UNMANNED AERIAL VEHICLE (UAV)

MCTE 4362
(ROBOTIC HARDWARE SYSTEM)

By: Nursyafiqah binti Sobri (1914338)

Lecturer: Asst. Prof Dr. Zulkifli bin Zainal Abidin

LET'S GET STARTED WITH UAV 😆

TABLE OF CONTENTS

01

INTRODUCTION

HAVE YOU EVER HEARD OF UAV?

- Unmanned Aerial Vehicle (UAV) = Drones
- It is essentially a flying robot that is controlled remotely or can fly autonomously with software-controlled flight plans embedded in its system that work in conjunction with sensors and a global positioning system (GPS)
- Drones are of different types and sizes and are used for a variety of purposes
- "An unmanned aircraft or ship guided by remote control or onboard computers." - ***Merriam Webster***
- "A drone, in technological terms, is an unmanned aircraft. ... Essentially, a drone is a flying robot that can be remotely controlled or fly autonomously through software-controlled flight plans in their embedded systems, working in conjunction with onboard sensors and GPS." - ***Internet of Things Agenda***

INTRODUCE THE UAV CONCEPT

- UAVs include both autonomous (capable of operating without human input) drones and remotely piloted vehicles (RPVs)
- A UAV is capable of controlled, sustained level flight and is powered by a jet, reciprocating, or electric engine

02 HISTORY & APPLICATION

HISTORY OF DRONES

1898
Nikola Tesla premieres a small radio operated boat at a Madison Square Garden exhibition

1935
Queen Bee
Created in the UK, this drone was used by the military for moving target practice.

2001–Present
Predator
Designed in the U.S. This drone is used for surveillance and targeted warfare.

2003-Present
Commercial drones gain popularity in construction, real estate, search and rescue, ect.

1918
Kettering Bug
Designed to drop bombs on targets during WWI. The war ends before the Bug is used.

Photo by Greg Hume

1964-1969
The Lightning Bug was created for surveillance during the Cold War by the United States.

2013
Amazon CEO, Jeff Bazos, announces the company's drone delivery plan, opening the door for commercial drone use.

1907
Breguet-Richet Gyroplane 1

1922
Oehmichen No. 2

1931
Fairey IIIF Queen

1935
DH.82 Queen Bee

1956
Convertawings Quadrotor

1999
Roswell Flyer and Draganflyer

2002
X-4 Flyer Mk I

Artist: James North

DRONE APPLICATIONS

1. USE IN AGRICULTURE

- It assist farmers with crop output

Improve water management
- From their aerial positions, UAVs identify leaks in irrigation systems

Soil Analysis with Drones
- Can fly over the fields and determine the data information in real-time like nitrogen levels

Improve Crop Health
- Can identify plant counts, the presence of diseased plants, and map out fields accurately

Crop Spraying Is More Precise with Drones
- Can increased efficiency and ensure uniform spray coverage

2. SURVEYS OF INFRASTRUCTURE

AI 3D Modeling With Drones Speeds Up Infrastructure Management

- Have the power to autonomously inspect structures such as buildings, roads, and bridges with aid of advanced sensors

Drones Provide Better Thermal Inspection Options

- Equipped with thermal cameras where it can quickly survey an entire bridge or building easily

Drones Improve the Safety of Infrastructure Management

- Drones complete an inspection without ever placing a human in harm's way

3. PERFORM CRITICAL SEARCH-AND-RESCUE MISSIONS

Have access to aerial data of a large area

- Allows responders to map the entire search zone and pinpoint possible places where the missing person might be trapped

Fast access

- Drones can reach a location a lot faster, even can reach inaccessible places

Examples of rescue drones:

