, the 9V (assume its a wall adapter) is connecting directly to the Arduino. The Soil Moisture Sensor is connected to the 5V and GND pins. The LED Indicator is also connected to GND through a resistor.

Data Analysis & Key Points for Analysis

So far, we have built something that continuously collects data, outputs sensor readings, and controls the water delivery. Some of the data outputs we can analyze and consider are:

1. Soil Moisture

This is the main data point, telling us how the soil moisture changes over time with the plant being sprayed when the moisture drops below a threshold

2. When the Motor is active

This can tell us how long the spray usually goes on until the moisture changes

3. How long the spray occurs

This data point combined with (3) can be used to automate the water spraying process

4. LED durations

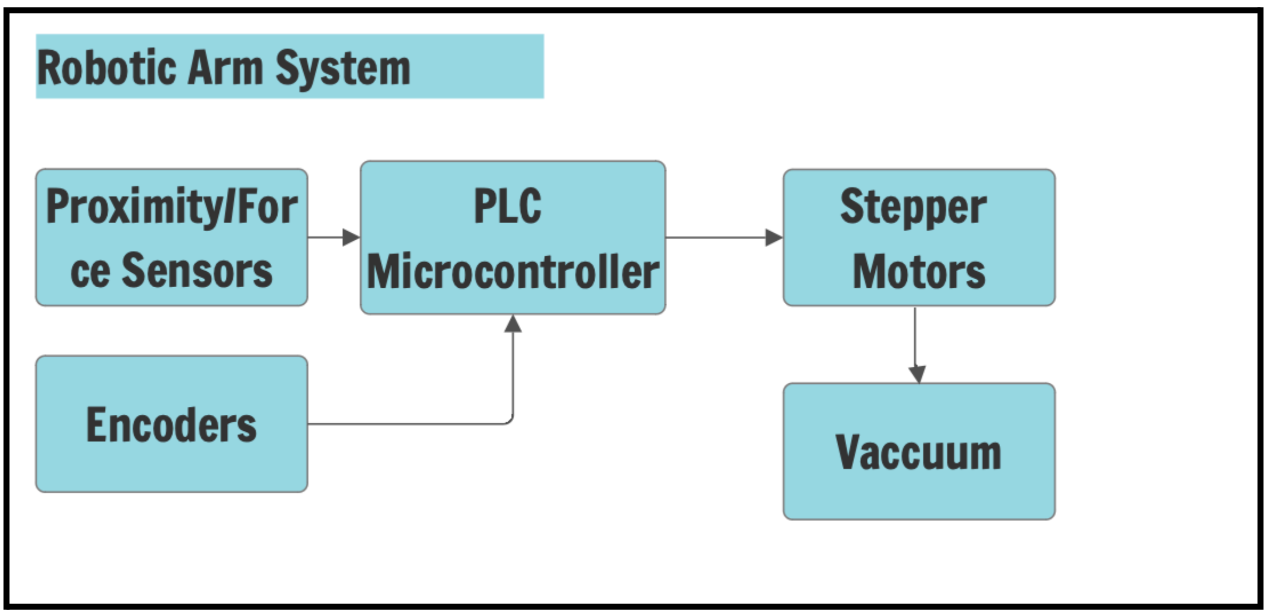
This data point can tell us how long the system is on and/or monitor power supply health

Essentially, these data points can eventually be used and analyzed to automate this process. Some other things to consider will be the environment (whether the plant is placed in direct sunlight and/or how the sunlight pattern changes over the season), efficiency of water usage, and how to engineer a failsafe for when things go wrong.

