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Agriculture Maintenance & Crop Monitoring Drone

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TEAM SP23-07

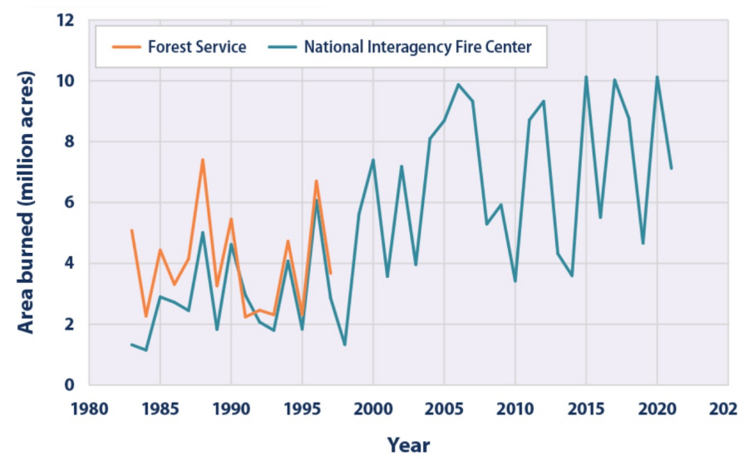
Abstract

Agriculture covers approximately 40% of the Earth's land surface and is an indispensable component of human survival. However, farmers are confronted with a myriad of challenges, including the menace of wildfires, suboptimal pest control, and insufficient water management. Wildfires threaten crops, resulting in substantial losses in revenue for farmers and food quality. Improper pest control can lead to excessive use of pesticides, which can inflict damage on crops and environment. Inadequate water management can cause a reduction in crop yields, wastewater, energy, and trigger pollution. Given the significance of agriculture, effective solutions to these challenges are critical to ensure the continued success of the industry.

