Fun 4
PAGE NO.:
DATE:

10/02/23

COMPONENTS OF DRONES

(i) Propellers

→ Speed and load lifting ability of a drone depends on shape, size, and number of propellors.

→ Thus, long propellors create huge thrust to carry heavy loads at a low RPM and use sensitive to change in rotation speed.

→ Short propellors carry fewer loads, change the rotation speed quickly and require high speed for more thrust.

(ii) Motors

→ Both motor brushless and brushed type can be used for drones.

→ Brushed motor is less expensive and used for small-sized drones.

→ Brushless-type motors are very powerful and energy efficient, but need ESC to control their speed.

(iii) ESC (Electronic Speed Controller)

→ It is used to connect the Battery to the electric motor for the power supply.

→ Converts the signal from the flight controller to (RPM) of the motor.

→ ESC is provided to each motor of the drone.

(iv) Radio Transmitter – Sends the radio signal to ESC to pilot To control motor speed

(v) Radio Reciever – Recieves the signal from the pilot.

(vi) Battery – High-power capacity, Lithium Polymer (LiPo) is used for most drones.

(vii) Speed Control – It is connected between the control unit and motors and battery supply

(viii) Flight Controller (FC) •

→ It is the brain of a drone (boad)

→ FCB controls the drone from the ground (Ctdftg)
(Cpwmb&tc)

→ Can also be defined as a computer processor which manages balance and telecommunication controls

→ It performs the following functions :-

a) Sensing - Uses set of sensors for height, speed etc.

b) Controlling - naturally control motion of drone

c) Communicating - for battery level recharge or flight further, we need communication

→ It is really is like our own braine but made for flying.

REQUIREMENTS FOR DESIGNING DRONE FRAMES

(i) Thrust Calculation:-

$$T = \frac{1}{H} \times \frac{(P+W)}{M}$$

(ii) Payload Calculation:-

$$P = T \times M \times H - W$$

Where:- T = Thrust ⇒ amount of upward force your drone can produce when at ~~full~~ throttle

H = hover throttle % ⇒ force which gives the propellers on your drones enough power to go airborne

P = Payload Capacity ⇒ Addition weight that can be attached to the drone

W = Weight of the drones frames

M = No. of motors ⇒ working principle component

Fun 4
PAGE NO.:
DATE:

CONNECTING THE ESP8266 TO ARDUINO

- Connect our ESP8266 to an Arduino board.
- We are going to control an LED with 8266.
- Once installed the library and connected the ESP8266 to the Arduino, now is the time to download the Blynk mobile app.
- Install the app and finish the registration process, if required.
- Create a new project with connection type "WIFI' and device "Arduino IDE'.

ESP 8266	Arduino
RX	3
TX	2
VCC	3V
CH_PD	3V
GPIO 0	No connection
GPIO 2	No connection

*) Embedded C program for traffic light system using 8051 microcontroller:-

```
#include <reg51.h>
//signal
sbit r = P1^0 //red
sbit y = P1^1 //yellow
sbit g = P1^2 //green
//delay function
void delay (unsigned long int t){
  while (t>0){
    unsigned long int i;
    for(i=1 ; i<10 * 1275; i++); //buffer loop
      t--;
  }
}
void trafficlight() {
    r=1;

    delay (100);
    P1.0    r=0; -
    P1.1    y=1; -

    delay (100);
        y=0;
        g=1;

    delay (100);
        g=0;

}
```

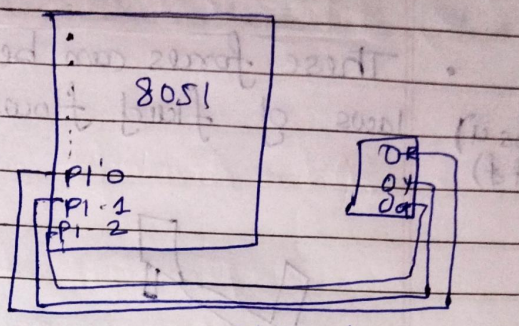
r=1 ← 12750 / 10 → r = 0x10

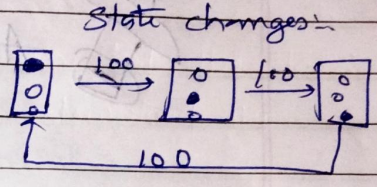
{XY2 (PIN_NO, output)} → ( ) → P1.0 → g
P1.1 → Y
P1.2 → R

