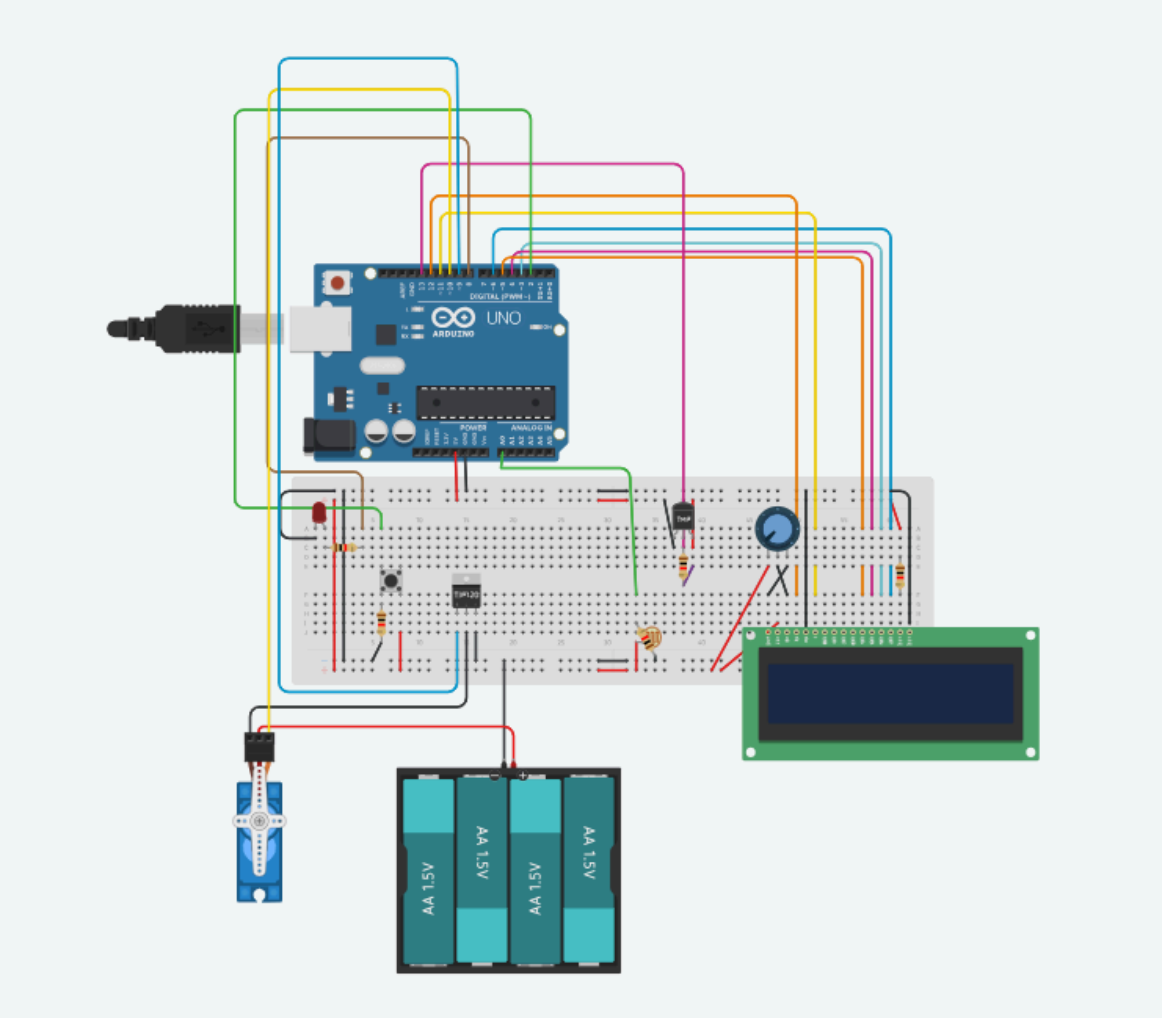
GREENHOUSE MANAGEMENT SYSTEM V3

Problem Statement

There is a need for an expansive greenhouse plant care system that would address issues of temperature control and light management. Many systems are not connected together and do not provide visual indications of temperature or light. This system records the current values of these variables, while also writing into memory the lowest and highest values. A servo has been added to perform a sweeping motion whenever the temperature becomes too high.

Design



The Arduino Uno R3 microcontroller is connected to multiple sensors, an LED light and a servo:

- DS1820 TO92 digital temperature sensor
- Photoresistor
- LED light
- LCD display
- Button
- 4xAA batteries
- TIP120 transistor
- Servo motor

There is an LCD display that shows the current value of the measurements. The values can be cycled through by pressing the button. The button cycles between the current temperature, current light level, highest and lowest temperature and then highest and lowest light.

