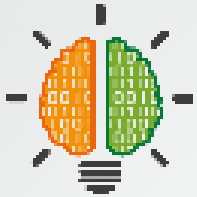


SIH 2020

An AI Based Drone software for waste management

Team name: Binary

Team members :

- Mansee Agrawal
- Harshika Urkude
- Anjali Nayak
- Prashant Jha
- Vinod Kumar Gupta
- Snigdha Singh

Problem

Statement : Geo Tracking of Waste and Triggering Alerts and Mapping Areas with High Waste Index

Theme : Waste Management

Organization name : CDK Global

PS Number : RA26

Objective : Build a drone software to monitor the waste lying on the land.

Problem Statement

- We do have waste lying in the cities which makes it hard for cleaning staff to know which area requires more attention and urgent garbage/waste pickup.
- With Swachh Bharat App, it requires people to capture the images of garbage and Geo tag the images, due to which adoption is low.
- With the drone connectivity and intelligent algorithm, pattern matching the drone can fly in designated coverage areas help monitor the waste.
- Mapping the location on the map with the Waste Quantity Index, so that the waste management team can quickly take action based on the waste level thrown in an area.

Expected Solution

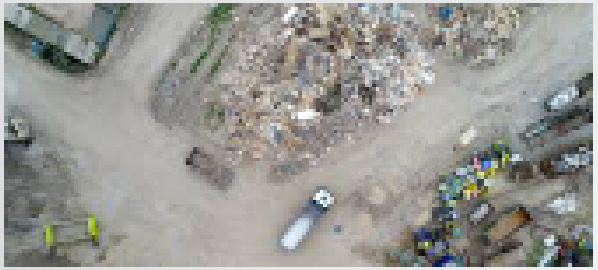
- Simulate a trigger model by calling an API and passing data values:
  - GPS Code location
  - Date and Time
  - Image of waste
- Interface to read the trigger and alert the nearest proximity Municipal Staff.
- Analytics to cluster the data and provide analytics by region.
- Visualization Report to view GPS Location of waste and also view history of the site after 24 hours and report status.

What we have implemented..

The final product of this solution is divided in following modules:

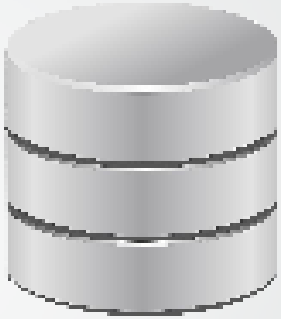
1. Image capturing and classification
2. Triggering alert to the nearest municipality
3. Geological and statistical analysis

Workflow



Images sources : Drones,
Public surveillance cameras

Classification of images based on amount of waste index: High , medium, low



Images saved with their classification and geo-coordinates

Analytics to show which region Require more attention

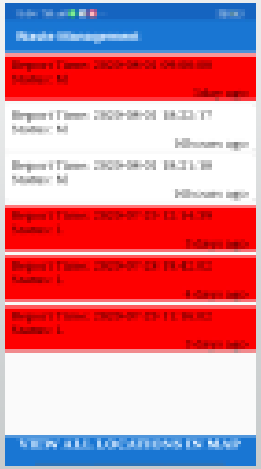
Alert notification sent to assigned waste collection In-charge of the area