Fun 4
PAGE NO.:
DATE:

o/p:-

```
//main function
void main (){
    x=y=q=0
[while (true){
  → trafficlight();}
}//main ends
```





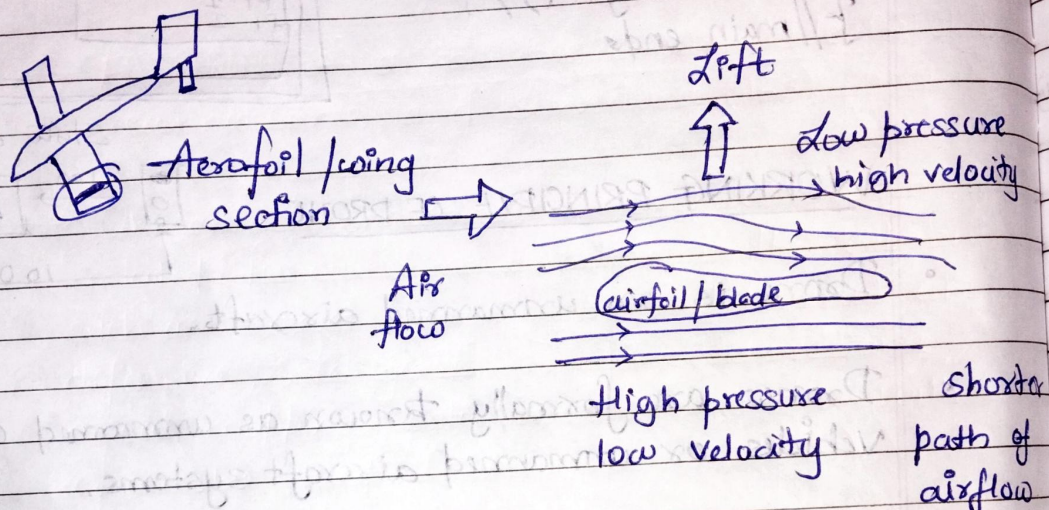
WORKING PRINCIPLE OF DRONE

- Drone is an unmanned aircraft.
- Drones are formally known as unmanned aerial vehicles or unmanned aircraft systems.
- Essentially, drone is a flying robot that can be remotely controlled or fly autonomously using software-controlled flight plans, that can be work in conjuction with the onboard sensors and a global positioning system (gps).
- Working-Fluid dynamics plays a significant role in the design and development of aircraft and drones.
- Drones consist of the working principle of the aerodynamics of aircraft.
- A sufficient amount of upward force is required to lift the vehicles against gravity which is named Lift.
- The force created to move the vehicle or body in motion is called Thrust.

- These forces can be studied using the kinematics laws of fluid flows.

(Fcbs 4) (Iat f)

WP of aerodynamic lift



- Force is directly proportional to the velocity of the air at the inlet.

F = Force
V = velocity
ρ = density
t = time
A = Area
m = mass

$$F = \text{constant}\ (mV)/t$$

Re-write the equation :- $F = (\text{constant})\ (m/t)V$

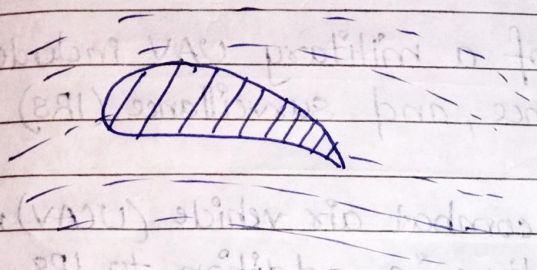
$$\therefore m/t = \rho VA$$

$$F = \text{constant}\ (\rho VA)V$$

Fun 4
PAGE NO.:
DATE:

