

# Electronic Components

## 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 Filters

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]

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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](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](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](https://cdn.sparkfun.com/assets/learn_tutorials/8/0/4/RFM95_96_97_98W.pdf)