UWA ELEC5552

Indoor Surveillance Drone
Team 2-02

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Operation Manual
Volume 1

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Team Number: Team 2-02

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Revision History

Date	Version	Description	Author
30/10/2025	1.0	Initial creation of document and template based of real manuals	Daniel Papasergio
08/10/2025	1.1	Introduction Read before first flight Added brief lines under each heading to provide starting point	Daniel Papasergio
20/10/2025	1.2	What's Included, Connecting to Aircraft Propellor and Propellor Guards, Battery updated	Daniel Papaersergio
20/10/2025	1.3	Finished up PCB and Camera	Josh Gorn Ba-Nang Vo

Table of Contents

1. What's Included

- 1x Drone – Pre-assembled
- 1x 2S 800mAH 50C Battery

2. Read before first flight

The following sections MUST be read in full before operating the drone:

- 4.1 Using for the first time
- 5.0 Flight and Safety

3. Introduction

This indoor surveillance drone is designed for the UWA Aviation Labs (UWAAL) as a remote autonomous way to monitor confined indoor spaces, such as a garage where GPS signals do not penetrate. The drone is packed with important features such as ToF (Time of Flight) sensors for obstacle detection and avoidance, hover control to resist wind interference and a dedicated ESP-32 CAM for remote video monitoring capability over WiFi. The drone has a maximum flight time of 3 minutes, an easy user interface for control via a webserver and safety failsafes such as propellor guards and automatic shutoff in the event of a communication failure.

4. Aircraft

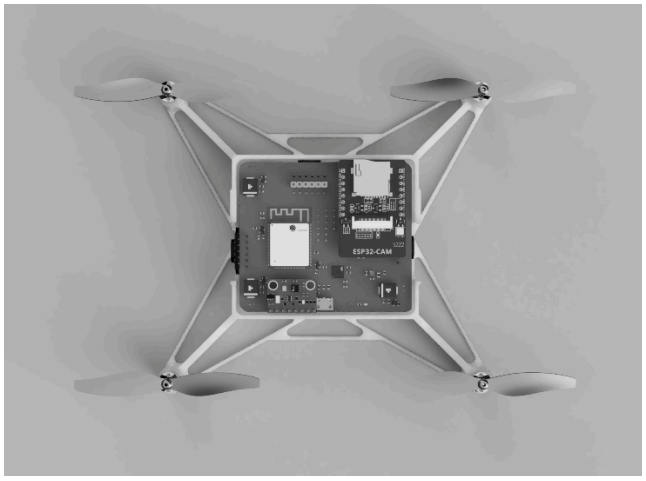

Figure 1 Top-down render of the drone

The Team 2-02 drone is sleek and small utilising a strong ABS box design for the chassis, this chassis design is 20.9x20.9x3.3cm and weighs 34 grams and will all components in weighs 34 grams. Don't let this small size and weight fool you the drone is mighty, equipped with 4, which can provide 40 grams of thrust each, providing great flight authority. A smorgasbord of sensors and components from ultrasonic time of flights to optical flow allow for real time data monitoring.