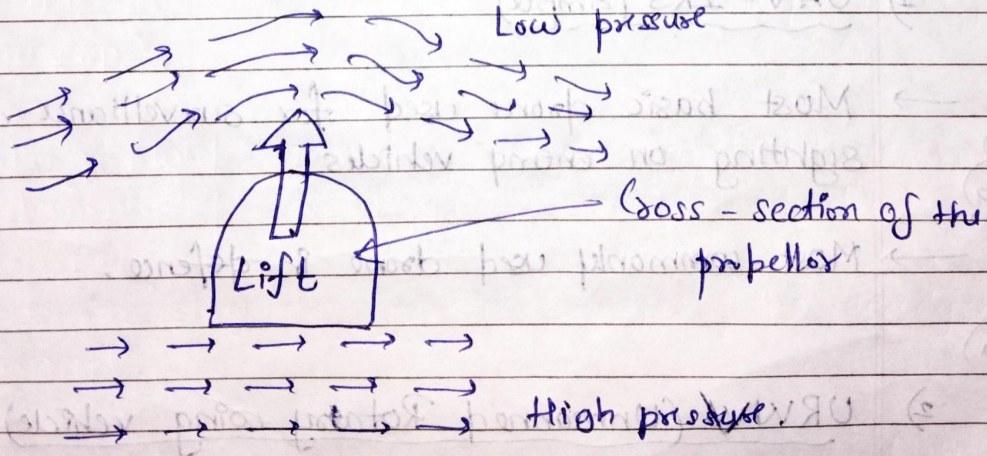
$\Rightarrow F = \text{constant} \times \rho V^2 \leftrightarrow$ Change the constant to include A

$= \text{constant} \times \rho \times A \times V^2$



- High fluid pressure at the bottom and low pressure at the top of the propeller causes an upward force called lift.

- The amount of lift force depends on the angles of inclination of the aerofoil or propellor.



Fun 4
PAGE NO.:
DATE:

18/02/23

*) MISSION CONTROL DRONES - DEFENCE

- UAV → Aircraft without a human pilot (Awhp)

→ Functions of a military UAV include intelligence, reconnaissance, and surveillance (IRS) (MUAV int

→ Unmanned combat air vehicle (UCAV) meet combat-related functions in addition to IRS capabilities, such as target tracking and deployment of defensive, intelligence gathering, surveillance; aerial mapping, anti-terrorist activities with remarkable speed. (UCAV) (crf) (iatIRSc)

(tt & dodging) (s, am data wrs)

- Some defensive-based drones:-

1) UAV - IRS (simple)

→ Most basic drone used for surveillance and target-sighting on enemy vehicles.

(mbd) (sats oe)

→ Most commonly used drone in defence.

(curdid)

2) URWV (Unmanned Rotary wing vehicle)

B+bo) → Best for battlefield combat operations

→ Eg:- Black Eagle class (Israel operation)

3) Unmanned underwater vehicles (UUWVs)

→ Ideal for undertaking underwater surveillance and reconnaissance of targets operating in coastal regions.

→ Helps in tracking of hostile submarines operating under submerged conditions.

(UUUH)