DJI Inspire Series

Parrot ANAFI Thermal

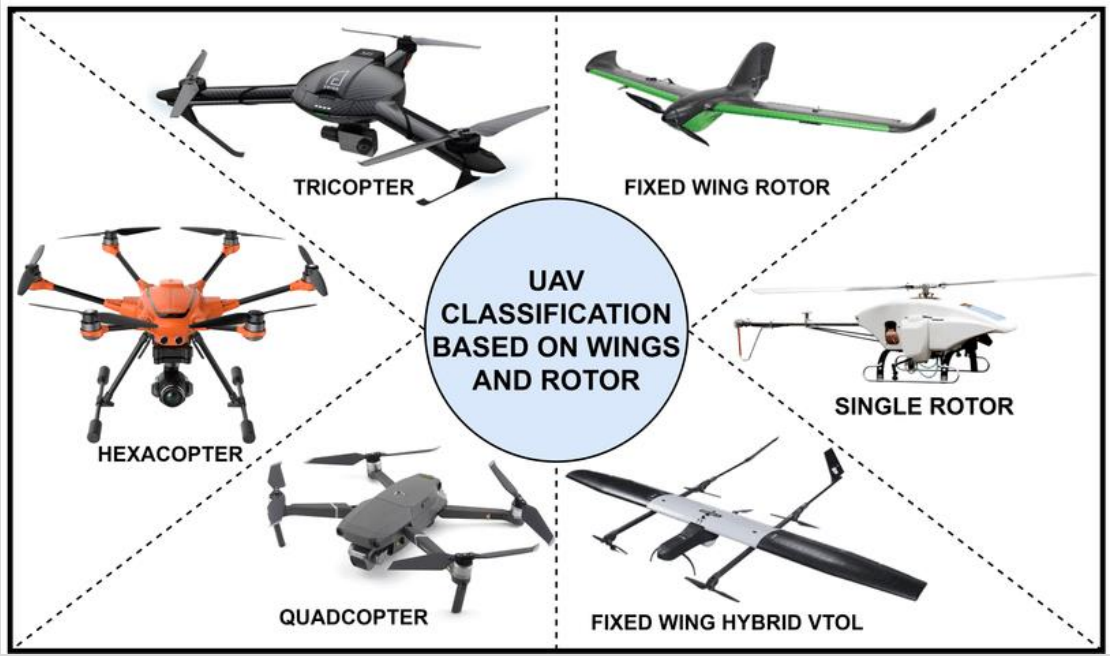
03

MAIN COMPONENTS OF UAV

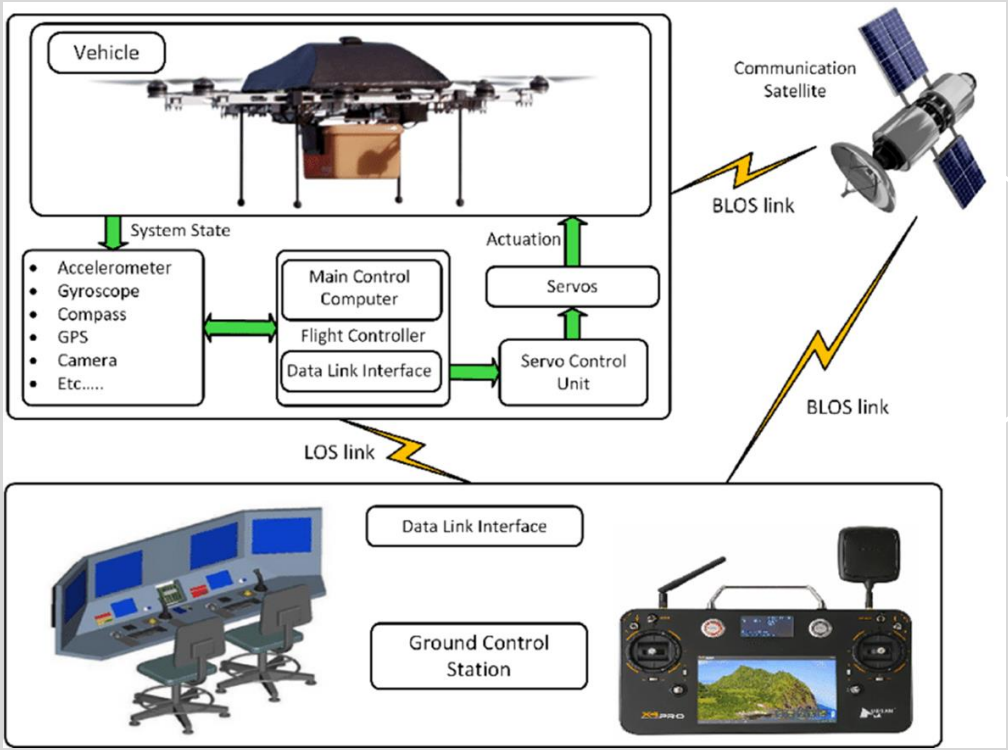
TYPES OF UAV

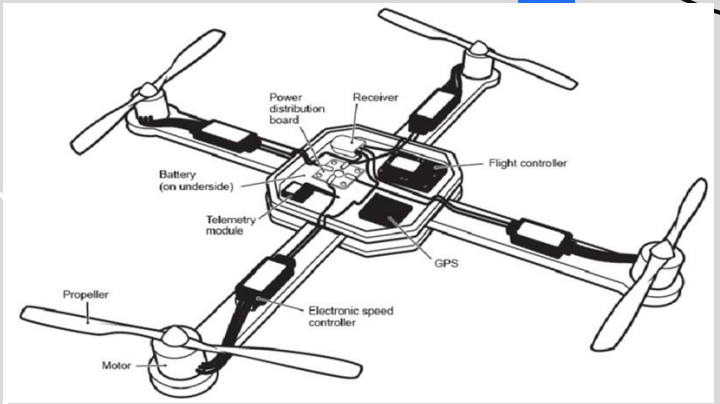
Every UAV uses the same components to operate:

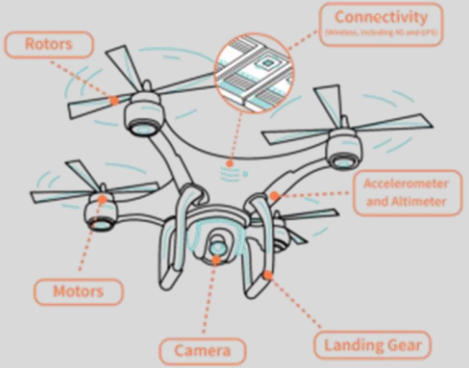
1. **Flight Controller**
2. **Propellers**
3. **IMU**
4. **Communication system**



