d)

First,

Speaking about the Hardwares I'll go with

- Raspberry Pi 4/5 as a High-level controller (which takes care of the object detection, color detection, autonomous driving, waypoint navigation.

- Esp8266 for swarm communication.

- Pixhawk flight controller as low-level controller (for controlling the motors, it will be commanded by Raspberry pi)

- Battery for supply

- GPS module to know the exact location of the drone

- IMU module to know the orientation of the drone.

- ESC (Electric motor Speed Controller)

- Camera (to detect the color of the object)

- LIDAR (to get all the info about distance and dimensions)

- Pressure sensor (to get the height of the drone)

- 4 BLDC (Brushless DC Motor) for its high speed and less weight.

Ok now coming on to the work flow,

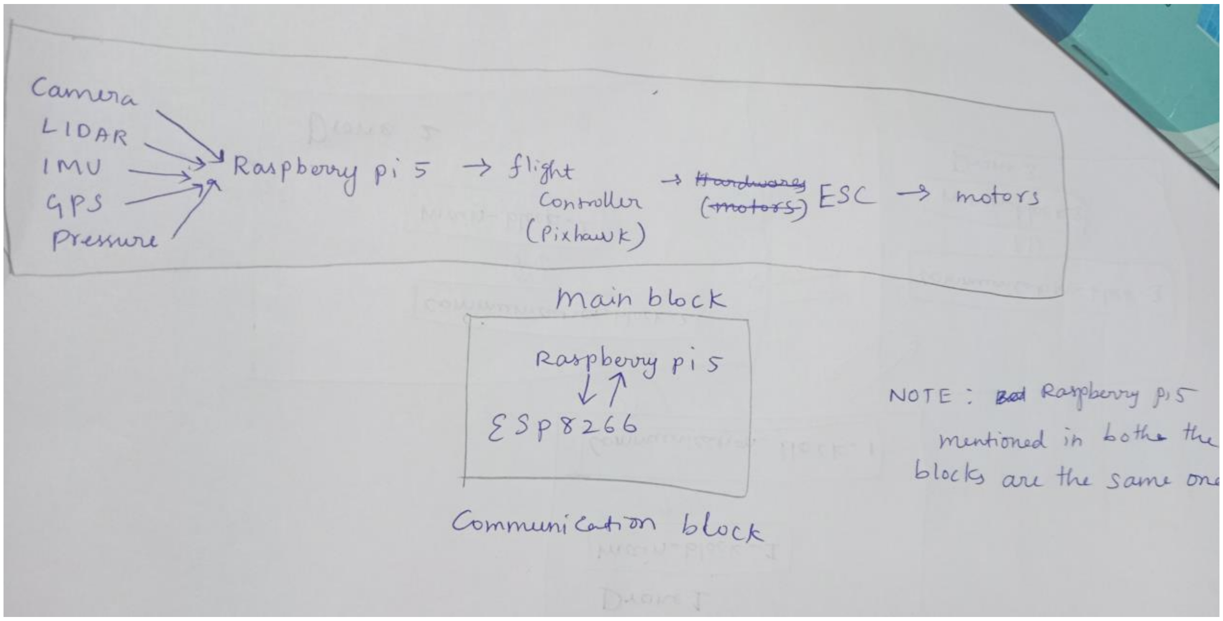
We need to connect all the sensors (camera, IMU, GPS, LIDAR, pressure sensor) to the Raspberry PI as these are the inputs to our system.

