Electronic Components List

1. Flight Controller

Model – Pixhawk PX4

2. GPS Module

Model – Ublox NEO-M8N GPS [subject to change]

3. Batteries

Model - Tattu 6S 22000mAh 22.2V 25C LiPo Battery Pack with XT90 Connector

4. Power Distribution Board [PDB]

Model - Matek Systems PDB-XT90

5. Multispectral Camera [DIY]

Modify a standard camera by adding filters

    a. Near Infrared Filter [700-1000nm] [NDVI, RE NDVI, LAI, NDWI]

    Model – Hoya R72 Infrared Filter

    b. Red Filter [620-750nm] [NDVI, RE NDVI, GNDVI, CI, LAI]

    Model – Schott RG630 Long-Pass Filter + Thorlabs FELH0750/Schott BG40 IR-Cut Filter (Combination)

    c. Red Edge Filter [700-750nm] [RE NDVI, CI]

    Model – Schott RG715 Long-Pass Filter + Thorlabs FELH0750/Schott BG40 IR-Cut Filter (Combination)

    d. Green Filter [500-600nm] [GNDVI, NDWI]

    Model – Wratten 58 Green Filter

6. Thermal Camera

Model – Waveshare MLX90640 Thermal Camera Module

7. RGB Camera x 5

Model - Raspberry Pi Camera Module 3 NoIR

8. Communication Module [if]

Model - RFM95 LoRa Module

9. Microcontroller

Model – Raspberry pi 4/5

10. Control Algorithm

Ardupilot [Open source] [Will need minor modifications]

11. Minor Sensors
   a. Temperature sensor [if]

   Model - DHT22 (AM2302)

   b. Atmospheric Pressure Sensor

   Model - BMP280

   c. CO2 sensor

   Model - MH-Z19 NDIR CO2 Sensor

   d. Ultrasonic Sensor

   Model - HC-SR04

12. BLDC Motors

Model – 3508 700KV

13. Propellers

Model - Gemfan 15x6

14. Electronic Speed Controller

Model - T-Motor F60A ESC [Any 60A ESC would work]

15. Sprinklers

Model - TeeJet AIXR 11004-VP

16. Controller

Model – Ground station interface [software via PC]

Mechanical Components

1. Tank

Material – High Density Polyethylene [HDPE]

Capacity – 10L

Mounting – Securely Mounted on the Drone Frame

2. Sprinkler

Model – TeeJet AIXR 11004-VP

3. Frame

Material – Carbon Fibre/Aluminium Alloy

Dimension – 1000mm – 1200mm

4. BLDC Motors

Model – 3508 700KV

5. Propellers

Model – Gemfan 15x6

Size – 15 inches

6. Battery

Model – Tattu 6S 22000mAh 22.2V 25C LiPo Battery Pack with XT90 Connector

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Sensor Details and Integration with Drone

1. Temperature Sensor (DHT22)

Output Format: Digital signal (I2C or one-wire interface)

Brief Description: Measures relative humidity and temperature.

Use in Drone: Monitors environmental conditions for safe flight and data analysis.

Communication Interface: I2C or one-wire

Power Consumption: Low power consumption (typically around 2.7µA in sleep mode).

Sensor Type: Capacitive humidity sensor and thermistor.

Relevant Details: Can be affected by airflow and humidity calibration may be required for accurate readings.

2. Atmospheric Pressure Sensor (BMP280)

Output Format: I2C digital interface

Brief Description: Measures atmospheric pressure and temperature.

Use in Drone: Determines altitude, air density, and weather conditions.

Communication Interface: I2C

Power Consumption: Low power consumption (typically around 1.1µA in sleep mode).

Sensor Type: Piezoresistive pressure sensor and thermistor.

Relevant Details: Can be used with GPS data to calculate altitude more accurately.

3. CO2 Sensor (MH-Z19)

Output Format: UART digital interface

Brief Description: Measures carbon dioxide concentration.