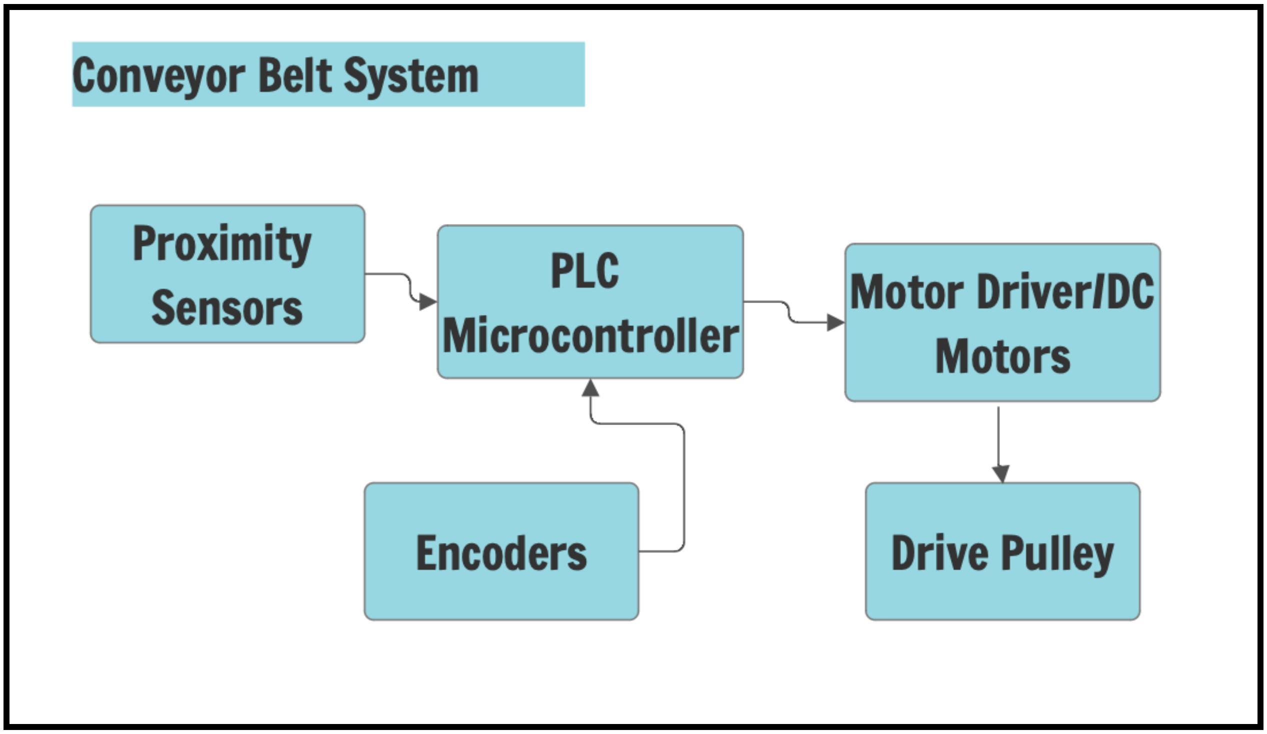
Homework 2: Mechatronics

Sensors & Actuators
Actuator: This could be the motors on either side of the beams because they will move based on signal and whether or not a piece needs to be moved/placed/picked up
Sensor: This could be the tracking cameras and track the location of the robots?