Components Workflow

Image sources : Drones,
Public surveillance cameras

Waste classification API

Firebase database

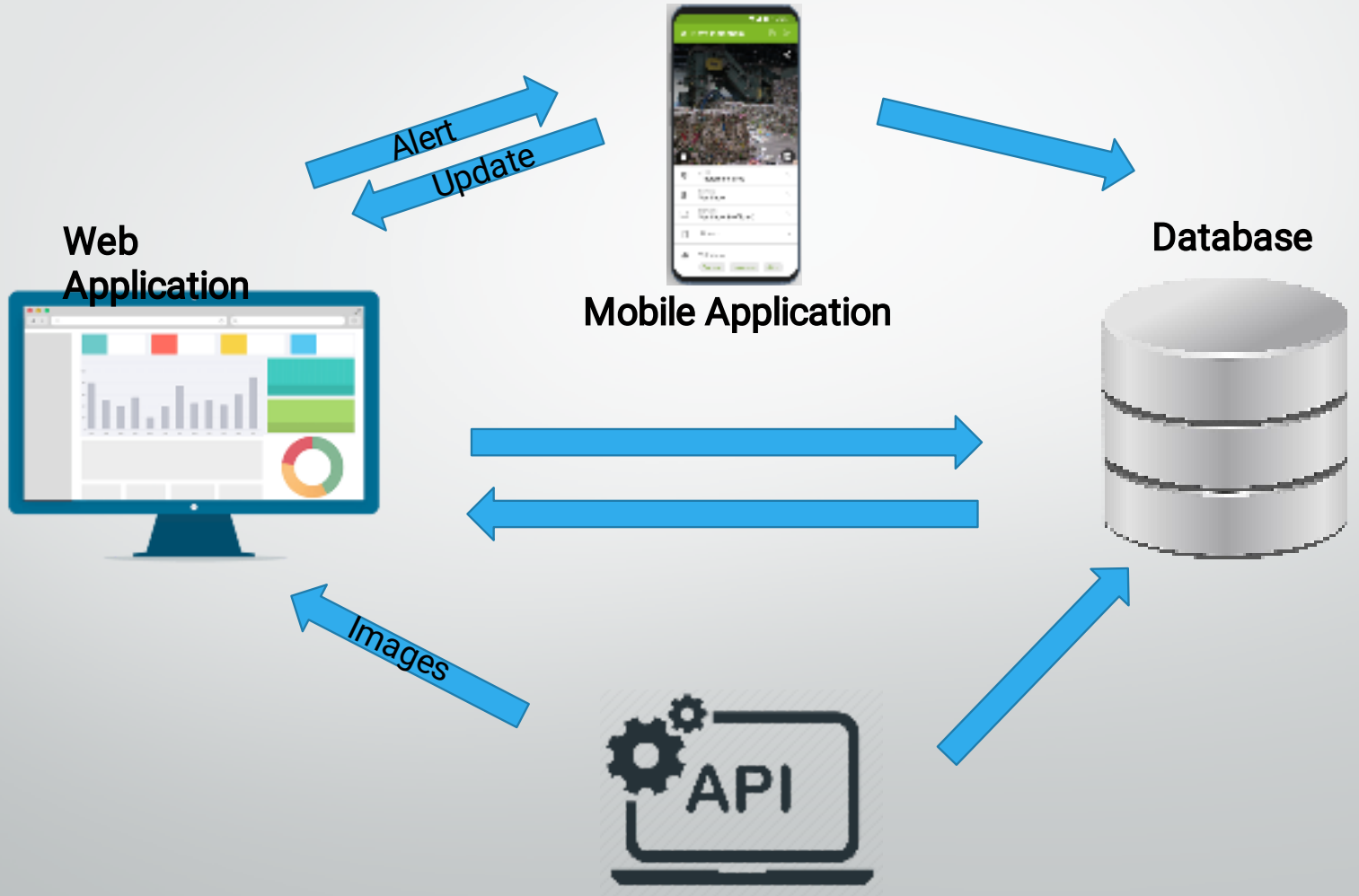


Alerts to nearest municipality

Database for Website

Analytics

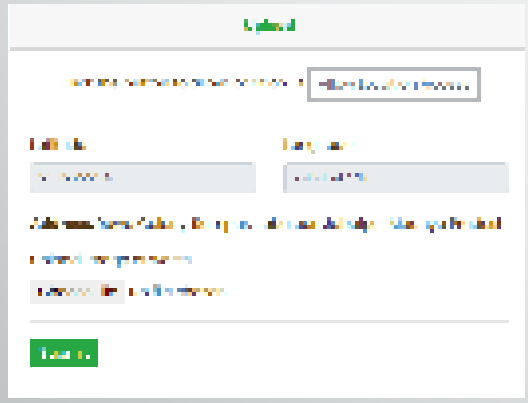
Product Architecture



Part I

Image capturing and classification

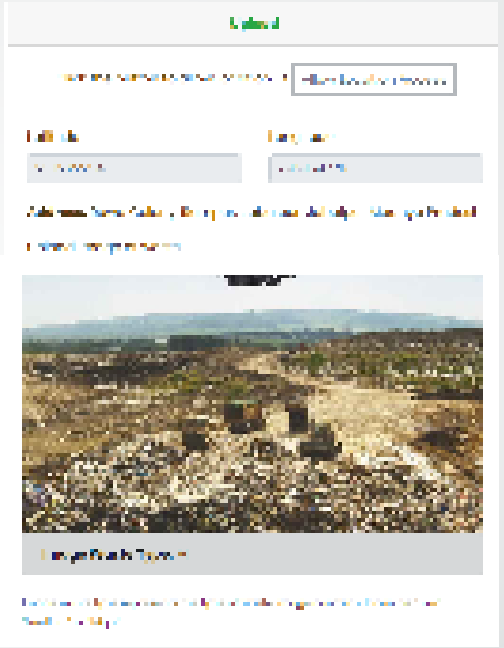
Image capturing



We are currently using website for
Image capturing and classification
Instead of drone

Image
+
geo-coordinates

