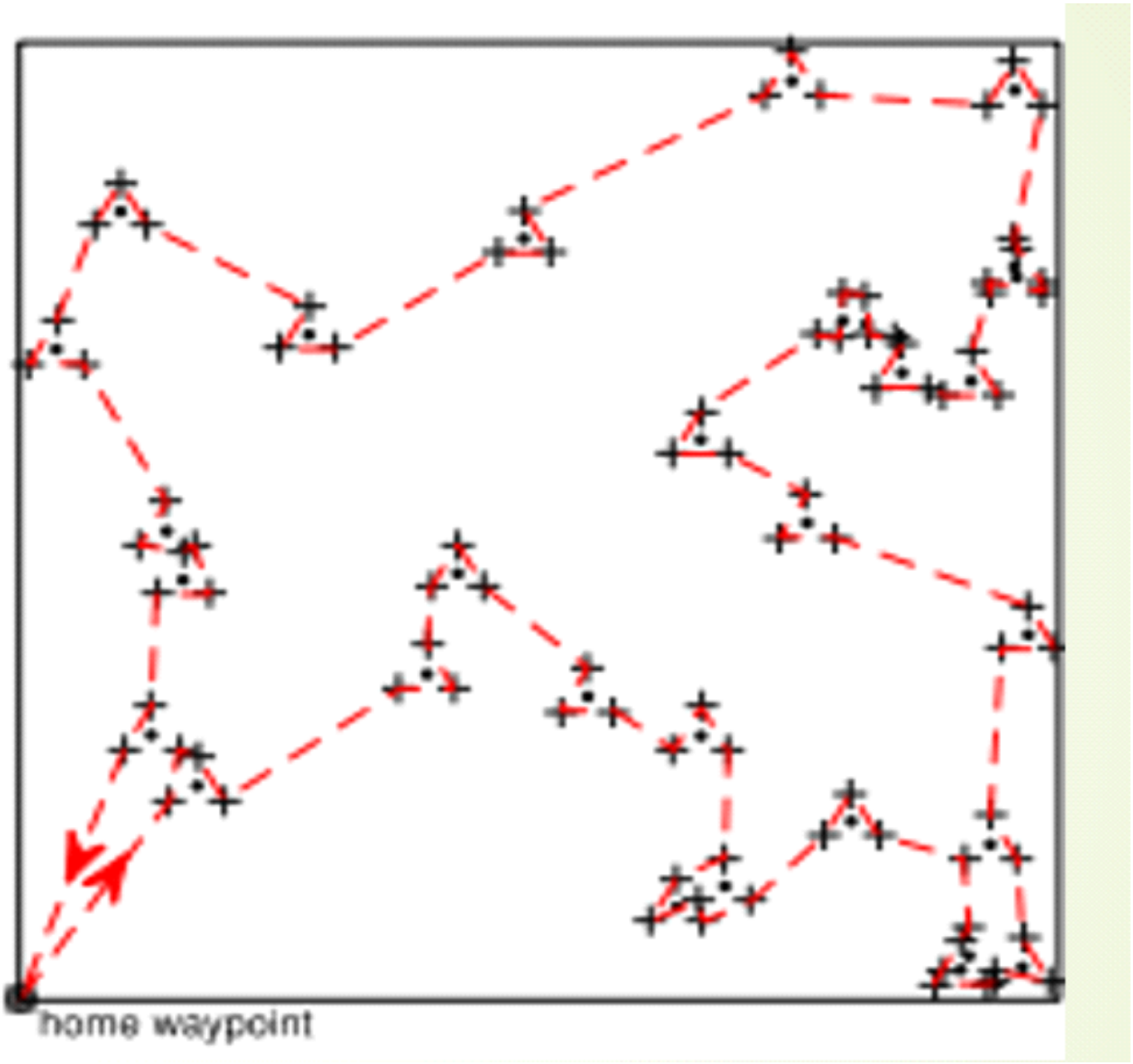
Methodology:

Waypoint Generation:

Technology involved: Global Positioning System(GPS), Global Navigation Satellite System (GLONASS).