Keywords: agriculture, wildfires, pest control, water management

Objective

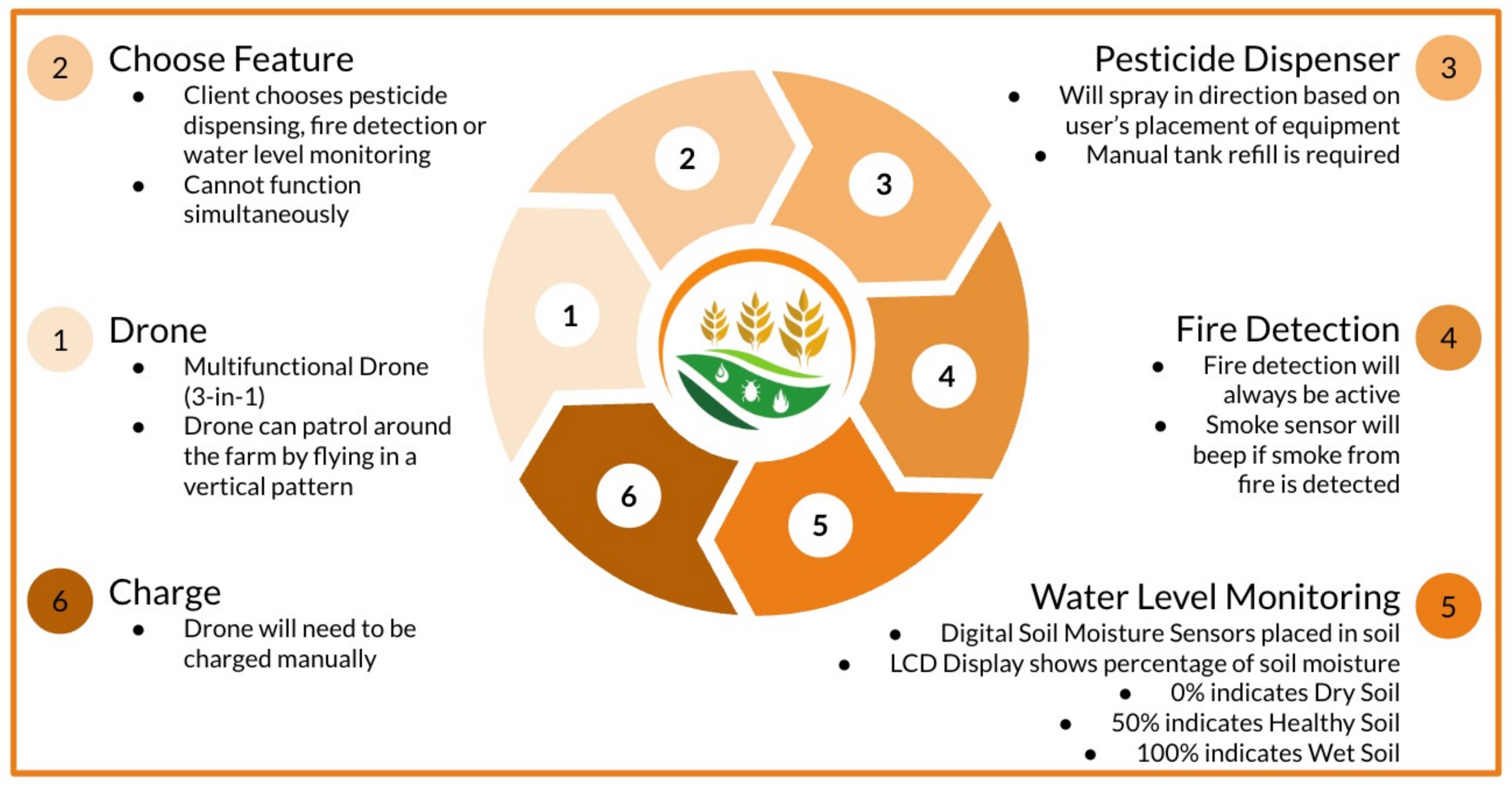
- ❑ Develop a multifunctional three-in-one drone that can:
  - ❑ Detect fires & providing alerts aurally with beeping sounds
  - ❑ Dispense pesticides
  - ❑ Monitor soil moisture to regulate water levels



Research Challenges

- ❑ Multi-Functional Drone
  - ❑ Lack of directions provided with drone kit
  - ❑ Yaw, pitch & roll adjustments, calibration & stability
  - ❑ Weight distribution of 3 features applied onto a single drone, including placement of Arduino & 9V batteries
  - ❑ Weather during testing process
- ❑ Pesticide Dispenser - Feature 1
  - ❑ Proper dimensions of hose, pump/motor & tank
- ❑ Fire Detection - Feature 2
  - ❑ Smoke sensor threshold & sensitivity with Arduino IDE software
- ❑ Soil Moisture Levels - Feature 3
  - ❑ Accuracy with soil moisture percentage readings
  - ❑ Soil moisture level thresholds (dry, healthy, wet)
  - ❑ In ADC (Analog-to-digital converter) peripherals & % values

Methodology



2 Choose Feature
- Client chooses pesticide dispensing, fire detection or water level monitoring
- Cannot function simultaneously

