SASTA OLIPHANT SCIENCE AWARDS

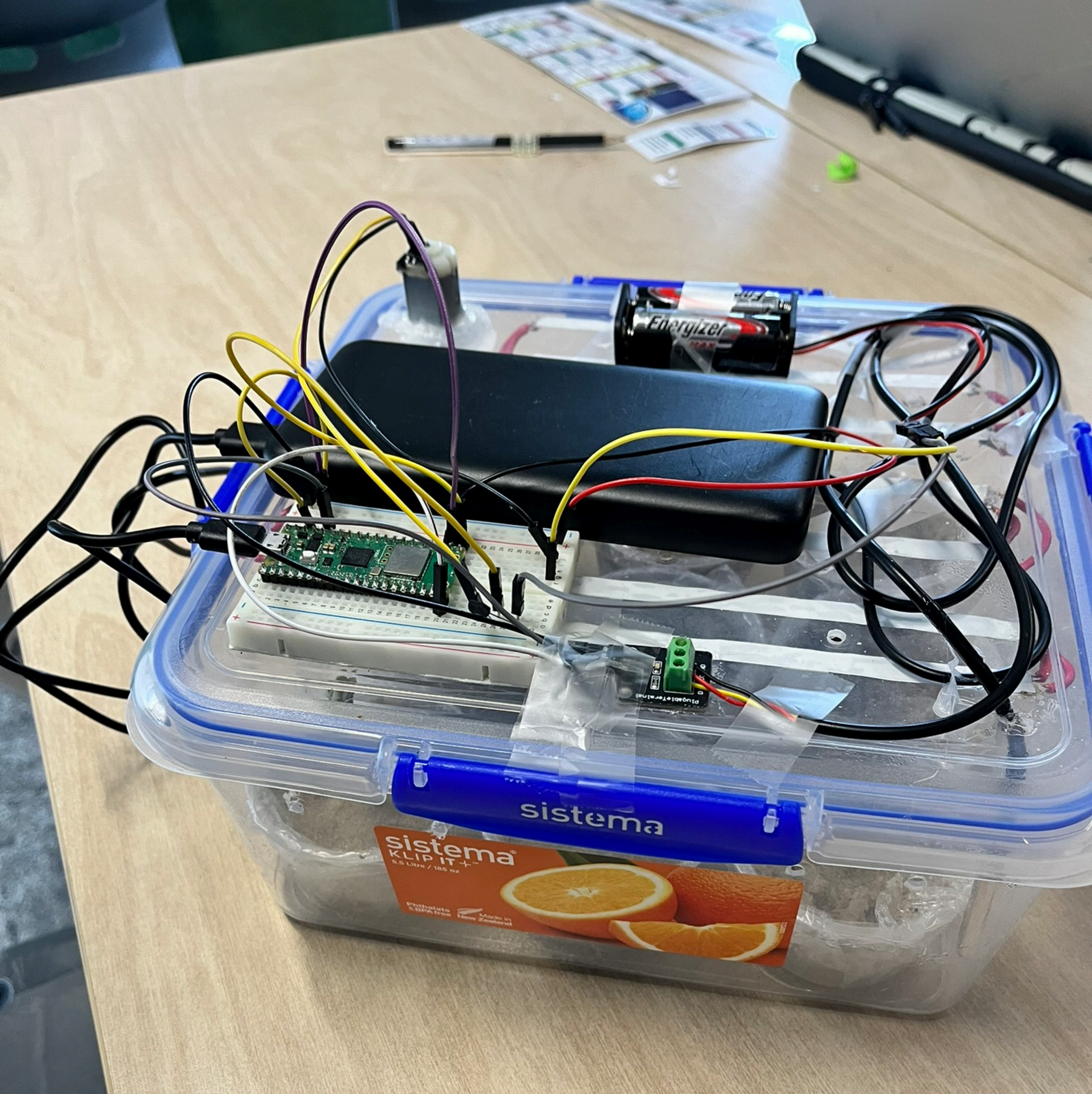
Prize Winner

Programming, Apps & Robotics

Year 11-12

Brendon Ngo

Thomas More College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Controlling Greenhouse Temperatures

Year 11, Thomas More College

The aim of this is to test how controlling the temperatures of a green house can have an effect of the growth of plants, in this experiment we will be using water spinach as our plants, which grow at a optimal temperature between 20-30 degrees Celsius.