Pin definitions:

- Temperature Sensor (DS18B20) - Digital 13
- Light Sensor - Analog A0
- LED Output - Digital 8
- Button Input - Digital 2
- TIP Output - Digital 9
- Servo Output - Digital 10
- LCD RS - Digital 12
- LCD Enable - Digital 11
- LCD D4 - Digital 5
- LCD D5 - Digital 4
- LCD D6 - Digital 3
- LCD D7 - Digital 6

EEPROM layout

Address	Size	Name	Explanation
0	1 byte	Magic_Value	Indicates valid EEPROM data
1-4	4 bytes	highestTemp	Highest recorded temperature
5-8	4 bytes	highestLight	Highest recorded light level
9-12	4 bytes	lowestTemp	Lowest recorded temperature
13-16	4 bytes	lowestLight	Lowest recorded light level
17-20	4 bytes	counter	Last display mode

Interrupt instructions:

1. buttonISR():

- Debounces button input (500ms threshold)
- Sets `buttonPressed` flag for main loop processing
- Uses `millis()` for software debouncing

2. Function: `ISR(TIMER2_COMPA_vect)`
- Increments counter variables
- Sets `sensorReadFlag` every 500ms
- Sets `displayUpdateFlag` every 500ms
- Sets ‘servoUpdateFlag’ every 15ms

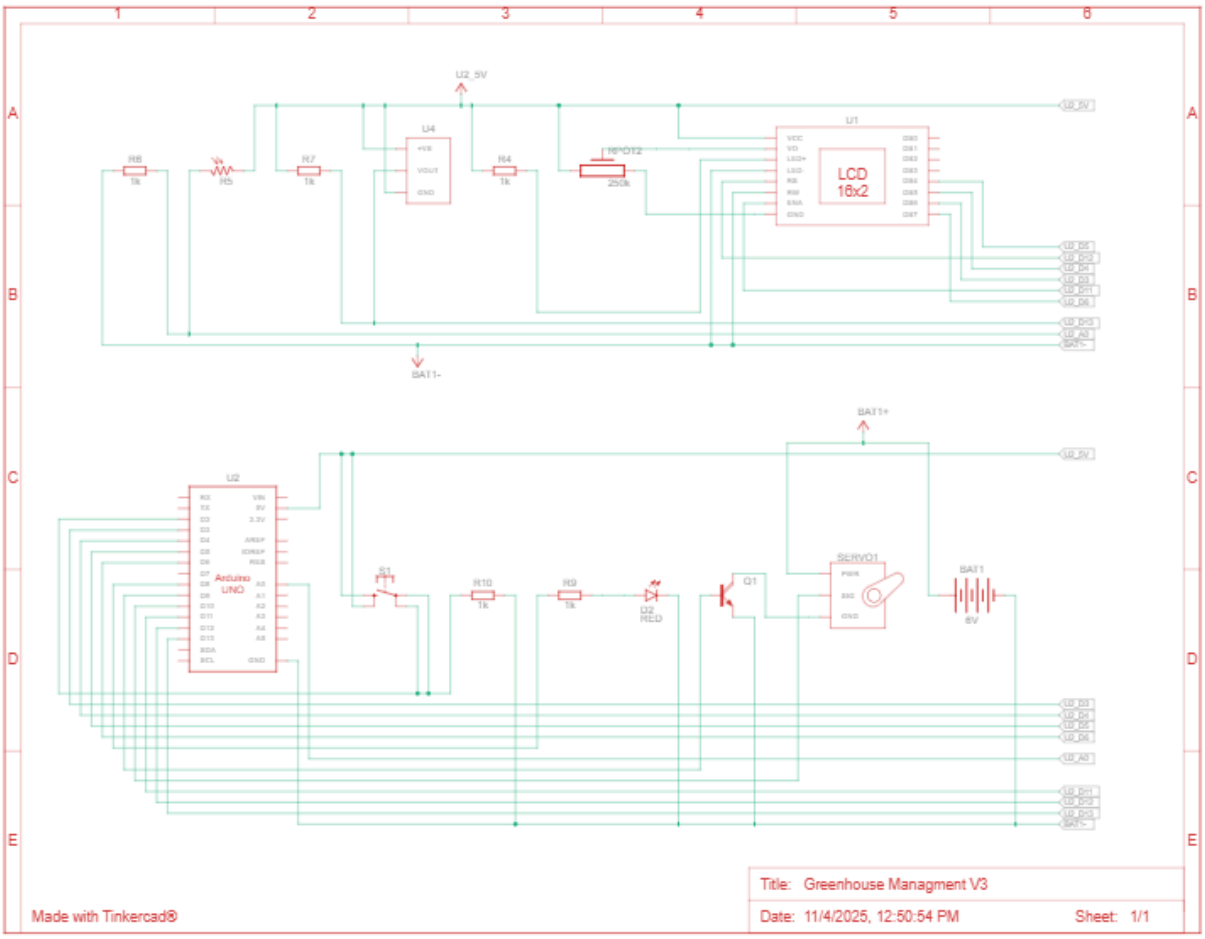
What works

The system successfully measures the values from the sensors and is able to write them to memory to survive a power reset. The LCD screen switches values by button press. The servo activates when the temperature reaches a certain value.

Future improvements

- Assuming that the light sensor would be in the same room as the plants, there needs to be a system that would make sure that the LED lights would not trigger the light sensor and create an ON/OFF loop.
- A DC motor might be better for this task rather than a servo motor.

Schematic


LCD
16x2
Arduino
UNO
SERVO1
Q1
D2
RED
6V
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Components list

Name	Quantity	Component
U1	1	LCD 16 x 2
U2	1	Arduino Uno R3
R4 R6 R7 R9 R10	5	1 kΩ Resistor
Rpot2	1	250 kΩ Potentiometer
R5	1	Photoresistor
U4	1	Temperature Sensor [TMP36]
D2	1	Red LED
S1	1	Pushbutton
Q1	1	TIP120
Bat1	1	4 batteries, AA, no 1.5V Battery
SERVO1	1	Positional Micro Servo