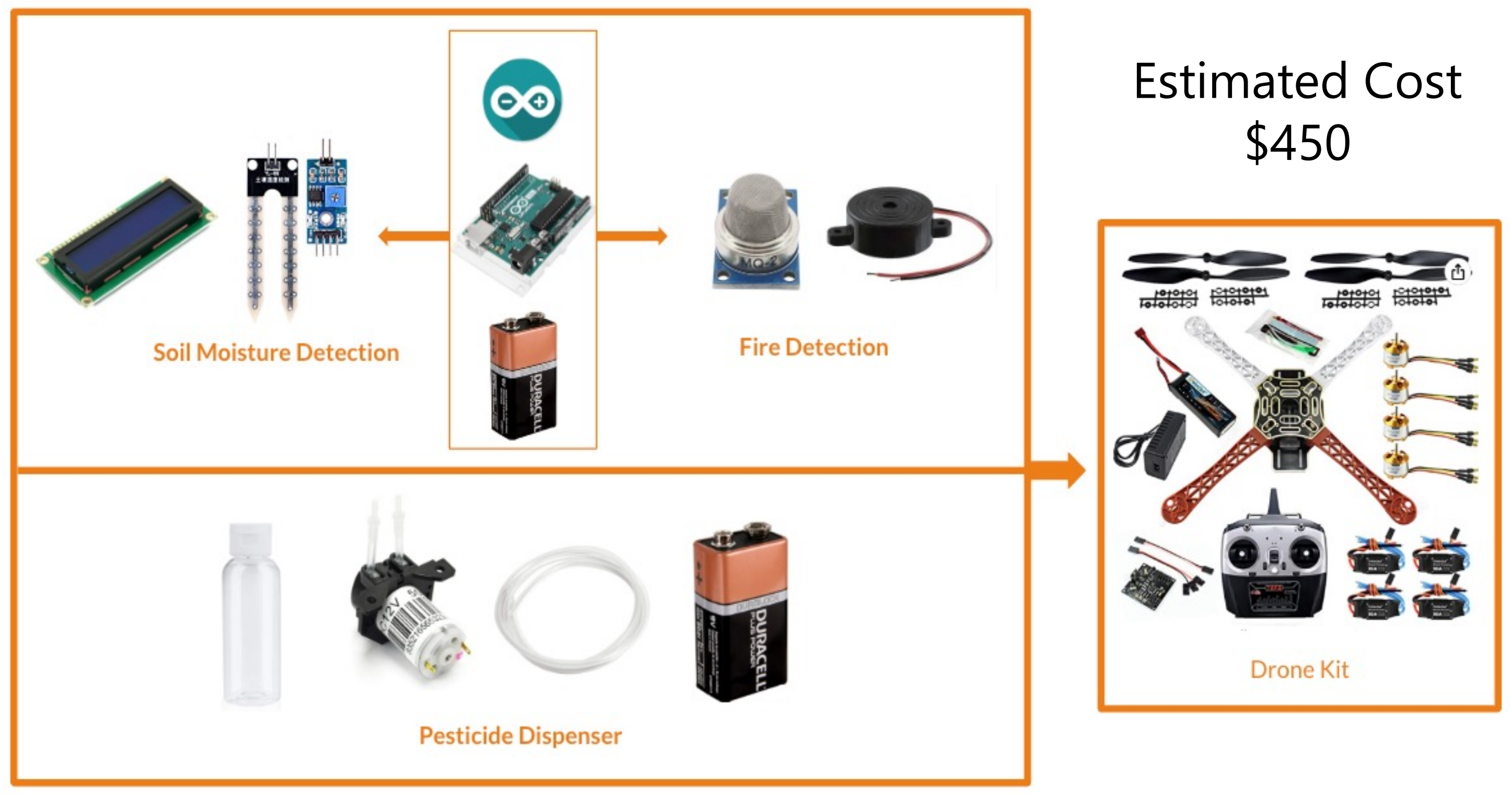
1 Drone
- Multifunctional Drone (3-in-1)
- Drone can patrol around the farm by flying in a vertical pattern