Trajectory planning Algorithm: Global Positioning System (GPS), Angle of Arrival(AOA), Received signal strength indication(RSSI), LOCALIZER BEE, VERIFIER BEE.

Verifier BEE:



- *Figure 1 Verifier Bee*

- We have prior knowledge of the position of the nodes.
- we have to impose that the node is reachable by all the waypoints forming the verifiable triangle that contains it.
- Verifier Bee operates in three phases:
    - initial path construction
    - iterative improvement

    - waypoint reordering [1]

Collection of Data:

- Collection of data
    - Internet.
    - Drone (Collecting from the various streets).
    - Videos of local street (Various Cities).

- Total images: 1858
    - Clean roads:1000
    - Potholes:550
    - Garbage:308

More data will be gathered once we get the devices.

Deep Learning Inception Model:

Inception-v3 is trained for the ImageNet Large Visual Recognition Challenge using the data from 2012. This is a standard task in computer vision, where models try to classify entire images into 1000 classes, like "Zebra", "Dalmatian", and "Dishwasher". Likewise, we classify the images into 3 categories: clean roads, dirty roads, potholes.

Technology Involved: Google Inception Model, python script, dataset gathered by drone.

Here is the initial result by training images,

Diagram:

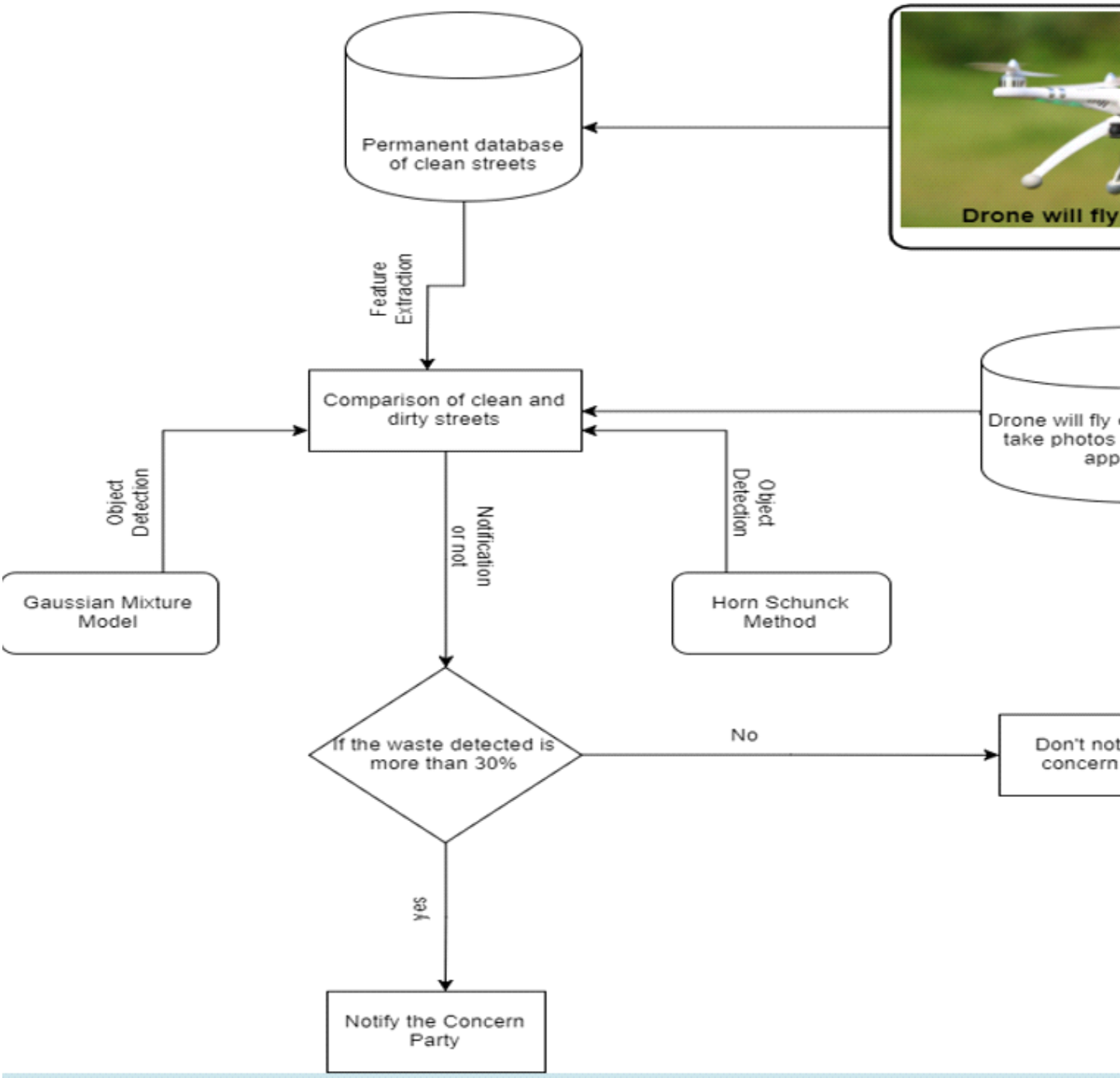
Below is the system design.