Waste
classification API

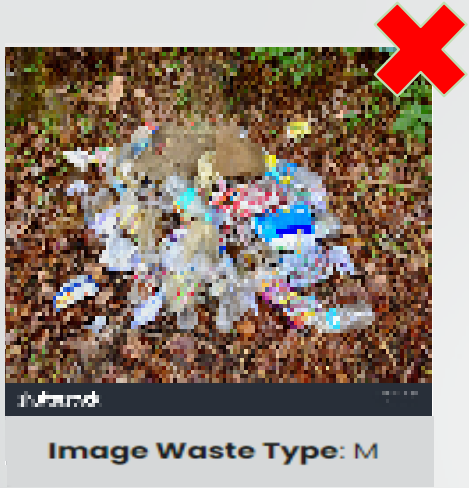


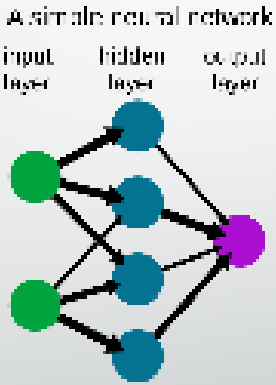
Geo-tagged image with classification

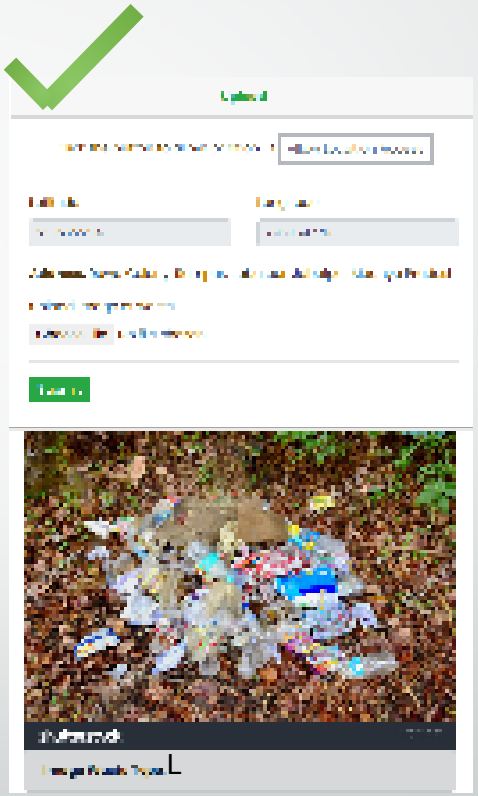
Firebase Database

What is Waste Classification API?

1. Resnet-50 classification model
2. Trained by transfer learning for waste classification
3. Self improving model







If model classifies an image wrong he can change the classification type to be updated in the database. Our model trains on these images regularly.