BASIC ARCHITECTURE OF UAV

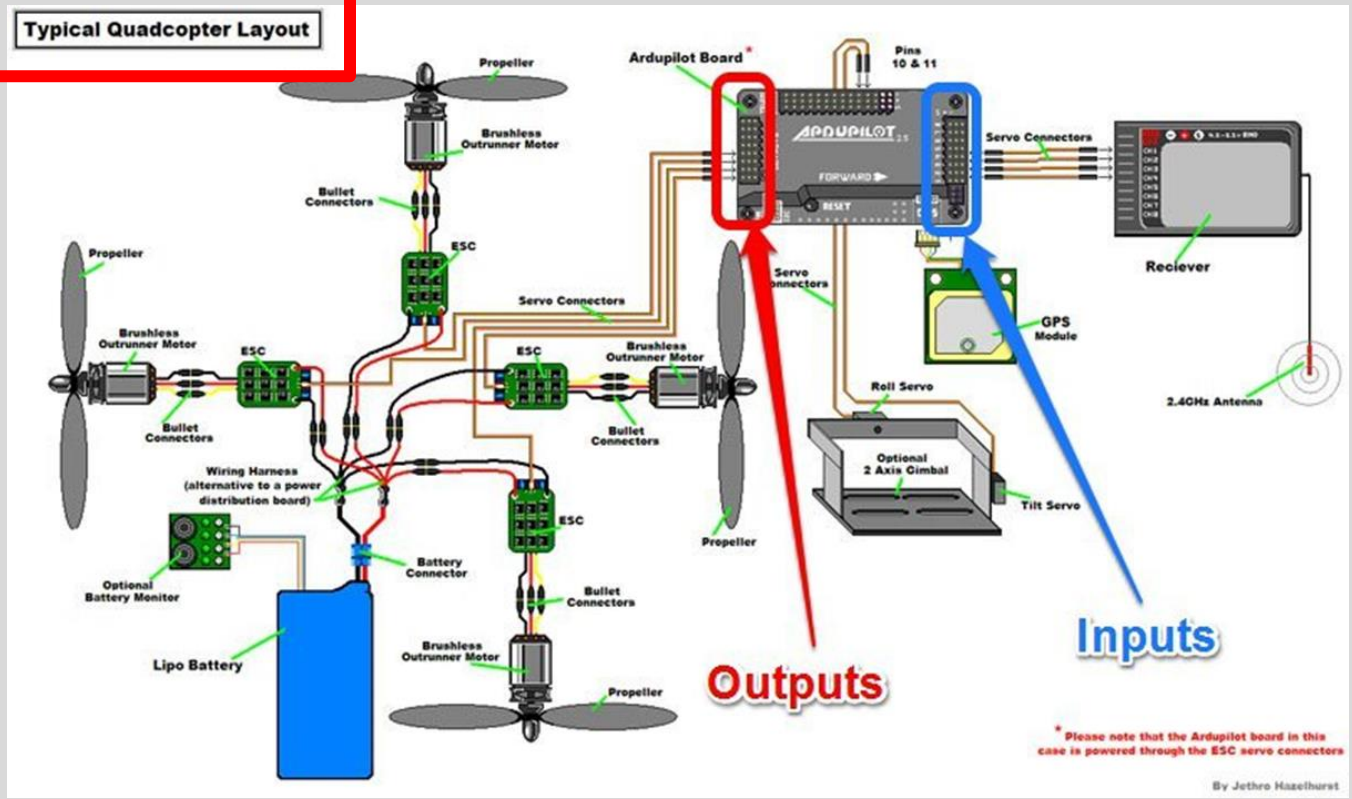






BASIC ARCHITECTURE OF UAV

BASIC ARCHITECTURE OF UAV



COMPONENTS OF UAV

1. Hull Design
2. Propulsion System (Actuators/Locomotion)
3. Navigation System & Control
4. Data Collection
5. Data Transmission
6. Power Management

1. HULL DESIGN

Technical use for:

- Visual inspections
- Thermal reports
- Photography & Videography
- 3D scans

MULTI-ROTOR DRONES

- Offer greater control over position and framing, and hence they are perfect for aerial photography and surveillance
- Called multi-rotor because they have more than one motor, more commonly tricopters (3 rotors), quadcopters (4 rotors), hexacopters (6 rotors) and octocopters (8 rotors)

FIXED-WING DRONES

- Has one rigid wing that is designed to look and work like an aeroplane, providing the lift rather than vertical lift rotors
- Only needs the energy to move forward and not to hold itself in the air
- Makes them energy-efficient

Technical use for:

- Aerial Mapping
- Drone Surveying – Forestry/Environmental Drone Surveys, Pipeline UAV Surveys, UAV Coastal Surveys
- Agriculture
- Inspection
- Construction
- Security

Technical use for:

- Aerial LIDAR laser scan
- Drone surveying
- Carrying heavy payloads

SINGLE-ROTOR DRONES

- Single-rotor drone types are strong and durable
- They look similar to actual helicopters in structure and design
- A single-rotor has just one rotor, which is like one big spinning wing, plus a tail rotor to control direction and stability

FIXED-WING HYBRID VTOL

- VTOL stands for Vertical Take-off and Landing
- Merge the benefits of fixed-wing and rotor-based designs
- Has rotors attached to the fixed wings, allowing it to hover and take off and land vertically
- Eg: Amazon’s Prime Air delivery drone (picture below)