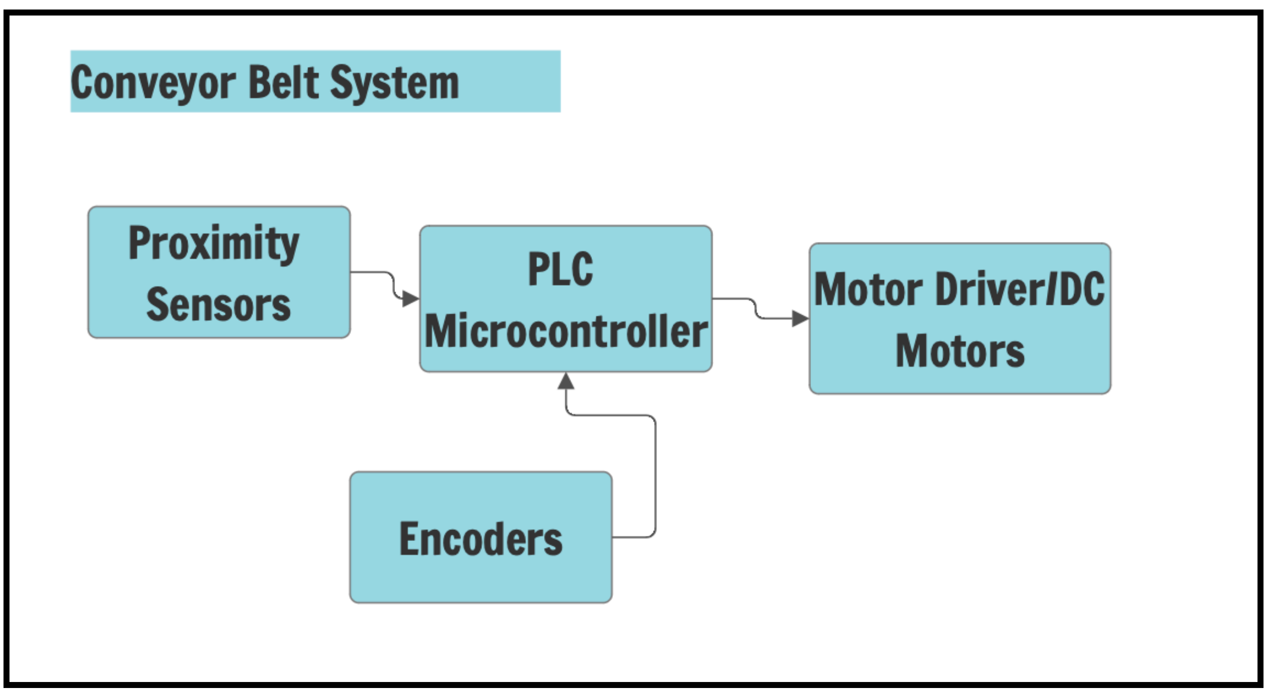
Design Challenge #1
Robotic Arm Mechanical Design
- Actuators: Stepper Motors (as shown in the slides)
- Some sort of vacuum to grip the objects (as shown in the video)
- Sensors: A camera or LiDAR sensor (for object detection), force sensor, encoders on motors, distance sensors (for motion)
- Microcontroller (for real-time control)
- CANBus communication (not sure about communication, haven't really learned yet)



Design Challenge #2
Conveyor Belt Mechanical Design
- DC Motors (for movement)
- Pulley System: Would have a drive pulley
- Sensors: Proximity sensors (belt alignments), Maybe some sort of encoder?
- PLC Microcontroller (for real-time control as shown in the slides)
- CANBus communication (not sure about communication once again, haven't really learned yet)



