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Team 2

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Individual Progress

During this week's Sensors Lab, my primary contribution was testing and validating sensor interfacing code for both a potentiometer and an HC-SR04 ultrasonic distance sensor using an Arduino Uno. These sensors are potentially relevant to our hexapod robot project, where reliable sensing is important for leg position feedback, obstacle detection, and environment awareness.

To ensure stable performance before full system integration, I created two independent test circuits and integrate two Arduino programs to evaluate each sensor separately. After confirming their functionality and stability, I shared the tested code and wiring setup with my teammates so they could integrate the sensors into the team's main program.

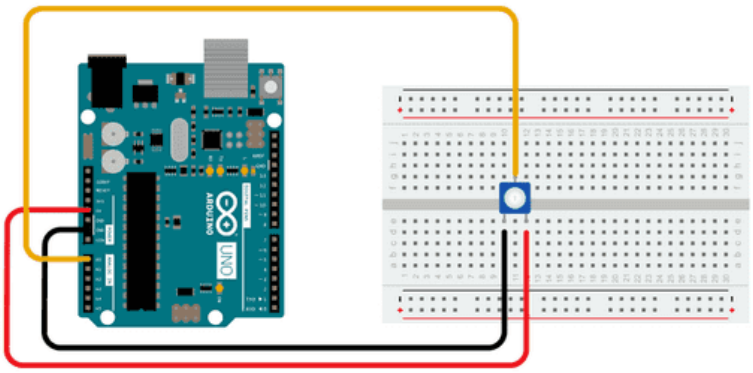
Potentiometer Testing

The potentiometer is an analog rotational position sensor that outputs a voltage proportional to its angular displacement. I constructed a dedicated circuit using a breadboard with the following connections:

- One outer pin → **5V**
- Other outer pin → **GND**
- Middle pin (wiper) → **Analog Pin A0**

The Arduino program continuously read the analog value using analogRead(A0) and streamed the values to the Serial Monitor. This allowed real-time observation of how rotation affected voltage output. The data range (0–1023) confirmed that the sensor was operating across its full measurable range.

```
void setup() {
  // put your setup code here, to run once:
  Serial.begin(9600);

}

void loop() {
  // put your main code here, to run repeatedly:
  int sensorValue = analogRead(A0);
  Serial.println(sensorValue);
  delay(1);
}
```