Technical use for:

- Drone delivery

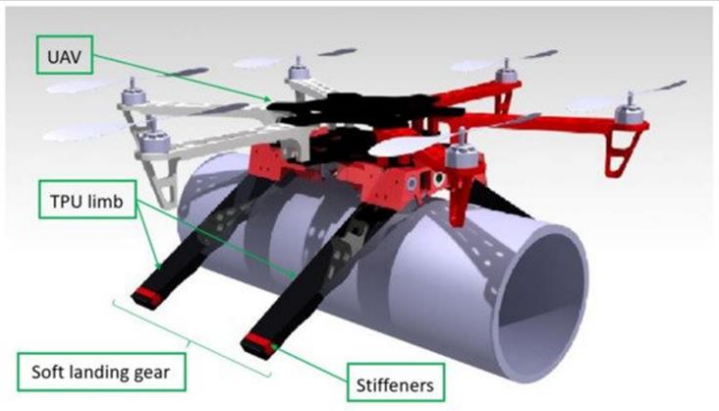


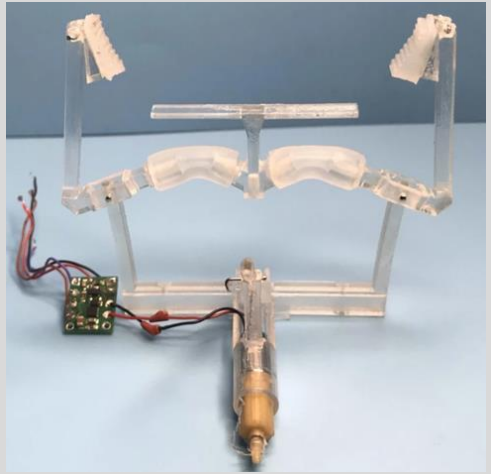

	Multi-Rotor	Fixed-Wing	Single-Rotor	Fixed-Wing Hybrid
Pros	• Accessibility • Ease of use • VTOL and hover flight • Good camera control • Can operate in a confined area	• Long endurance • Large area coverage • Fast flight speed	• VTOL and hover flight • Long endurance (with gas power) • Heavier payload capability	• VTOL • Have autopilot option to keep the drone stable around the sky • Long-endurance flight
Cons	• Short flight times • Small payload capacity	• Launch and recovery needs a lot of space • No VTOL/hover • Harder to fly, more training needed • Expensive	• More dangerous • Harder to fly, more training needed • Expensive	• Not perfect at either hovering or forward flight • Still in development
Price	$5k-$65k for pro drones	$25-$120k for pro drones	$25-$300k for pro drones	In development

2. PROPULSION SYSTEM (ACTUATORS/LOCOMOTION)

Propeller

Gripper





Water Nozzle

Using pump to spray liquid.

Main usage is currently for agriculture.