4.1 Using for the first time

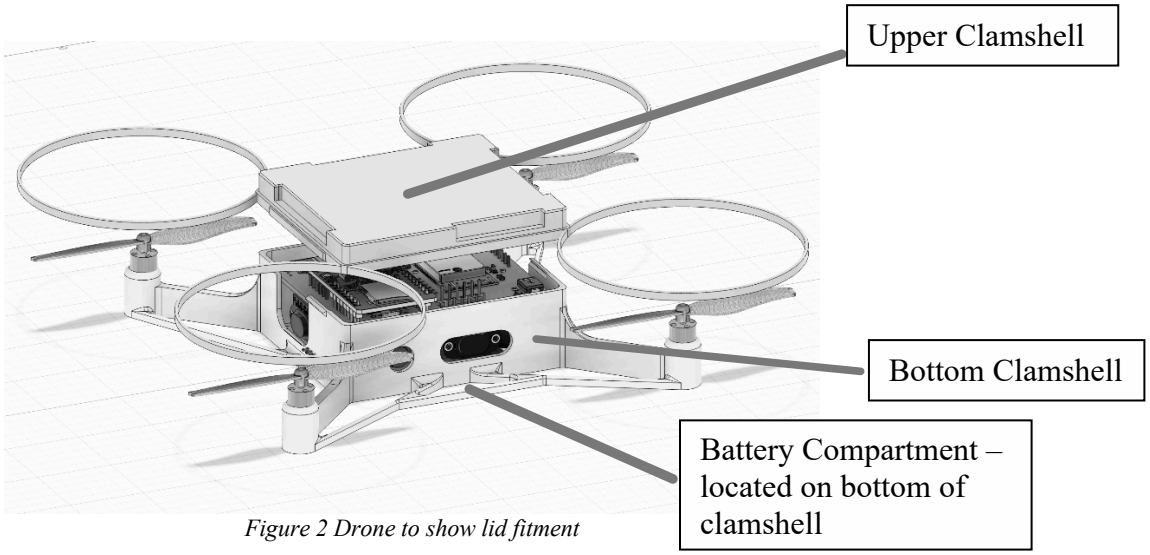

Figure 2 Drone to show lid fitment

The drone has a battery port located on the bottom of the drone, this is a simple clip fit which is used to hold the battery during flight and allow for removal to charge when drained as shown in Figure 2. The lid is also removable to allow for replacement of parts and debugging of the PCB to be easier in the event of an issue, this is again a simple clip fit as shown in Figure 2.

4.2 Connecting to the Aircraft

The drone is operated via a webserver; this is hosted locally by the drone's ESP-WROOM.

1. Power on the drone by connecting the battery.
2. Navigate to WiFi settings on your device.
3. WiFi "Drone 2-02" should appear after ~30 seconds.
4. Connect to WiFi.
5. Navigate to your devices preferred browser and input "192.168.4.1".
6. The drones web UI will now load on your device as shown in Figure 3.
7. To ensure connection is working move your hand near each of the obstacle sensors and determine if readings appear accurate.

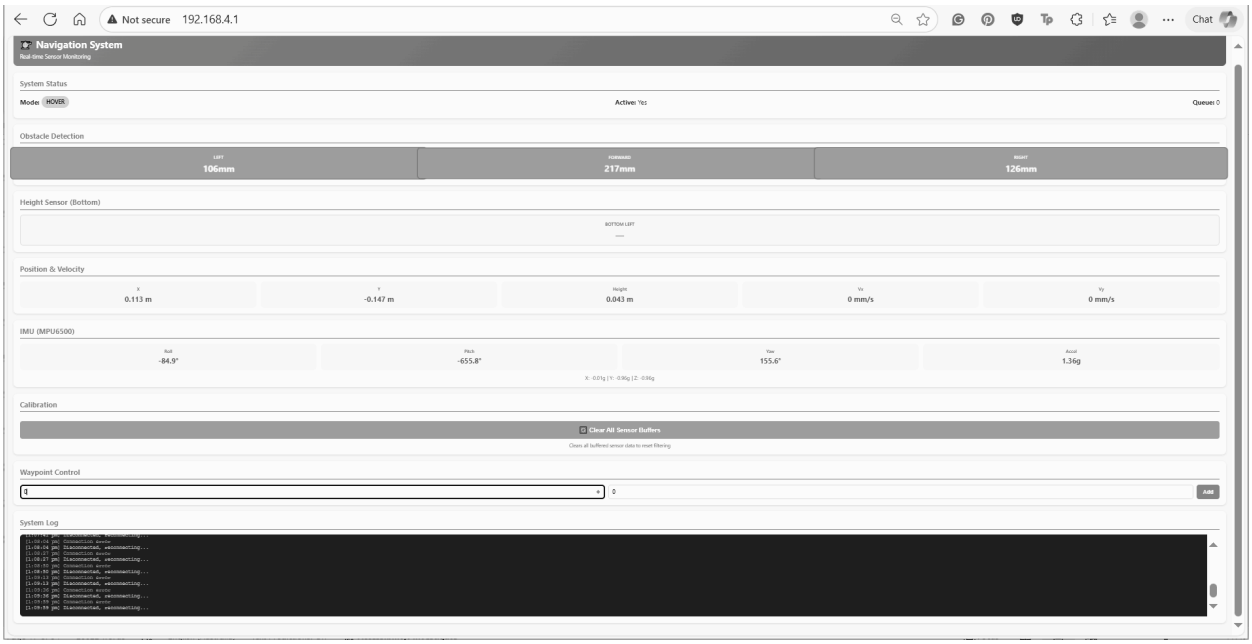

Figure 3 Drone Web UI

4.3 Controlling the Aircraft

4.3.1 Inputting flight path

The flight path is input via waypoint control, in which desired x and y coordinates are input.