4) Hunter - Killer UAV

→ Fully equipped with Advanced navigation and communication systems

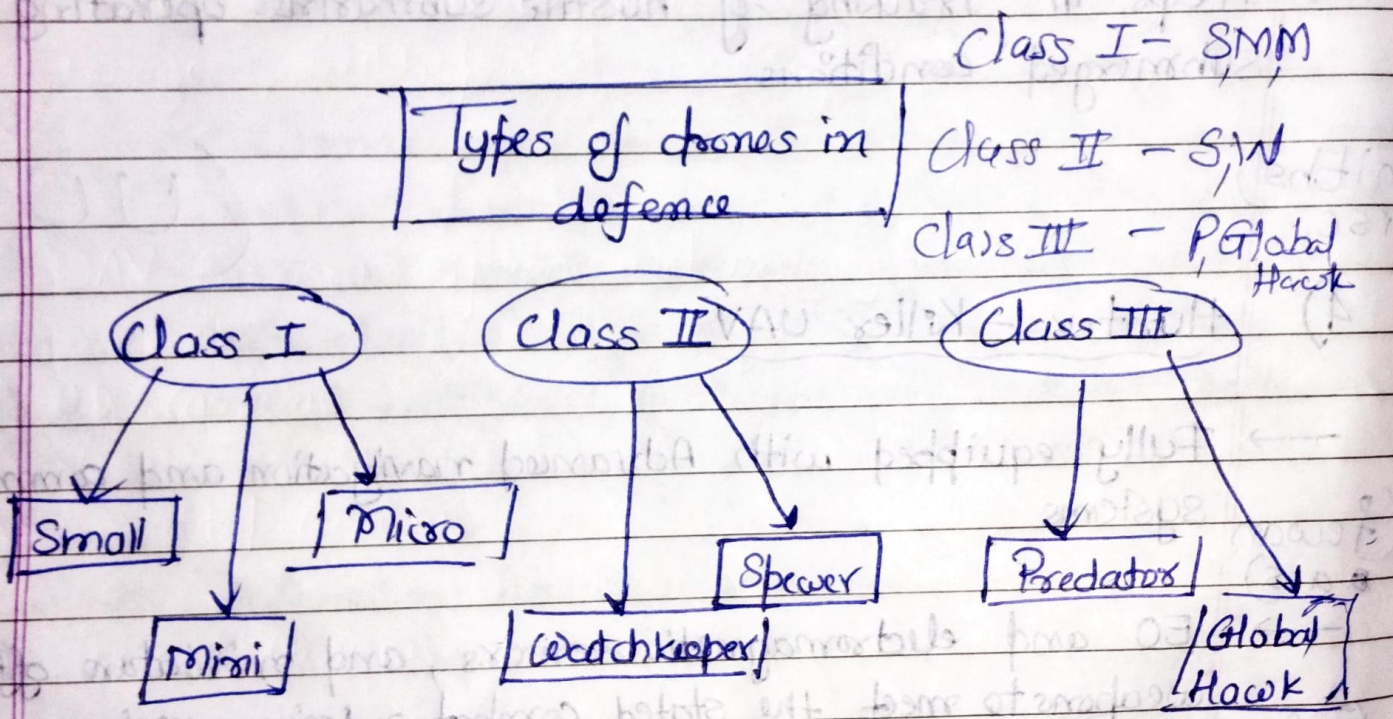
→ EO and electromagnetic sensors, and miniature offensive weapons to meet the stated combat mission requirements.

GCS for defence

- UAV ground control station (GCS) is a land-or-sea based control centre that provides the facilities for human control.
- It may refer to a system for controlling drones within or above the atmosphere,
- GCS software is typically run on a ground-based computer that is used for planning and flying a mission.

- Generally, every class of combat drones have there on GCS, but scientist are now advancing towards a GCS operating all unmanned aircraft.

CLASSIFICATION OF DRONES IN DEFENCE



Fun 4
PAGE NO.:
DATE:

* Controlling Cameras in Drones

- Drone cameras are relatively new, but they've become more popular, thanks to improving technology and shrinking prices.

- You can find great beginner drones with a camera, a drone with a powerful HD camera, and even high-res 4K camera

- Whilst the variety of models has grown quickly, most drones share many of the same controls and functionalities.

- When talking about a drone or a drone camera, we're typically referring to a typical quadcopter configuration.

- These models dominate the market almost exclusively, due to being relative simpler compared to single-rotor or other systems.

Fun 4
PAGE NO.:
DATE:

Cameras used in drones

- Unmanned vehicles such as UAVs, drones, UGVs and ROVs may use a wide variety of cameras to capture different kinds of imagery.

- These capture a wide variety of images like photos, thermal images, multispectral images for various applications.