Eg: crop spraying

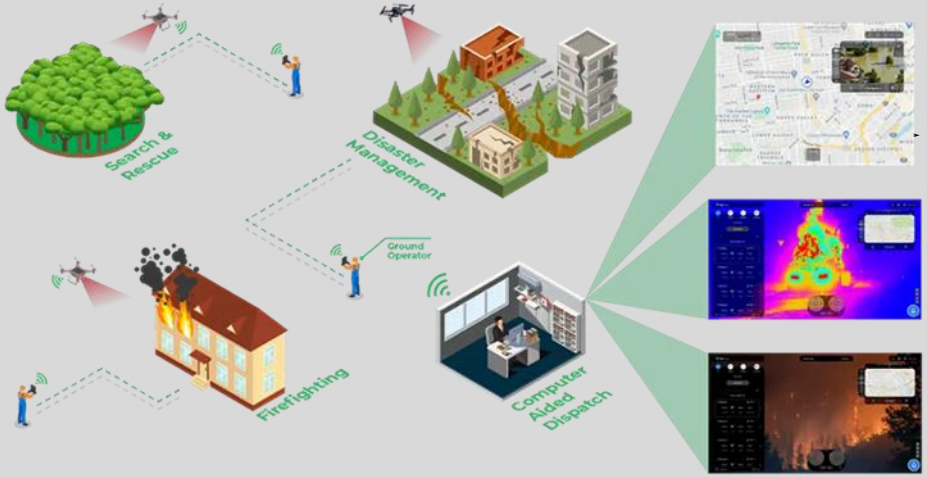
3. NAVIGATION SYSTEM & CONTROL

GNSS SYSTEM

GNSS system to get the best navigation information

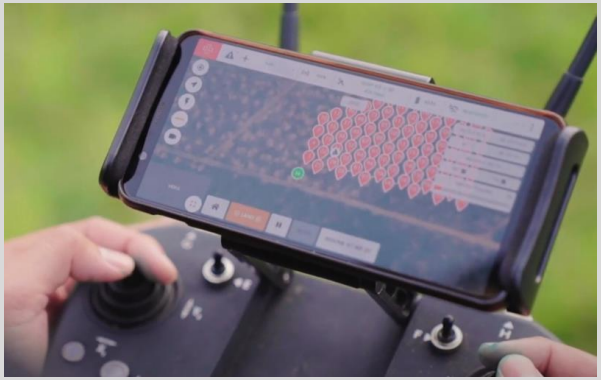
FlytNow

A cloud base service



GPS RTK Controller

Beacon for RTK

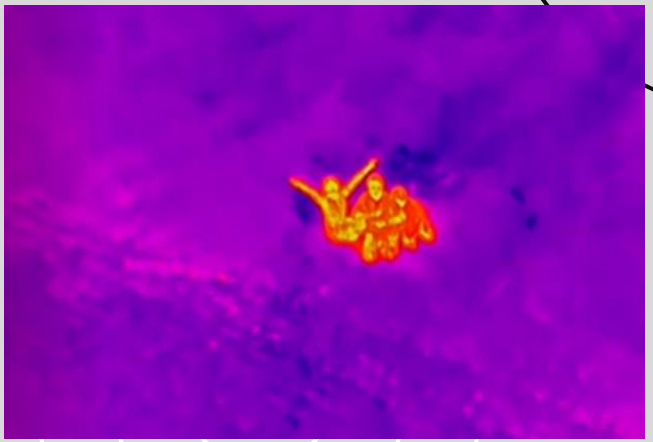


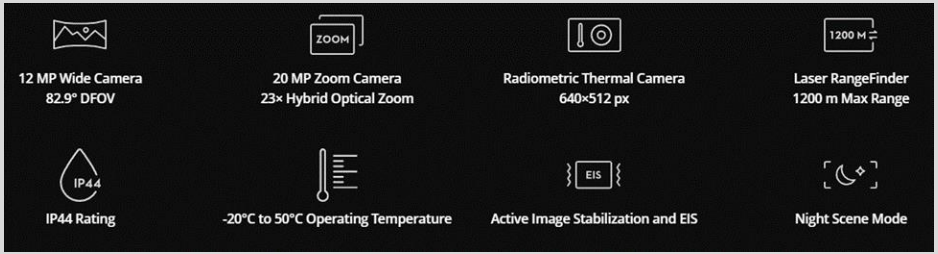
GPS RTK Controller

4. DATA COLLECTION

Thermal View

- Thermal Camera plays a huge role in findings victims





Long Range Viewer

30X Optical zoom makes it the greatest surveyor to be used to search people from a high place

Orientation, Motion and Heading

VN-200

INTRODUCTION

The VN-200 is a miniature, high performance GNSS-Aided Inertial Navigation System (GNSS/INS) that combines 3-axis gyros, accelerometers and magnetometers, a high-sensitivity GNSS receiver, and advanced Kalman filtering algorithms to provide optimal estimates of position, velocity, and attitude.