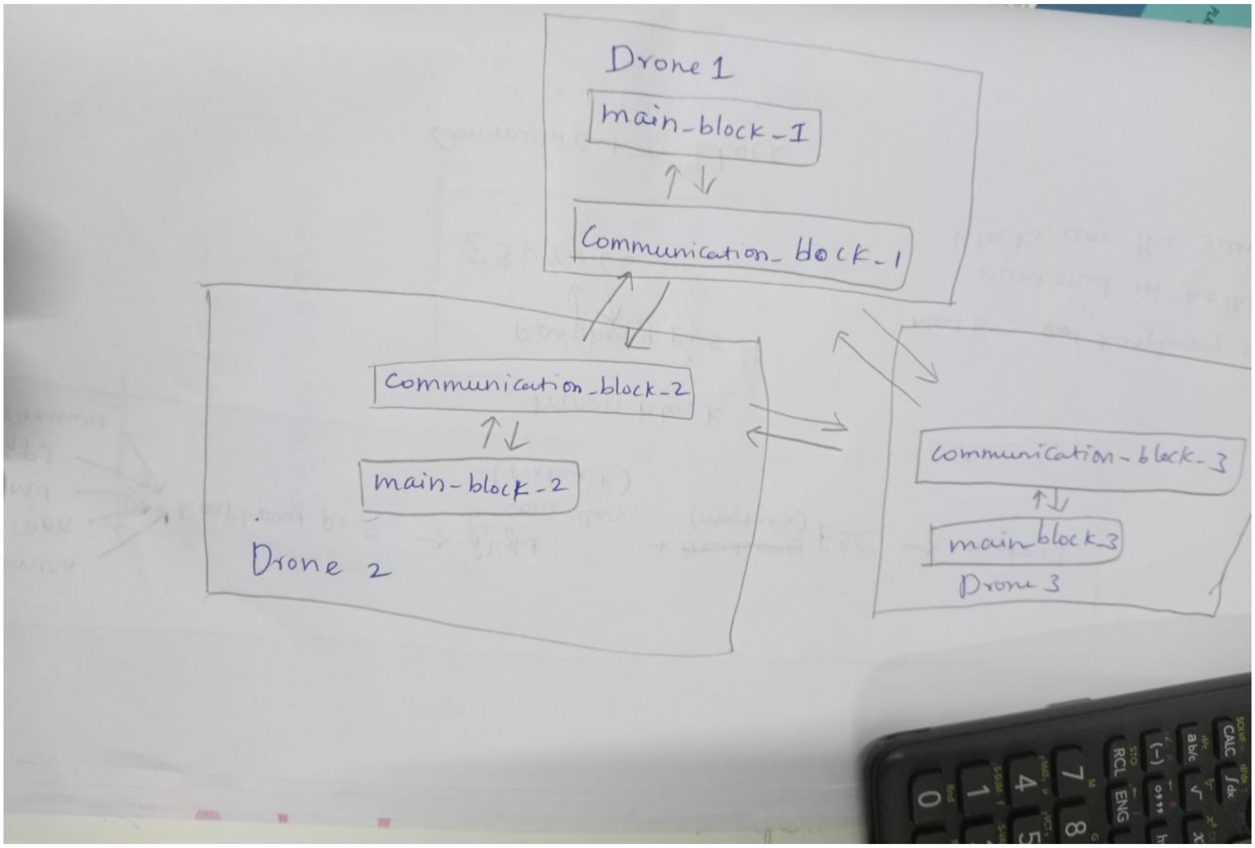
And connect the pixhawk flight controller and esp8266,