Ultrasonic Sensor Testing

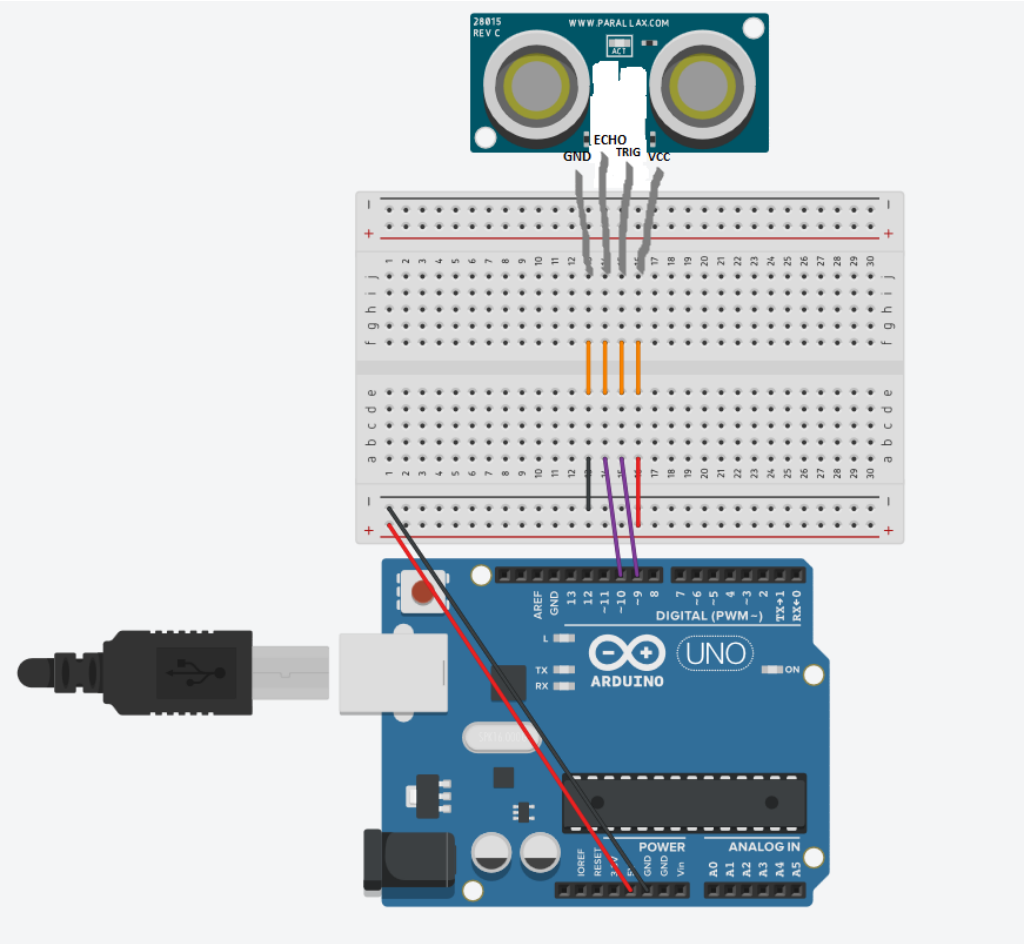
The HC-SR04 ultrasonic sensor is a digital distance sensor that measures the time delay between emitted and received sound waves to calculate distance. I set up a separate circuit with:

- **Trig → Digital Pin 9**
- **Echo → Digital Pin 10**
- **5V and GND** for power

The program triggered ultrasonic pulses and used pulseIn() to measure the echo duration. Distance was calculated using the speed of sound equation:

The measured distance values were displayed in centimeters on the Serial Monitor and compared with ruler measurements to verify accuracy.

```
const int trigPin = 9;
const int echoPin = 10;

float duration, distance;

void setup() {
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  Serial.begin(9600);

}

void loop() {
  digitalWrite(trigPin, LOW);
  delayMicroseconds(5);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

  duration = pulseIn(echoPin, HIGH);
  distance = (duration*.0343)/2;
··Serial.print("Distance:·");
  Serial.println(distance);
  delay(100);
}
```



Challenges

One issue encountered during potentiometer testing was incorrect wiring of the middle pin. Initially, it was mistakenly treated as a power/output pin instead of the **measurement (wiper) pin**, which caused abnormal resistance behavior where the minimum resistance appeared near the center. After correcting the wiring so that the middle pin connected to **Analog A0**, the output behaved linearly as expected.

Another minor challenge was ensuring stable serial output timing, which was addressed by adding short delays in the loop.

Relevance to Hexapod Robot Project

These sensors provide foundational capabilities for a hexapod robot:

- **Potentiometer:** can be used for joint angle feedback or calibration of servo positions.
- **Ultrasonic Sensor:** supports obstacle detection, navigation, and collision avoidance, which is critical for multi-leg robots operating in uneven or unknown environments.

Testing them individually reduced integration risk and ensured reliable sensor behavior before combining them with motor control and gait algorithms.

Teamwork & Integration

After validating both sensors, I provided the tested code, to my teammates. This allowed other members to work on UI development and multi-sensor code integration.

Plans

For the following week, I plan to research and compare different hexapod robot design configurations, focusing on leg mechanisms, servo placement, and structural stability. Our team will hold a meeting on Friday to evaluate several candidate hexapod designs and decide which configuration we will proceed with for fabrication and subsystem integration.