Part II

Solution for triggered alert

Firebase Database

Notification to manager

Send SMS

Alert SMS to waste collector

- COMPATIBLE FOR NON- SMART PHONE USERS
- USER FRIENDLY USER INTERFACE

Update by waste collector

Update "Y" + ReportID

Reports update to manager

MySQL

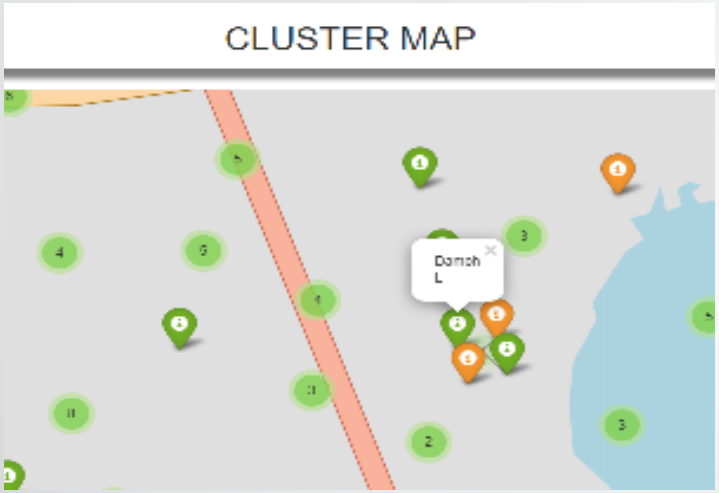
Updated in database

