Day 5 - Lab Report 1

Group 6
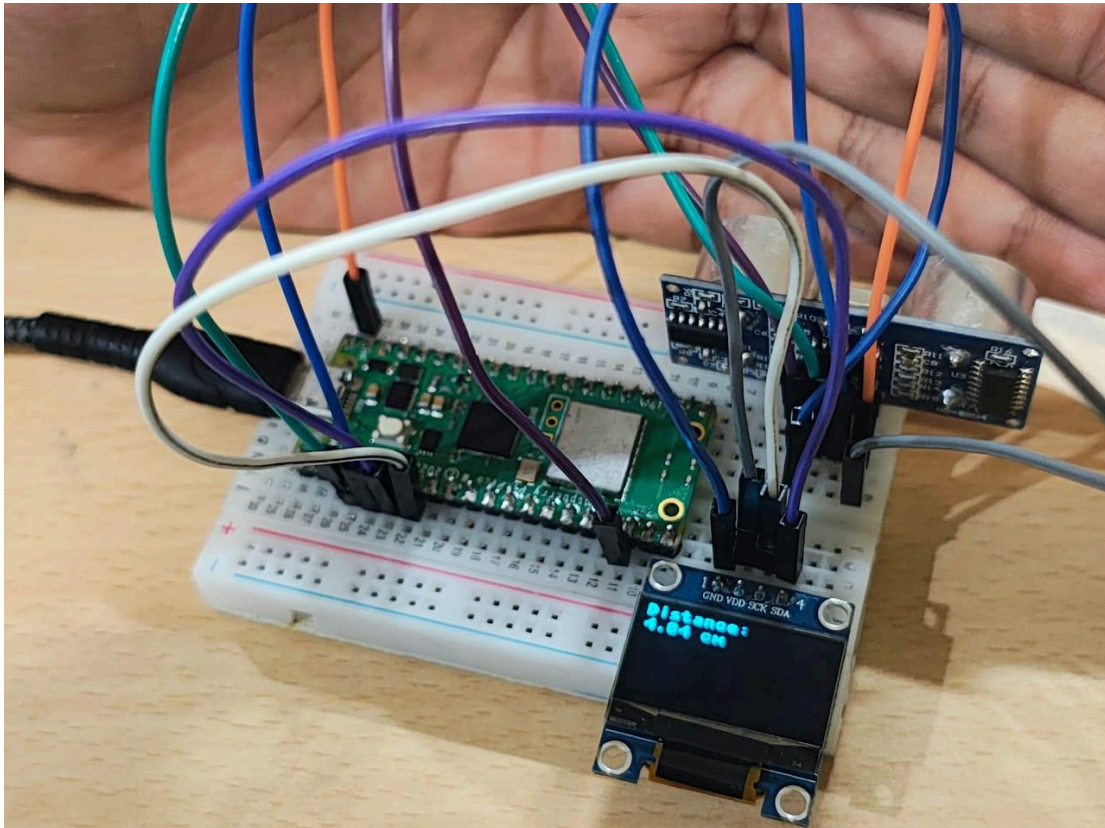
Title of the Experiment: Experiment with Ultrasonic sensor and OLED display

Objective: Measuring distance of an object with ultrasonic sensor and displaying it in OLED

Components Used:
1. Breadboard
2. Raspberry pi pico w
3. Ultrasonic Sensor(HC-SR-04)
4. m-m connecting wire
5. 16 bit display
6. PC to interface with Raspberry Pi
7. USB to B type connector

Image::

Code updates tested:

```python
from machine import Pin, I2C, time_pulse_us
import ssd1306
import time

# Define the pins for the ultrasonic sensor
trigger_pin = Pin(3, Pin.OUT)
echo_pin = Pin(2, Pin.IN)

# Initialize I2C for the OLED display
i2c = I2C(0, scl=Pin(5), sda=Pin(4))

# Initialize the OLED display
oled_width = 128
oled_height = 64
oled = ssd1306.SSD1306_I2C(oled_width, oled_height, i2c)

def measure_distance():
    # Trigger a pulse
    trigger_pin.low()
    time.sleep_us(2)
    trigger_pin.high()
    time.sleep_us(10)
    trigger_pin.low()

    # Measure the time for the echo to return
    duration = time_pulse_us(echo_pin, 1)

    # Calculate distance in cm
    distance_cm = (duration / 2) / 29.1

    return distance_cm

while True:
    distance = measure_distance()

    # Display the distance on the OLED
    oled.fill(0)
    oled.text("Distance:", 0, 0)
    oled.text("{:.2f} cm".format(distance), 0, 10)
    oled.show()

    time.sleep(1)
```

The applications identified where our circuit can be applied:

1. Automotive Industry

- Parking Assistance: Used in reverse parking systems to detect obstacles and alert the driver.
- Blind Spot Detection: Monitors areas around the vehicle to ensure no obstacles are present in blind spots.
- Collision Avoidance Systems: Helps in preventing accidents by detecting objects and vehicles in the vicinity.

2. Industrial Automation

- Level Measurement: Measures the level of liquids, solids, and powders in tanks and silos.
- Proximity Sensing: Detects the presence or absence of objects on production lines for automation processes.
- Robotics: Enables robots to navigate environments and avoid obstacles.

3. Medical Applications

- Ultrasound Imaging: Used for diagnostic imaging to visualize muscles, tendons, and internal organs.
- Therapeutic Applications: Utilized in physiotherapy for promoting tissue healing and pain relief.
- Fluid Monitoring: Measures the flow rate and volume of liquids in medical devices.

4. Consumer Electronics

- Gesture Recognition: Enables touchless control of devices such as smartphones and smart home systems.
- Distance Measurement: Provides accurate distance measurement for various applications like smart vacuum cleaners.

5. Agriculture

- Level Monitoring: Monitors the level of water in irrigation systems.
- Crop Monitoring: Used in drones to assess the health and growth of crops.
- Livestock Monitoring: Tracks the location and movement of animals.

6. Security and Surveillance

- Intrusion Detection: Detects unauthorized entry in secure areas.

- Automated Door Systems: Controls the opening and closing of doors based on the presence of individuals.

7. Environmental Monitoring

- Water Level Measurement: Monitors water levels in rivers, lakes, and reservoirs to prevent flooding.
- Weather Stations: Measures wind speed and other environmental parameters.

8. Home Automation

- Smart Home Devices: Controls lighting, heating, and other appliances based on occupancy and movement.
- Appliance Control: Integrates with home appliances to enhance user convenience and energy efficiency.

9. Navigation Systems

- Marine Navigation: Helps in navigating boats and ships by detecting underwater obstacles.
- Drone Navigation: Enables drones to navigate and avoid obstacles autonomously.

10. Sports and Fitness

- Motion Tracking: Used in wearable devices to monitor physical activities and exercise routines.
- Fitness Equipment: Enhances the functionality of exercise machines by tracking user performance and adjusting resistance levels.

Further enhancement in our work identified
In place of direct connection, we can do it using wifi module.