Hardware modules:

- Hardware Modules
    - Quadcopter: For flight and gathering data
    - Raspberry Pi/ Arduino/ Node MCU: GPS Trajectory, Data Logger
    - RFID Module (Warehouse Drone)
- Software Module
    - Python
    - GazeboSim
    - Matlab
    - Waston IoT
    - Google Inception module

- Verifier bee

workflow

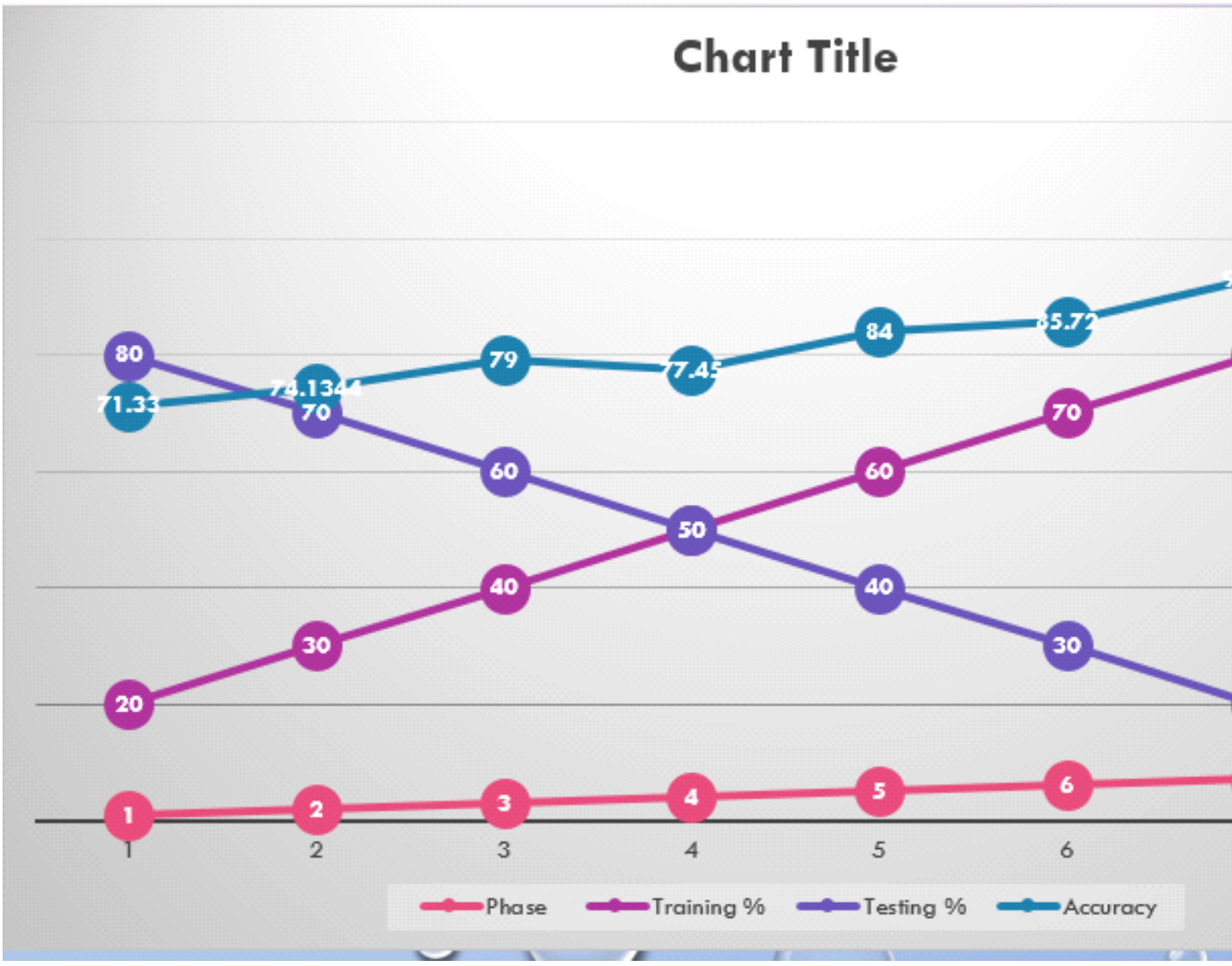


Analysis Table:

No	No of training images.	No of testing images	Type of testing images	Probability	Accuracy
1	3	750	Garbage roads	garbage dataset 0.9999995 potholes dataset:4.3115966e-07 clean roads 4.2900403e-08	98 %
2	20	750	potholes	potholes dataset 0.99998975 garbage dataset 8.9043315e-06 clean roads 1.2984551e-06	87.33%
3	50	1200	Clean roads	clean roads 0.997109 garbage dataset 0.0020415883 potholes dataset 0.00084943604	93%
4	100	1200	potholes	potholes dataset 0.999675 garbage dataset 8.9043315e-06 clean roads 1.2984551e-03	68%
5	150	1200	Garbage	garbage dataset 0.9999445 potholes dataset 5.31455966e-07 clean roads 5.2900403e-10	88%
6	25	1200	Clean roads	clean roads 0.997109 garbage dataset 0.0020415883 potholes dataset 0.00084943604	98%
7	100	1200	Clean roads	clean roads 0.9909473 garbage dataset 0.0020232389 potholes dataset 0.000882349	91%
8	28	1200	garbage	garbage dataset 0.9999995 potholes dataset 8.3345966e-08 clean roads 6.2700403e-09	76%
9	125	1200	garbage	garbage dataset 0.99994556 potholes dataset 1.3115966e-08	99%

				clean roads 3.2900403e-05	
10	65	1200	potholes	potholes dataset 0.9998111 garbage dataset 2.96453315e-05 clean roads 3.23332551e-06	94%

Analysis after image processing:



Information Decimate:

After the work is completed, and if the waste is detected, further action will be taken in form of notification to the concern party.

Software Used: Android application, Windows Application.

Image	Location	Date	Time	result
Image_1	Longitude Latitude	November 4, 2024	10:56 AM	Garbage / Clean / Potholes
Image_2	Longitude Latitude	November 4, 2024	10:57 AM	Garbage / Clean / Potholes

Bar Diagram:

References

[1] Analysis of localization for drone-fleet By Jin-Hyeok Kang, Kyung-Joon Park, Hwangnam Kim 28-30 october 2015-IEEE