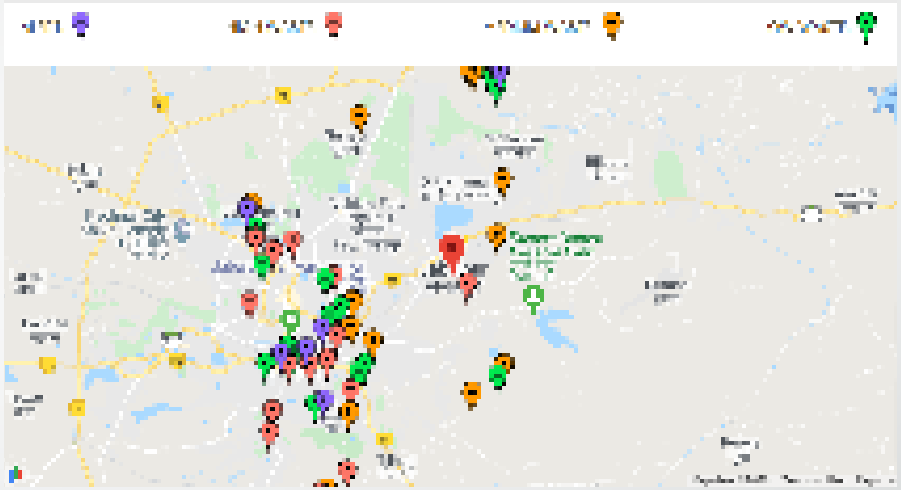
Part III

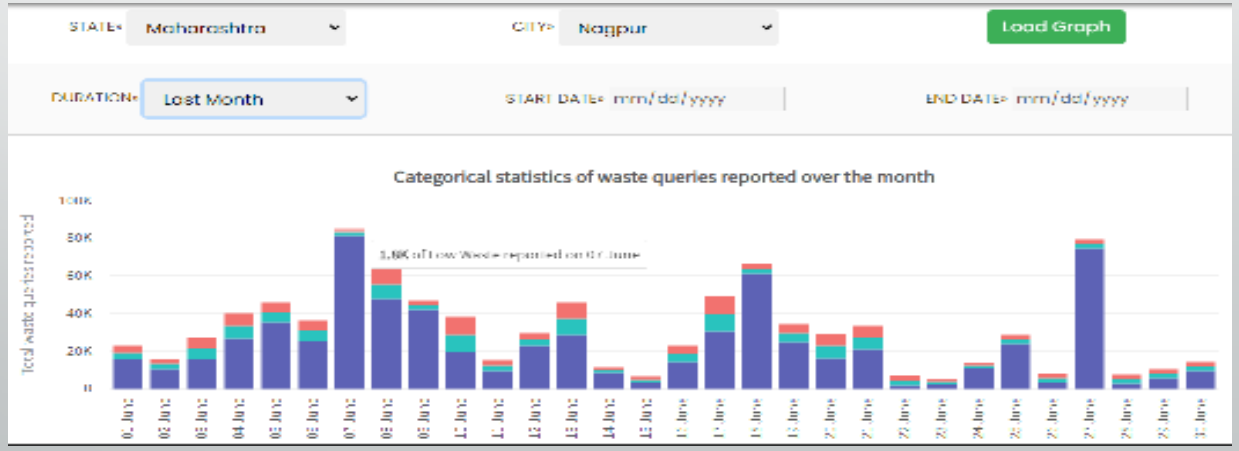
Solution for Analytics

Login as Manager

- TO VIEW ANALYTICS OF HIS DISTRICT

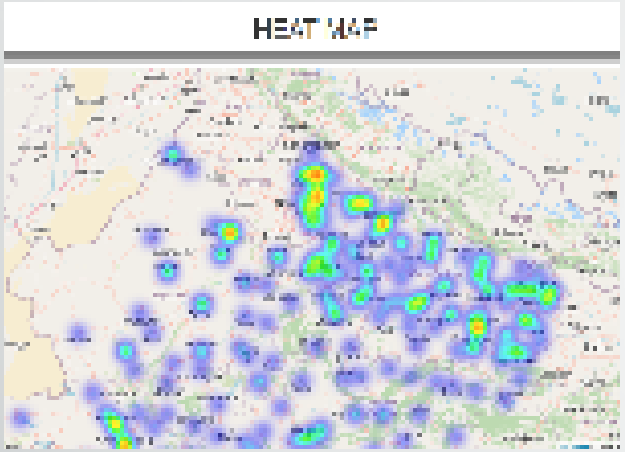


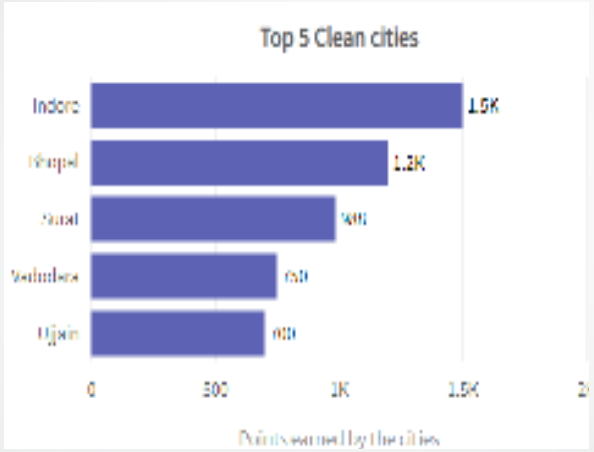


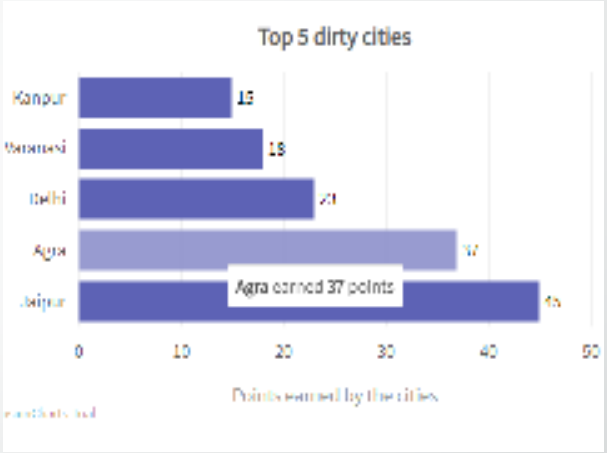


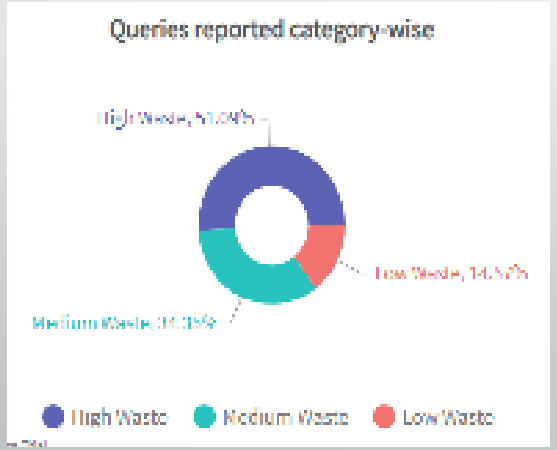
Login as Admin