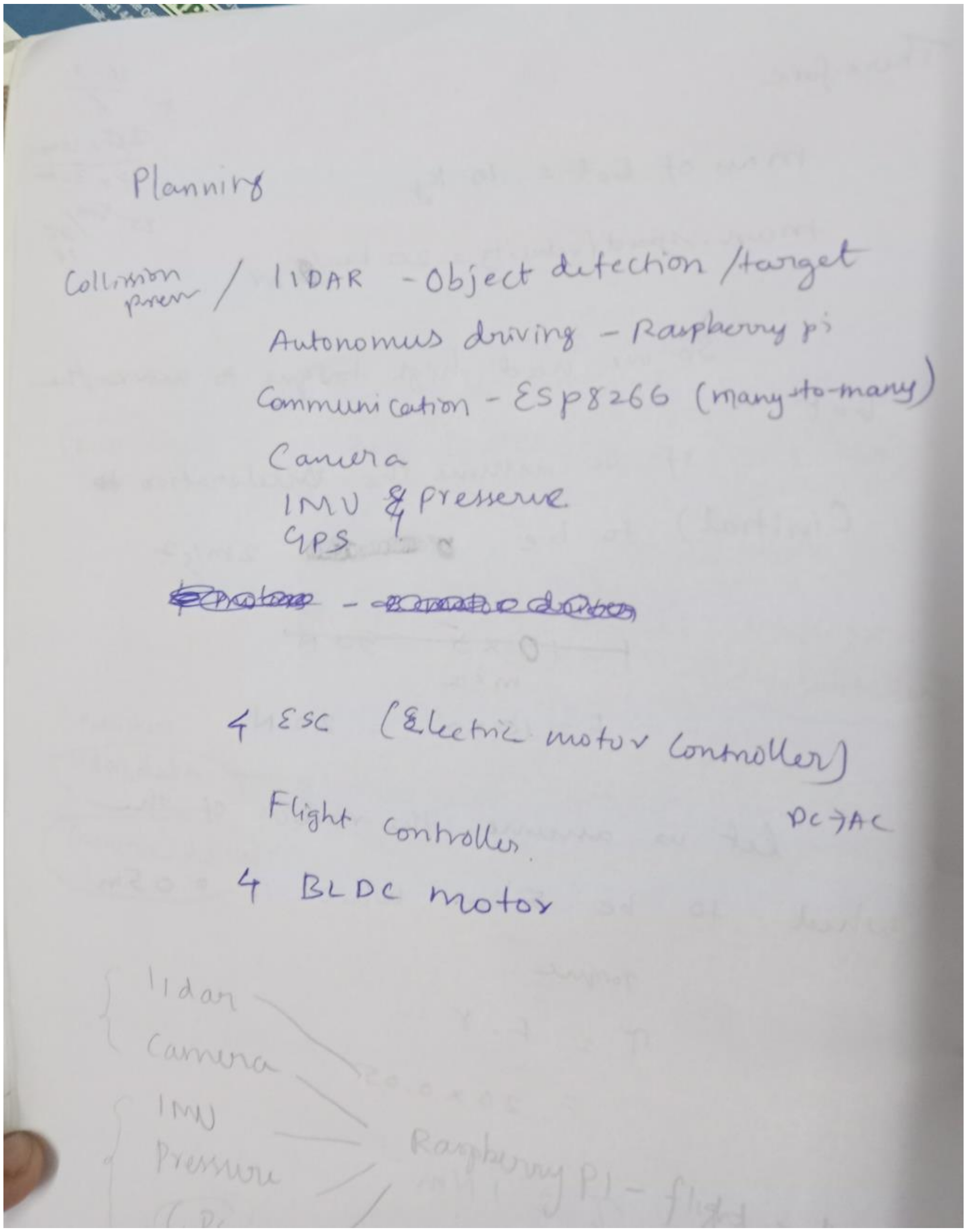
Here the esp8266 is used as both input as well as output, since it is the communication module and the pixhawk flight controller is commanded by raspberry pi.

The esp8266 of one drone is connected with the other two in a circular way.

The block diagram is shown below


Camera
LIDAR
IMU
GPS
Pressure
Raspberry pi 5
flight Controller (Pixhawk)
~~Hardware~~ (~~motors~~)
ESC
motors
main block
Raspberry pi 5
ESP8266
Communication block
NOTE : ~~Bot~~ Raspberry pi 5 mentioned in both the blocks are the same one


Drone 1
main_block_I
Communication_block_1
Communication_block_2
main_block_2
Drone 2
communication_block_3
main block_3
Drone 3



Planning

Collision prev / lIDAR - Object detection /target

Autonomus driving - Raspberry pi

Communication - ESP8266 (many-to-many)

Camera

IMU & Presserue

GPS

~~motors - motor driver~~

4 ESC (Electric motor Controller)

Flight controller. DC→AC

4 BLDC motor

lidar

Camera

IMU

Pressure

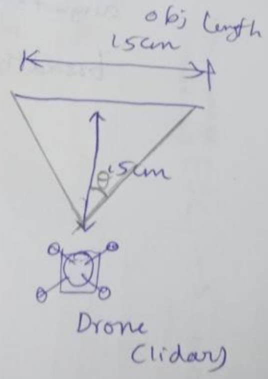
Raspberry PI - flight

let the drone fly at the altidude of 15 cm (assuming the lidar will be at the same height)

If any object detected then we found that there is a object ~~at~~ with 15 cm ~~legth~~ height

1st condition ok.