4.3.2 Obstacle Detection

The sensor readings output to the web UI as seen in Figure 3. When no obstacle is detected, the cells will display as green and system status mode will display “Navigation”. When a sensor detects an obstacle (sensor reads below 500mm) the respective cell will turn red, and the status mode will change to “Hover”.

4.3.3 Optical Flow

Inertial Measurement Device – Accelerometer and Gyroscope: Measures the drone’s linear acceleration and angular velocity using a combination of sensors, tracking motion in3D space to provide the user with data on orientation, heading and changes in positions, useful for tracking the drone’s own movement

4.4 Camera

Figure 4 Camera Used For Drone

The onboard camera system for the drone is based on the ESP32 CAM module which integrates both imaging and wireless communication functionalities. The camera's primary purpose is to provide live video feed during testing and demonstration. To optimize performance a 360p resolution provides a stable framerate with minimal transmission latency for smooth video stream. Camera module also supports a failsafe watchdog system that monitors communication latency. If connection is lost or latency exceed 200 milliseconds, propulsion is shutdown.

4.5 Circuit Board

The drone is controlled 72.4mm x 62.3mm, four-layer drone control PCB that has wireless PWM control, sensor feedback, power conversion and wi-fi capabilities. The circuit board is not to be touched by the user. For any queries, please contact the administrator. Keep out of reach of small children.