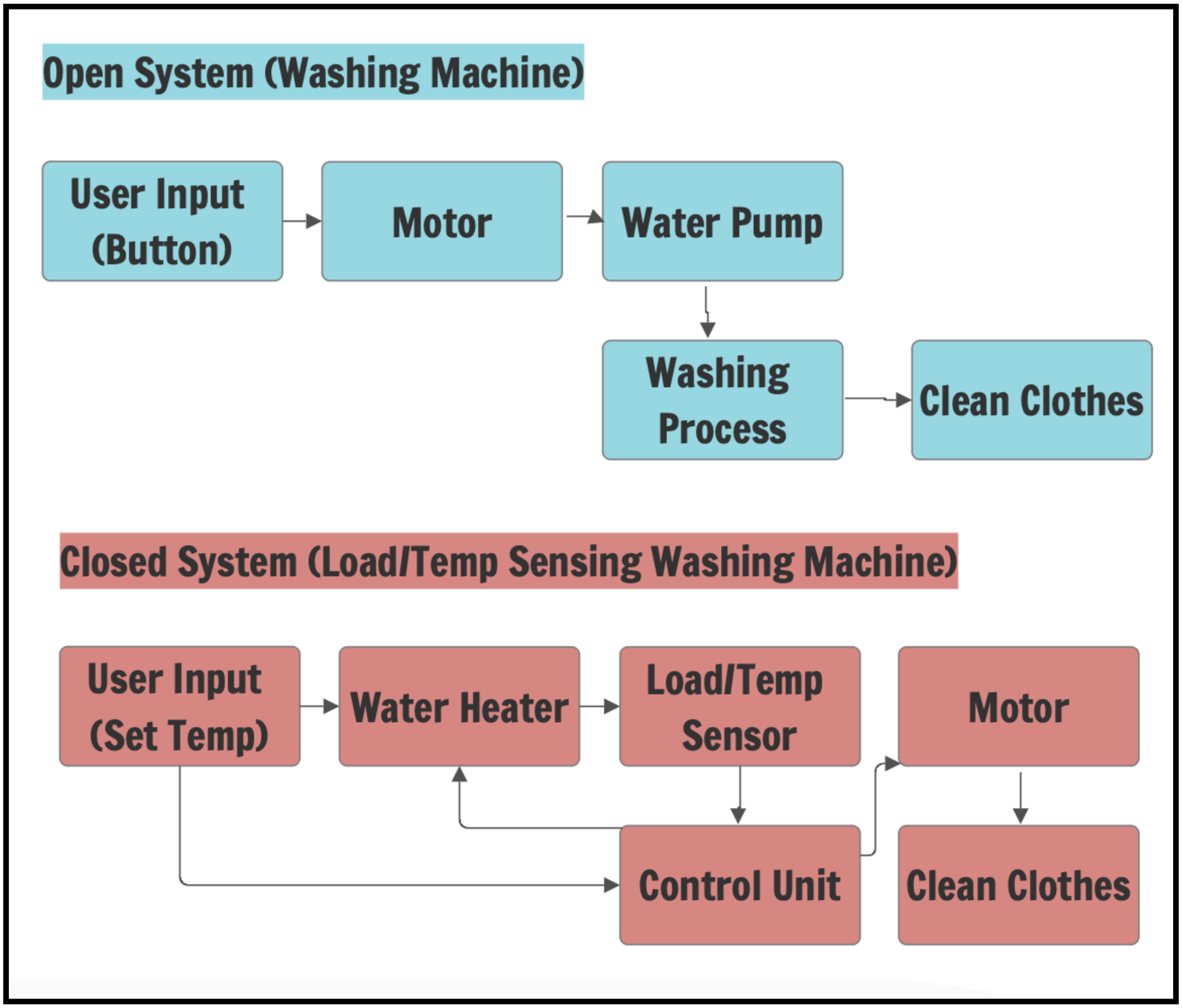
Major revision:



Controls Questions

1. Open-Loop & Closed-Loop Control Systems

a. An open-loop system does not take feedback. It acts on some set of instructions. A closed-loop system has feedback and uses it to adjust its instructions and processes. In this way, a closed-loop system is more accurate.
b. An example given during bootcamp of an open-loop system is a washing machine that runs only one fixed cycle vs a closed-loop system would be a washing machine that senses load and adjusted temperature accordingly.



<u>Open-Loop System</u>
This system is a simple, directed, flow. As shown in the blocks above, the user inputs their cycle choice and the system executes in the flow of blocks shown above.

<u>Closed-Loop System</u>

On the other hand, this system is more bidirectional. The user will choose a temperature and input their laundry. Based on how big their load is and/or what temperature they want it, this system will keep checking and monitoring temperatures and adjust accordingly. This is how a closed loop system takes feedback and reacts.

2. Positive Feedback

Positive feedback in closed-loop systems is something that augments or increases the response to deviate away from the original instructions.

3. My Closed-Loop Control System

In order to successfully design this control system, we want to make sure that the speed is maintained irrespective of outer factors and conditions. I looked at the example in the slides as reference for this part of the homework. I noticed that the diagram from the slides included a PID Controller and motor, all important parts to our own solution. For my closed-loop system, first you would have a set desired speed. This desired speed can be inputted by the user. Then, I would have a Controller (PID?) to process the input and compare the speed with desired speed. Then the Motor Driver would power the Electric Fan Motor accordingly. The Feedback Loop here would keep updating the controller to keep the desired speed constant irrespective of outside conditions. The sensor in this system would be a speed sensor.