Then let the drone fix itself/align itself before the object at 15cm distance the



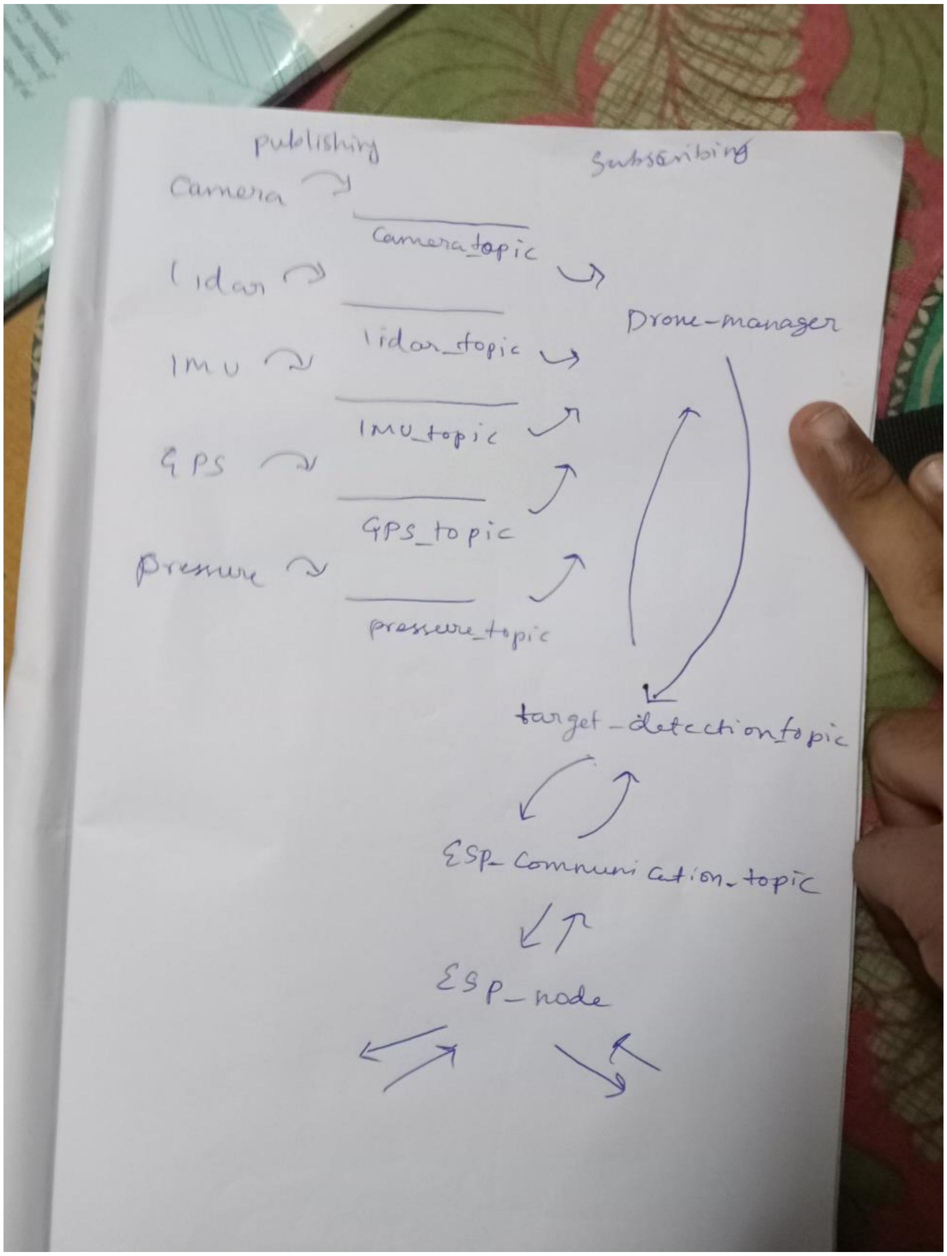
let the angle be θ

now

$$\theta = \tan^{-1}\left(\frac{7.5}{15}\right)$$

$$\boxed{\theta = 0.464 \text{ rad}}$$

$$\therefore \quad 2\theta = 0.927$$



For software here also basically we use ros .

We separately create specific topics for each sensor data and communication data and then that is processed by ros to get the necessary information .

References for this and code as well:

https://stackoverflow.com/questions/27928/calculate-distance-between-two-latitude-longitude-points-haversine-formula (to calculate distance bn two coordinates)

https://wiki.ros.org/ (for general syntaxes)

https://www.geeksforgeeks.org/multiple-color-detection-in-real-time-using-python-opencv/ (for colour detection)