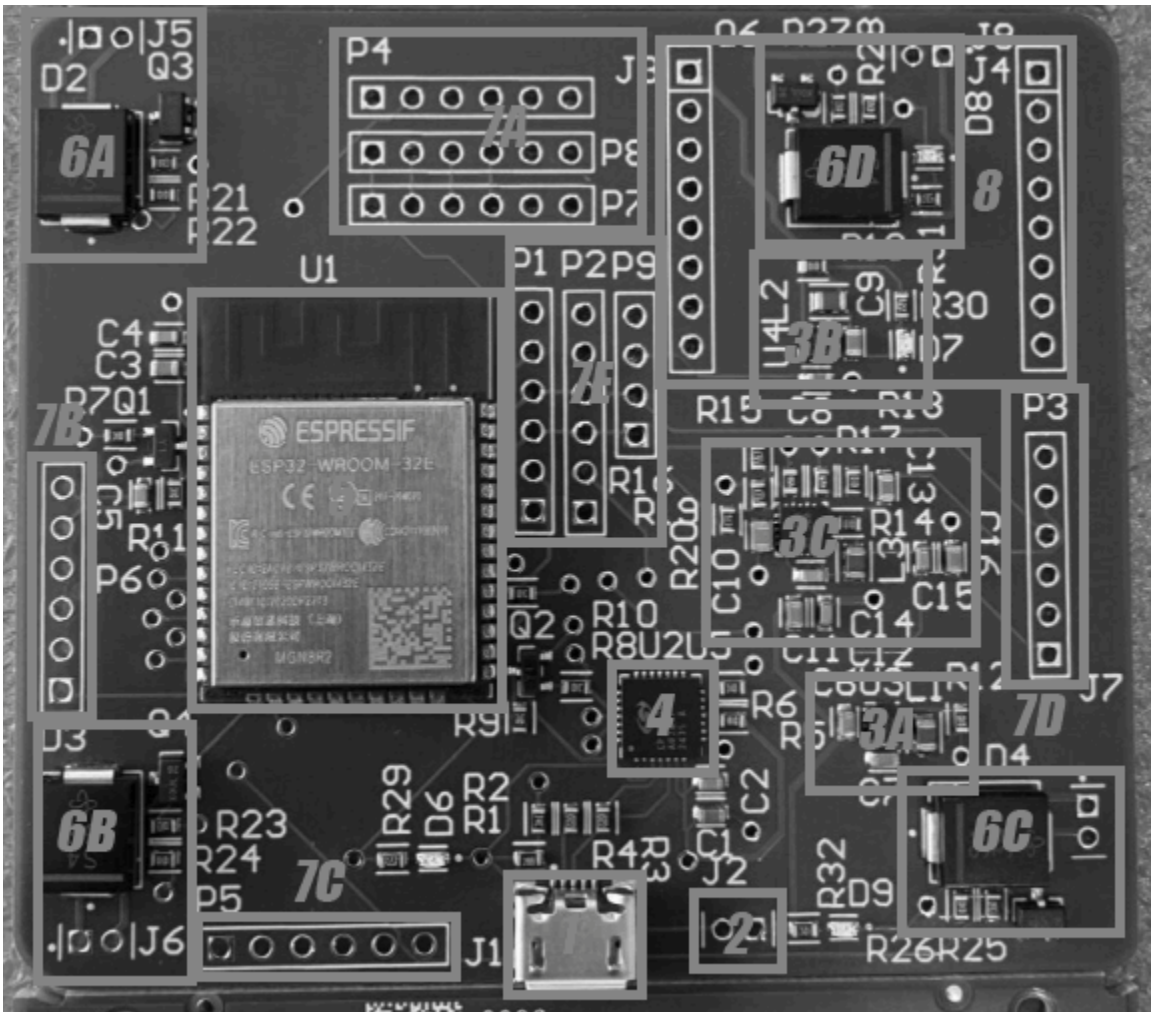

Figure 55 PCB

Table 1 PCB Components

Label	Name	Functionality
1	USB-Micro	Data input for flashing.
2	Power port	2S battery terminal input.
3A	+3v3 converter	Converts the battery voltage to 3.3V.
3B	+5V converter	Converts the battery voltage to 5V.
3C	Motor voltage converter.	Converts the battery voltage to 3.7V.
4	UART	Converts parallel data into serial.
5	ESP32-WROOM	The main processing chip. Controls the motors and reads sensor data.
6A	Motor driver 1	Controls motor speed, from a PWM signal.
6B	Motor driver 2	"…"
6C	Motor driver 3	"…"
6D	Motor driver 4	"…"
7A	Front sensors	Time of flight and optical flow.
7B	Left sensor	Time of flight.
7C	Back sensor	Time of flight.
7D	Right sensor	Time of flight
7E	Top and bottom sensors	Time of flight and
8	ESP-CAM	Streams camera footage.