6 Charge
- Drone will need to be charged manually

3 Pesticide Dispenser
- Will spray in direction based on user's placement of equipment
- Manual tank refill is required

4 Fire Detection
- Fire detection will always be active
- Smoke sensor will beep if smoke from fire is detected

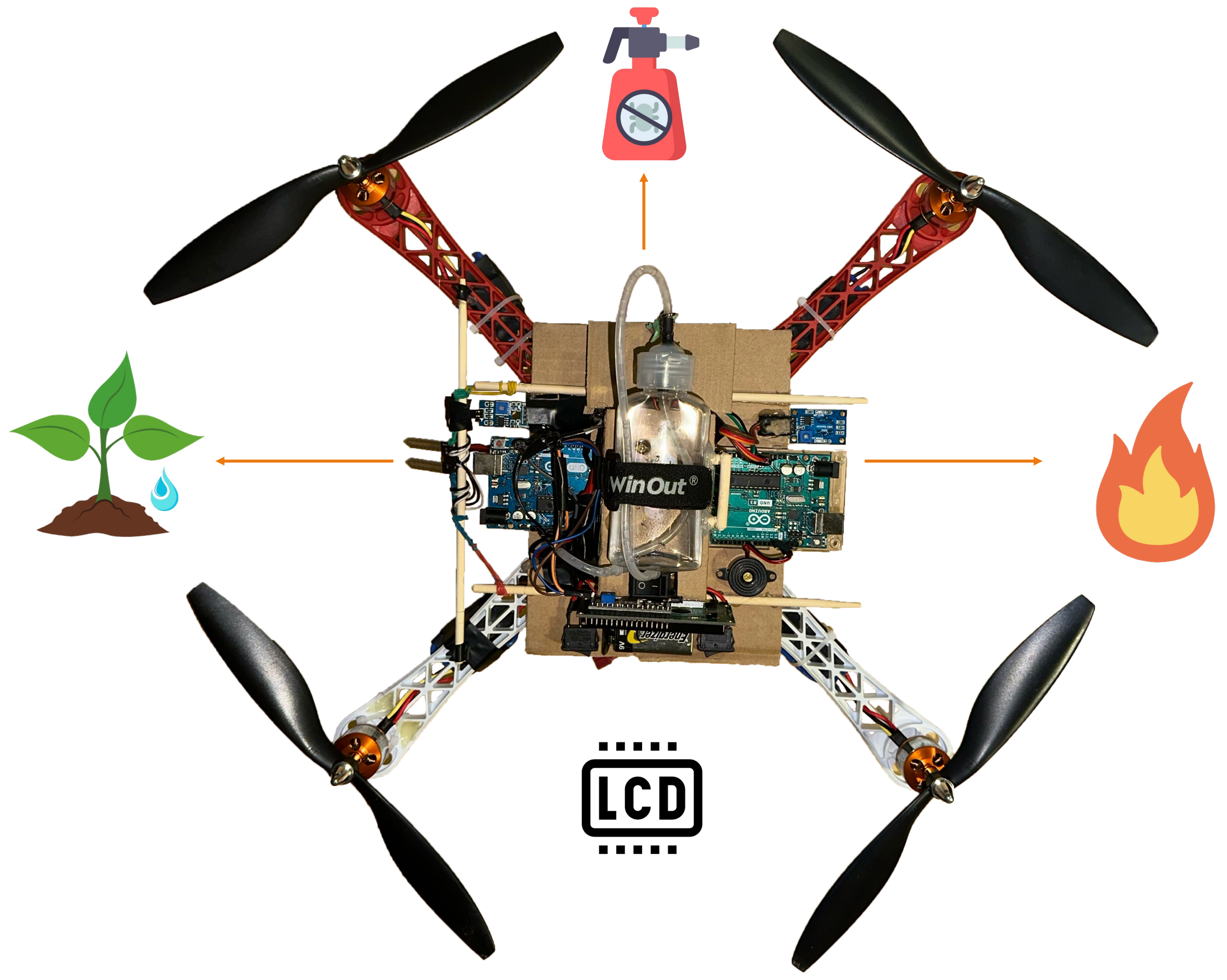
5 Water Level Monitoring
- Digital Soil Moisture Sensors placed in soil
- LCD Display shows percentage of soil moisture
  - 0% indicates Dry Soil
  - 50% indicates Healthy Soil
  - 100% indicates Wet Soil