Through the use of a Raspberry PiPico W, the program will be saved within the Pipico and runs on CircuitPython, which saves all code to the PiPico. It will automatically run as long as there is power supplied to the PiPico. From there the sensors and motors will be able to do everything on their own, with the motor decreasing temperatures, the LDR watching over how much light is emitted once reaching a certain darkness the Grow light strip will turn on, once day the light will be turned off. Currently this technology is being used in farms around the world mainly in regions of extreme climates and is used to grow plants as a sustainable source of food.

To be able to get my program to work, you will need to have a laptop that has a copy of mu editor and the Pipico is plugged into the laptop via a micro usb to usb a cable. From there you need to switch mu editor into circuitpython and open the code.py file on the Pipico, from there you press serial, and it will run on its own and it will display how the plants grow.

Pseudo code:

Import one wire bus

Import board

Import time

Import digitalio

Import analogio

WHILE true:

    Read LDR

    If LDR less than 600

        LED on

    Else

        LED off

    Read temp

    If temp > 30

        Fan speed = 100

    If temp < 20

        Fan speed = 0

    Else

Fan speed = 50

EndWHILE

Code:

```
This section imports all the tings needed from the library, that being time, the board, the input and output, and the temperature sensor library which is from a Adafruit electronics which has it's own circuit python library.
import time
import board
import digitalio
import analogio

from adafruit_onewire.bus import OneWireBus
from adafruit_ds18x20.adafruit_ds18x20 import DS18X20

 Here we announce the variable names (each input and output that being the temp sensor, the motor and LED)
""" All components used for the temperature sensor which is a onewire """
# Choose the data pin (change GP15 if needed)
ow_pin = board.GP28
# Set up the 1-Wire buss
ow_bus = OneWireBus(ow_pin)


"""All lines to be able to activate and use the motor and the pin it is in"""
fan = digitalio.DigitalInOut(board.GP10)
fan.direction = digitalio.Direction.OUTPUT
"""All lines to be able to activate and use the LED strip"""
LED = digitalio.DigitalInOut(board.GP11)
LED.direction = digitalio.Direction.OUTPUT
"""All lines to be able to activate and have input from the LDR"""
# Define the analog input pin
ldr_pin = analogio.AnalogIn(board.GP26)
def read_ldr(analog_in):
  return analog_in.value

# Scan for sensors on the bus
devices = ow_bus.scan()
if not devices: - If there is no temperature sensor it will pop up with a message saying there is none.
  print("No DS18B20 sensor found!")
else:
        -       If there is a sensor it will do the below
  sensor = DS18X20(ow_bus, devices[0])  # Use first detected sensor
  while True:
    LED.value = True – The LED will turn on and stays on so that the plants get their share of red and blue light
    try:
      temperature = sensor.temperature – it will turn the raw data from the temperature sensor into a actual temp in degrees Celsius
      print("Temperature: {:.2f} °C".format(temperature))
    except Exception as e:
        -       If there is something wrong it will say it could not read the sensor
      print("Error reading sensor:", e)
    time.sleep(1)
    if temperature > 20: - this will check is the temperature is above 20 degrees, if it is then the fan that pumps air into the green house will be on.
      fan.value = True
    if temperature < 20: - if the temperature is less then 20 then the fan turns off and the plants will survive without the need of air pumped in
      fan.value = False
```

Sources, and help received by:

The raspberry PiPico was given to the me from Mr. A Knight who assisted in getting the transistor to run, and teaching basic electronics to me.

There were difficulties at the beginning of the project with the temperature sensor not functioning properly, which was then fixed within the code by Mr. T Nykke, and showed me how to get it running and assisted in the use of the original fan being a pc fan which failed, and so was switched to a DC motor.

Mr. N Ackan assisted in giving time to help in the end 3D design of the greenhouse and supplying resources to assist in making it.

Mrs. E Daniel put together the application to the OSA and helped in finding people to talk to about this project.

Sites used:

https://spiderfarmer.eu/blog/greenhouse-temperature-control/

https://charleysgreenhouses.com/news/best-greenhouse-temperature-control-techniques-to-help-your-plants-thrive-all-year-round/

https://seedmart.com.au/water-spinach/