(Optimi)

- UAV camera systems and imaging include :-

1) HD Cameras
2) Embedded Cameras
3) Thermal Cameras
4) IR Camera Sensors

(HETI)

- Imaging payload on an unmanned vehicle may be connected to a control computer which triggers the camera, stores images, and records metadata such as camera settings

(Ipcamvmb ctoecwtk S; & rm)

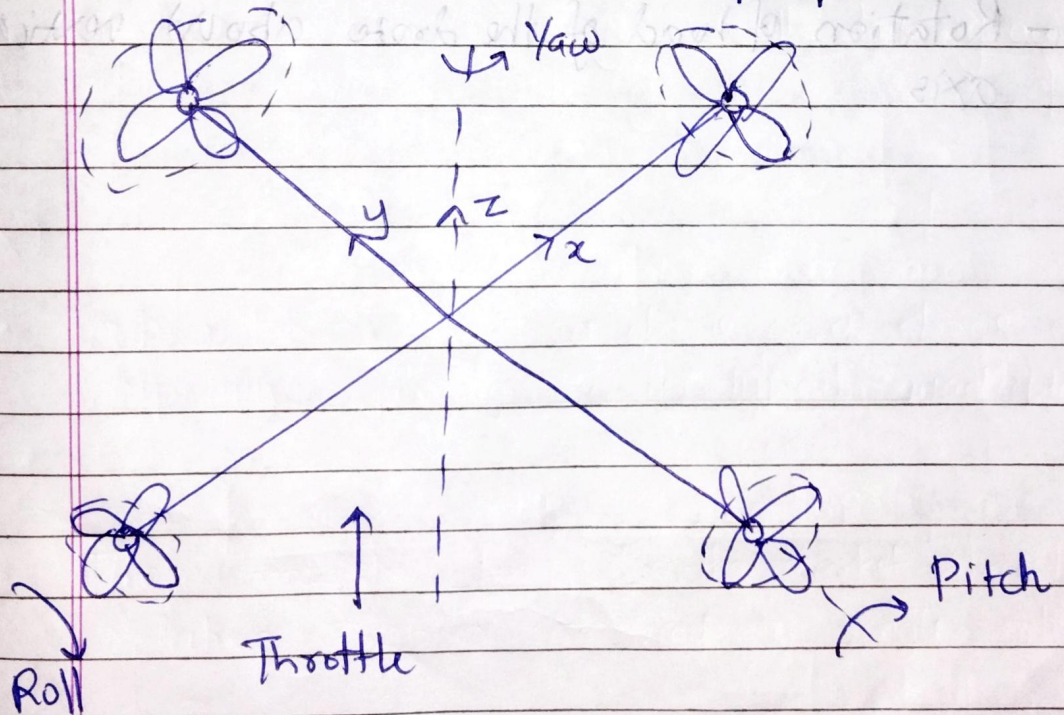
Fun 4
PAGE NO.:
DATE:

Rotor Working (Quadcopter)

- A quadcopter has 4 propellers at each frame corner.
- Diagonals ones rotate in one direction, while cross diagonals rotors rotate in other direction.

Components:-

1) Throttle / Hover: Up/down movement of the drone.
Faster speed of rotors makes it go up.
Slower speed makes it go down.



(RYP)

2) Pitch - forward and backward movement of the drone, above a lateral axis.

- Rear propellers > forward propellers → Drones move forward
- Rear propellers < Forward propellers → Drones moves back

3) Roll - Right / left movement of drones, about longitudnal axis.

Left rotors > Right rotors → Drone goes left
Right rotors > Left rotors → Drones goes right

(PRY)
(Above)

4) Yaw - Rotation of head of the drone about vertical axis.