Use in Drone: Monitors air quality and detects potential hazards.

Communication Interface: UART

Power Consumption: Moderate power consumption (typically around 50mA during measurement).

Sensor Type: NDIR (Non-Dispersive Infrared) sensor.

Relevant Details: Requires calibration for accurate readings and may be affected by temperature and humidity.

4. Ultrasonic Sensor (HC-SR04)

Output Format: Trigger and echo pulses (digital signals)

Brief Description: Measures distance to objects using sound waves.

Use in Drone: Obstacle avoidance and precise landing.

Communication Interface: Trigger and echo pins.

Power Consumption: Low power consumption (typically around 2mA during measurement).

Sensor Type: Ultrasonic transducer.

Relevant Details: Can be affected by temperature, humidity, and wind conditions.

5. GPS Module (Ublox NEO-M8N)

Output Format: NMEA sentences (serial communication)

Brief Description: Provides precise positioning and navigation data.

Use in Drone: Autonomous flight, navigation, and mapping.

Communication Interface: UART

Power Consumption: Moderate power consumption (depends on update rate and features).

Sensor Type: GNSS receiver.

Relevant Details: Requires clear sky for optimal accuracy and may be affected by interference.

6. Thermal Camera (Waveshare MLX90640)

Output Format: I2C digital interface

Brief Description: Measures infrared radiation to detect temperature differences.

Use in Drone: Thermal imaging, detecting heat sources, and monitoring plant health.

Communication Interface: I2C

Power Consumption: Moderate power consumption (depends on frame rate and resolution).

Sensor Type: Infrared microbolometer array.

Relevant Details: Requires calibration for accurate temperature measurements and may be affected by atmospheric conditions.

7. Raspberry Pi Camera Module 3 NoIR

Output Format: Image data (raw or JPEG)

Brief Description: Captures color images in low-light conditions.

Use in Drone: Aerial photography, videography, and object detection.

Communication Interface: CSI-2 (Camera Serial Interface)

Power Consumption: Low power consumption (depends on image resolution and frame rate).

Sensor Type: Sony IMX708 CMOS image sensor

Relevant Details:

- Fixed Focus: No manual focus adjustment.

- Global Shutter: Captures images simultaneously across the entire sensor for reduced motion blur.

- Wide Dynamic Range (WDR): Can capture images in high-contrast scenes.

- Low-Light Performance: Excellent low-light performance due to the large sensor and high sensitivity.

Note: The specific integration methods and software libraries will depend on the chosen development environment and the desired functionalities of the drone.

Sources:

- **DHT22 Datasheet:** https://cdn-learn.adafruit.com/downloads/pdf/dht.pdf

- **BMP280 Datasheet:** https://www.bosch-sensortec.com/products/environmental-sensors/pressure-sensors/bmp280/

- **MH-Z19 Datasheet:** https://www.winsen-sensor.com/d/files/PDF/Infrared%20Gas%20Sensor/NDIR%20CO2%20SENSOR/MH-Z19%20CO2%20Ver1.0.pdf

- **HC-SR04 Datasheet:** https://cdn-learn.adafruit.com/downloads/pdf/ultrasonic-sonar-distance-sensors.pdf

- **Ublox NEO-M8N Datasheet:** https://content.u-blox.com/sites/default/files/NEO-M8-FW3_DataSheet_UBX-15031086.pdf

- **Waveshare MLX90640 Datasheet:** https://www.waveshare.com/wiki/MLX90640-D55_Thermal_Camera

- **Raspberry Pi Camera Module 3 NoIR Datasheet:** https://www.raspberrypi.com/documentation/accessories/camera.html

- **Pixhawk PX4 Documentation:** https://docs.px4.io/main/en/

- **ESP32 Documentation:** https://docs.espressif.com/projects/esp-idf/en/stable/esp32/index.html

- **RFM95 Datasheet:** https://cdn.sparkfun.com/assets/learn_tutorials/8/0/4/RFM95_96_97_98W.pdf