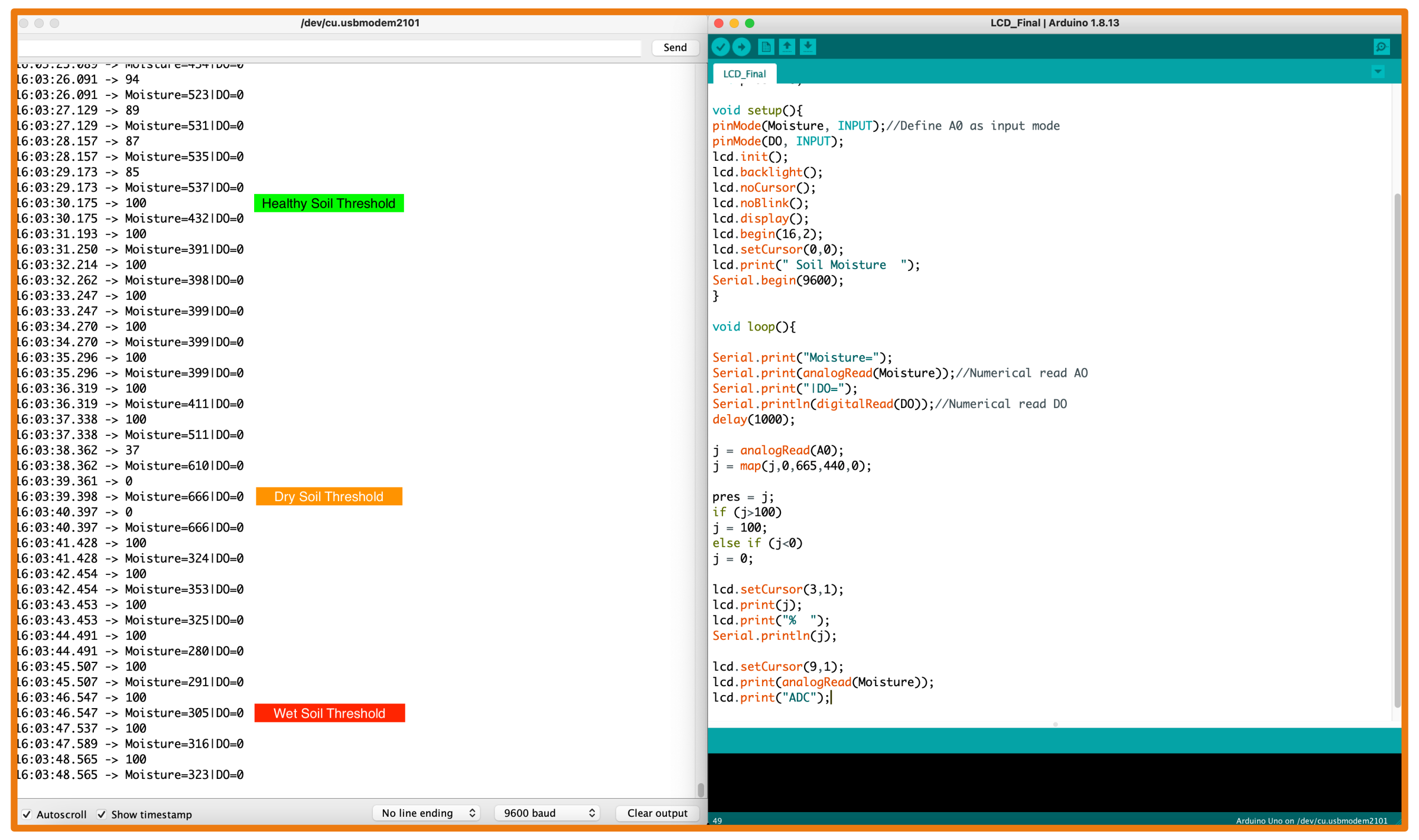


Estimated Cost
$450

Results

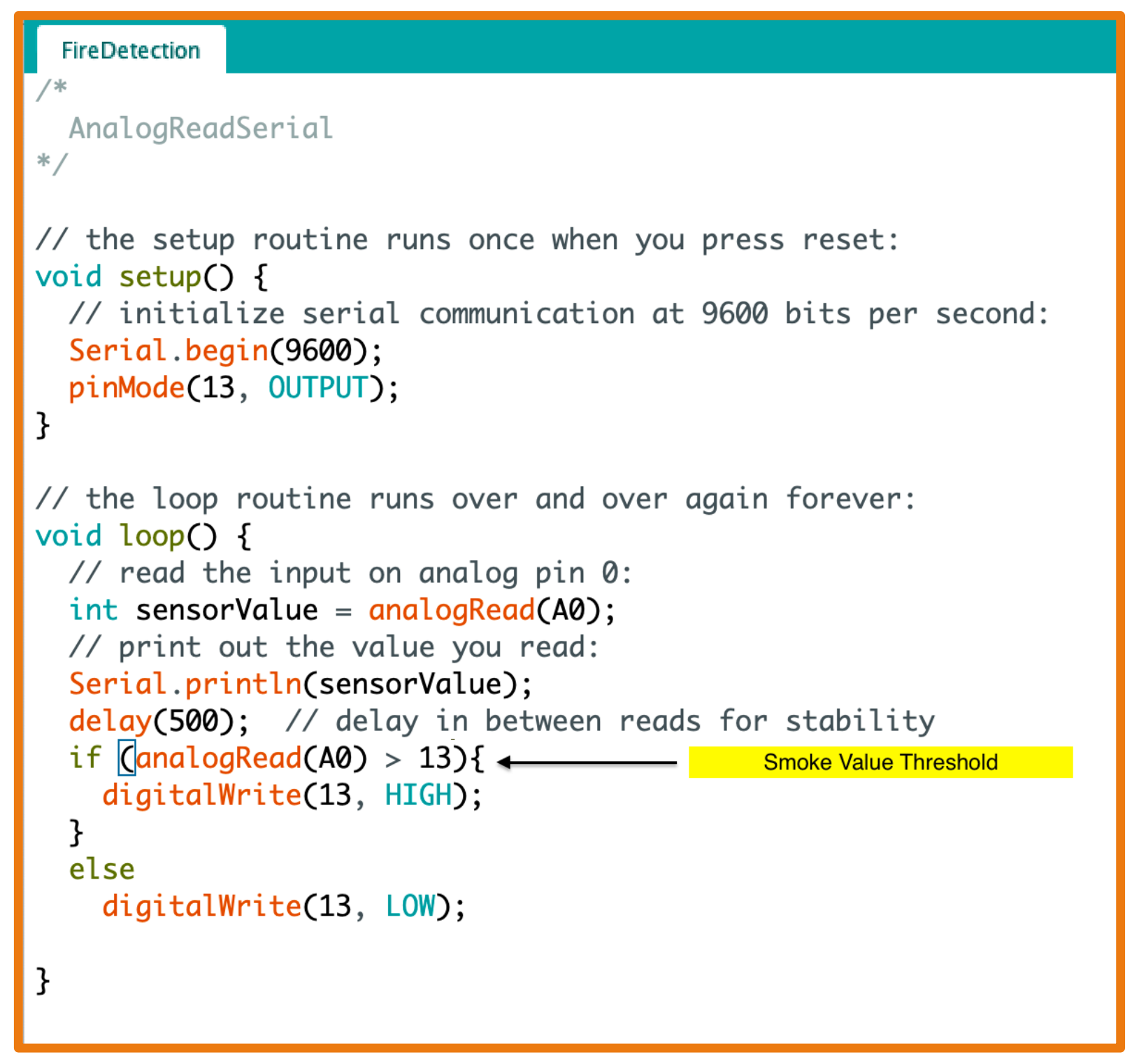
- ❑ Successful implementation of Multi-Functional Drone
- ❑ The 3 features are interchangeable
- ❑ Proper values were determined for smoke sensor threshold and soil moisture thresholds
- ❑ Arduinos are accessible on both sides to alter code
- ❑ Low stability during flying process due to weight





```
16:03:26.091 -> 94
16:03:26.091 -> Moisture=523|DO=0
16:03:27.129 -> 89
16:03:27.129 -> Moisture=531|DO=0
16:03:28.157 -> 87
16:03:28.157 -> Moisture=535|DO=0
16:03:29.173 -> 85
16:03:29.173 -> Moisture=537|DO=0
16:03:30.175 -> 100                    Healthy Soil Threshold
16:03:30.175 -> Moisture=432|DO=0
16:03:31.193 -> 100
16:03:31.250 -> Moisture=391|DO=0
16:03:32.214 -> 100
16:03:32.262 -> Moisture=398|DO=0
16:03:33.247 -> 100
16:03:33.247 -> Moisture=399|DO=0
16:03:34.270 -> 100
16:03:34.270 -> Moisture=399|DO=0
16:03:35.296 -> 100
16:03:35.296 -> Moisture=399|DO=0
16:03:36.319 -> 100
16:03:36.319 -> Moisture=411|DO=0
16:03:37.338 -> 100
16:03:37.338 -> Moisture=511|DO=0
16:03:38.362 -> 37