5. Flight and safety

5.1 Propellors and Propellor Guards

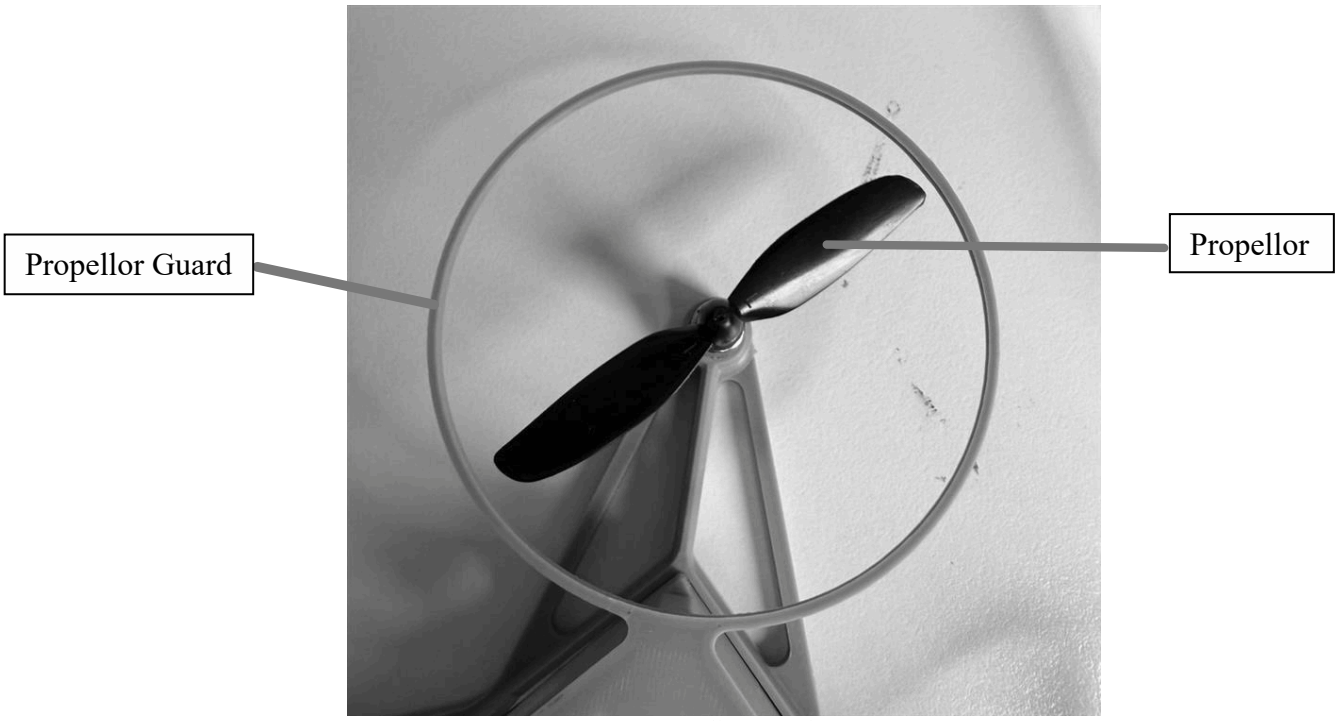

Figure 6 6 Propellor Guard on Drone

The propellors are 3 inches long and spin to very high rpm when in operation. The sharp design of the propellors and high speed combine to become a high safety hazard. Contact with the propellors can result in cuts, and thus when in operation the propellors must be avoided.

The drone cover includes fixed propellor guards these surround each individual propellor so that in the event the drone collides with a person or an object the guard will prevent the propellor from directly contacting. This helps prevent cut risks and the drone should never be operated without them in place or if they become damaged.

5.2 Battery

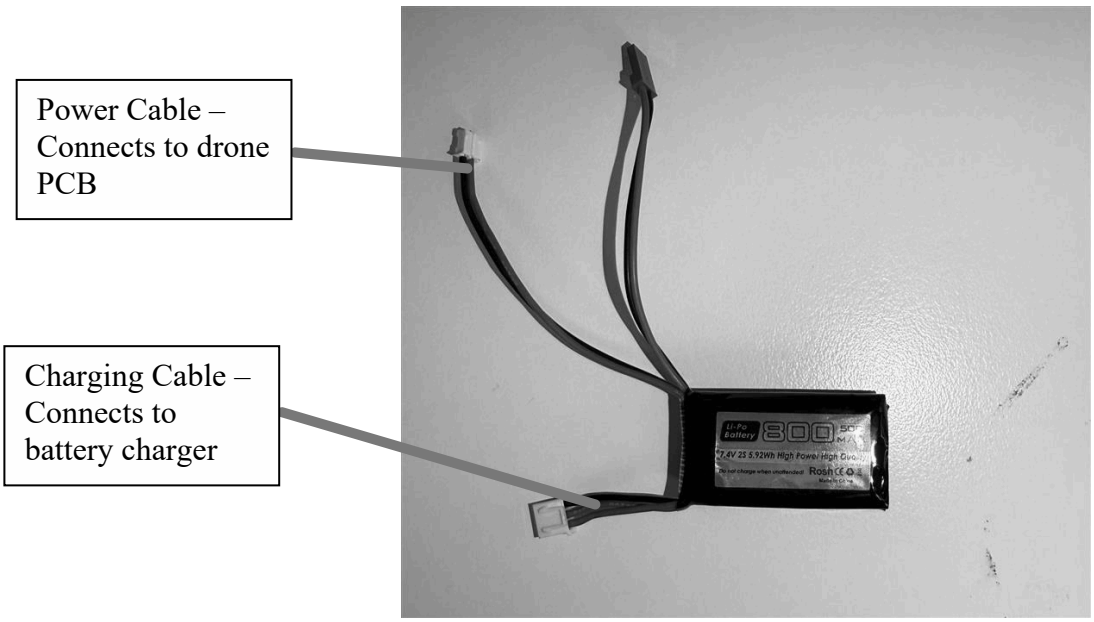

Figure 7 7 2S 50C 800maH battery

Ensure to only use only the provided 2S 800mAH battery with the drone. Incorrect Battery use could result in overheating of components on the board resulting in a fire hazard and insufficient power for operation.

In the result the drone battery overheats, remotely disarm the drone and evacuate the space, putting your own safety first. If it is safe to do so call emergency services using 000 and find a ABE/ABC fire extinguisher following their instructions provided to attempt extinguishing the flame.

Figure 8 8 Provided Battery Charger

When the drone is not in use the battery must be stored at most at half full capacity, and within a fire safe LiPo storage back. The battery should be charged only with the provided charging station, while the battery is being charged it should be placed on a hard non-flammable surface under supervision.