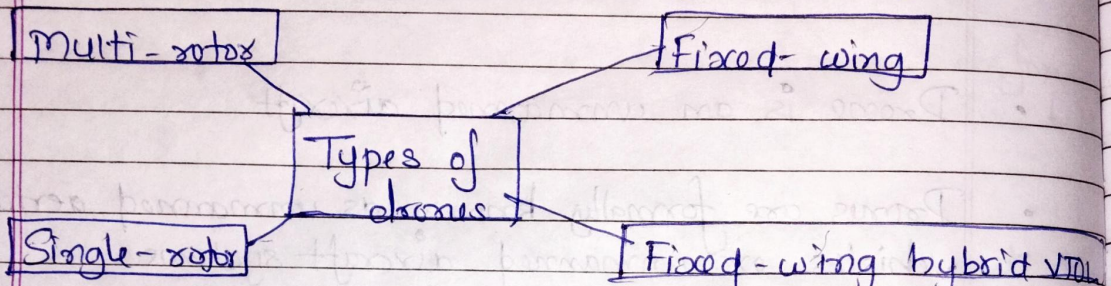
Fun 4
PAGE NO.:
DATE:

TYPES AND CATEGORIES

- Drone is an unmanned aircraft.
- Drones are formally known as unmanned aerial vehicles or unmanned aircraft systems.
- Essentially, flying a drone is a flying robot that can be remotely controlled or fly autonomously using software-controlled flight plans, that work in conjuction with onboard sensors and a global positioning system (GPS).
- Drones are basically used for doing something where humans cannot go or carrying out a mission that is impossible for humans.
- Drones or UAVs allow you to communicate with the physical drone and controller on the ground.
- Drones spread across various applications such as search and rescue, Agriculture, traffic monitoring

Fun 4
PAGE NO.:
DATE:

- Till date, we have studied four types of drones:-



- In-brief description of these types are as follows:-

a) Multi-Rotor drones

→ Used for professional use

→ often low price and small in size

(Physics) (etc&m) → Easy to control and maneuver.

Eg:- Used in Aerial photography, Agriculture etc

b) Single-rotor drones

→ Long-endurance flight

→ Fast-speed than multi-rotor drones

Eg:- Used in Aerial LiDAR laser scanning

(Alis)

e) fixed-wing drones

(i) Greater stability in wind (gsiw)

(ii) Expensive and difficult to land (eadtl)

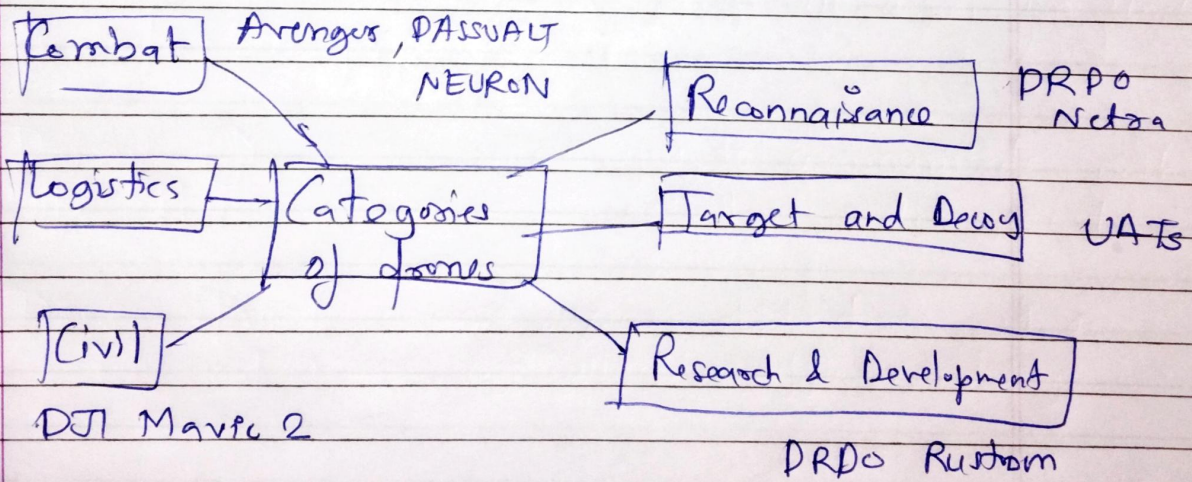
eg:- Used in Aerial mapping, utility inspection

d) fixed wing drones VTOL hybrid

(i) Uses VTOL and hover operations

(ii) Requires more training

→ Some categories of drones are as follows:-



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