0.2°	**0.03°**	**5-7°/hr**
Dynamic Heading Accuracy	Dynamic Pitch/Roll Accuracy	Gyro In-Run Bias (typ.)
< 0.04 mg	**±16 g**	**±2,000˚/sec**
Accel In-Run Bias	Accelerometer Range	Gyroscope Range
800 Hz	**400 Hz**	**500 mW**
IMU Data	Navigation Data	Power

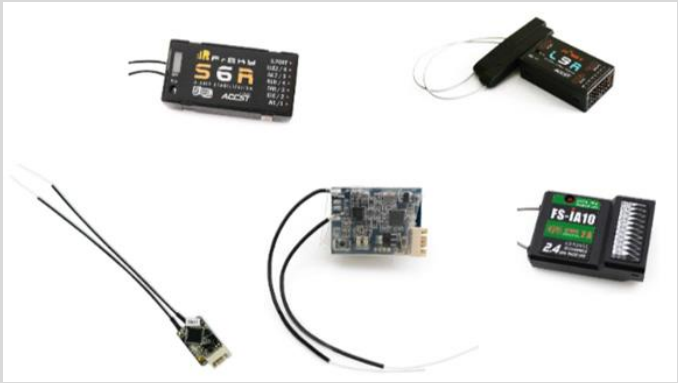
5. DATA TRANSMISSION

First Person View

People can perceive the first person view of the drone

Radio Frequency

Remotely control the drone



Radio Receiver

6. POWER MANAGEMENT

Battery with Fast Charging Station

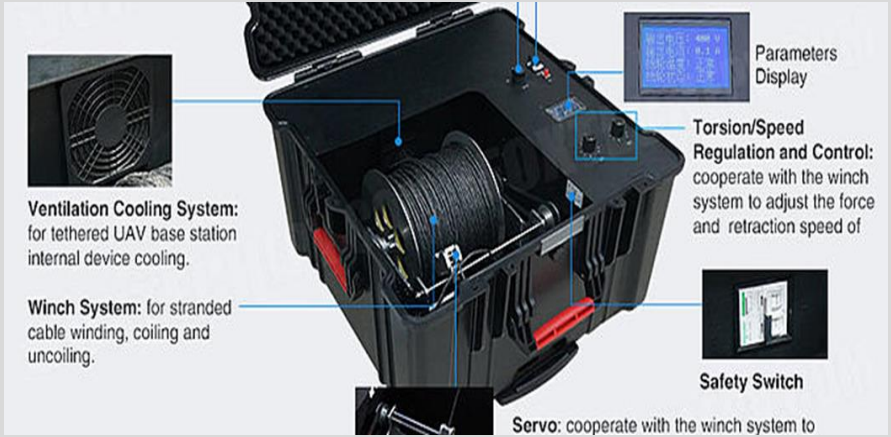
WB37 Intelligent Battery

Capacity: 4920 mAh
Voltage: 7.6V
Type: LiPo
Energy: 37.39 Wh
Charging Time (using BS60 Intelligent Battery Station):
70 min (15 °C to 45 °C);): 130 min (0 °C to 15 °C)

BS60 Intelligent Battery Station

- For DJI Matrice 300 RTK batteries
- Charge 8xTB60 & 4xWB37 batteries
- Built-in carry telescoping handle
- Automatic pressure valve
- Status LEDs & firmware updateable
- Requires USB type-C cable & remote
- Hard-shell case with built-in wheels
- Padlock holes for improved safety
- Air intake & air vent

Tethered Drone



Winch system to keep wire neatly coiled

UAV COMPANIES IN MALAYSIA

Poladrone https://poladrone.com/about_us.html

Vortex Edge Sdn Bhd http://www.vortex-edge.com/uav-solutions/

Malaysia UAV Developments Association https://muda.org.my/

DEFTECH https://www.deftechust.com/copy-of-products

Dragonfly Robotix https://www.dragonflyrobotix.com/

Kambyan Network https://www.kambyan.net/

DroneCult https://www.dronecult.photography/

THANK YOU!