16:03:38.362 -> Moisture=610|DO=0
16:03:39.361 -> 0
16:03:39.398 -> Moisture=666|DO=0    Dry Soil Threshold
16:03:40.397 -> 0
16:03:40.397 -> Moisture=666|DO=0
16:03:41.428 -> 100
16:03:41.428 -> Moisture=324|DO=0
16:03:42.454 -> 100
16:03:42.454 -> Moisture=353|DO=0
16:03:43.453 -> 100
16:03:43.453 -> Moisture=325|DO=0
16:03:44.491 -> 100
16:03:44.491 -> Moisture=280|DO=0
16:03:45.507 -> 100
16:03:45.507 -> Moisture=291|DO=0
16:03:46.547 -> 100
16:03:46.547 -> Moisture=305|DO=0    Wet Soil Threshold
16:03:47.537 -> 100
16:03:47.589 -> Moisture=316|DO=0
16:03:48.565 -> 100
16:03:48.565 -> Moisture=323|DO=0
```

```
void setup(){
pinMode(Moisture, INPUT);//Define A0 as input mode
pinMode(DO, INPUT);
lcd.init();
lcd.backlight();
lcd.noCursor();
lcd.noBlink();
lcd.display();
lcd.begin(16,2);
lcd.setCursor(0,0);
lcd.print(" Soil Moisture  ");
Serial.begin(9600);
}

void loop(){

Serial.print("Moisture=");
Serial.print(analogRead(Moisture));//Numerical read A0
Serial.print("|DO=");
Serial.println(digitalRead(DO));//Numerical read DO
delay(1000);

j = analogRead(A0);
j = map(j,0,665,440,0);

pres = j;
if (j>100)
j = 100;
else if (j<0)
j = 0;

lcd.setCursor(3,1);
lcd.print(j);
lcd.print("%  ");
Serial.println(j);

lcd.setCursor(9,1);
lcd.print(analogRead(Moisture));
lcd.print("ADC");
```



```
/*
  AnalogReadSerial
*/

// the setup routine runs once when you press reset:
void setup() {
  // initialize serial communication at 9600 bits per second:
  Serial.begin(9600);
  pinMode(13, OUTPUT);
}

// the loop routine runs over and over again forever:
void loop() {
  // read the input on analog pin 0:
  int sensorValue = analogRead(A0);
  // print out the value you read:
  Serial.println(sensorValue);
  delay(500);  // delay in between reads for stability
  if (analogRead(A0) > 13){ <-------- Smoke Value Threshold
    digitalWrite(13, HIGH);
  }
  else
    digitalWrite(13, LOW);

}
```

Acknowledgement

Our gratitude goes to Professor Maria Striki, our advisor, for her support and guidance, as well as to Kevin Wine for his assistance at the lab. We also want to extend our thanks to the Electrical Engineering Department for providing us with this valuable experience.

References

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