- TO VIEW COMPARATIVE ANALYSIS OF ALL CITIES

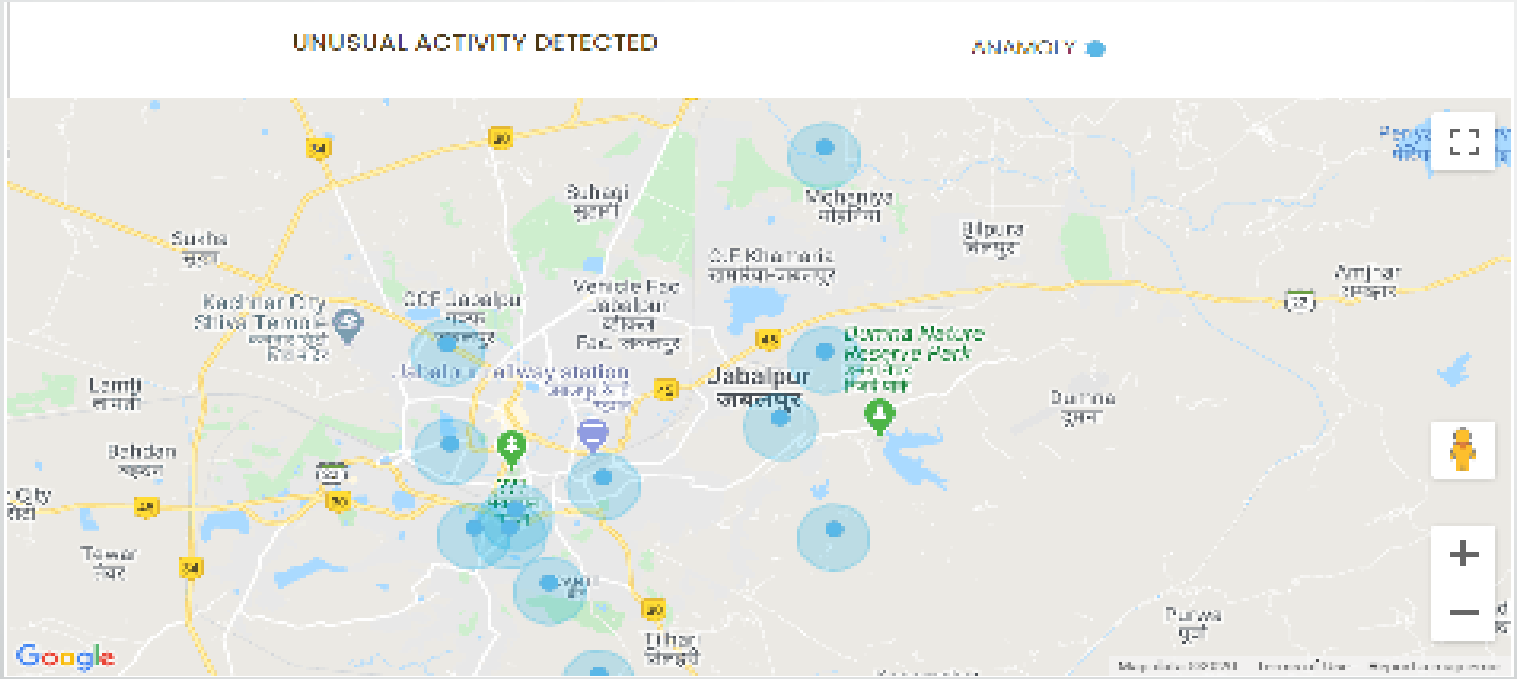








Solution of anomaly detection



Causes of anomaly data are false report submitted by waste collector or the place being hotspot of waste generation.

Technology Stack

Web

Front End

Back End

Database

Classification Model

Technology Stack

Android

Development

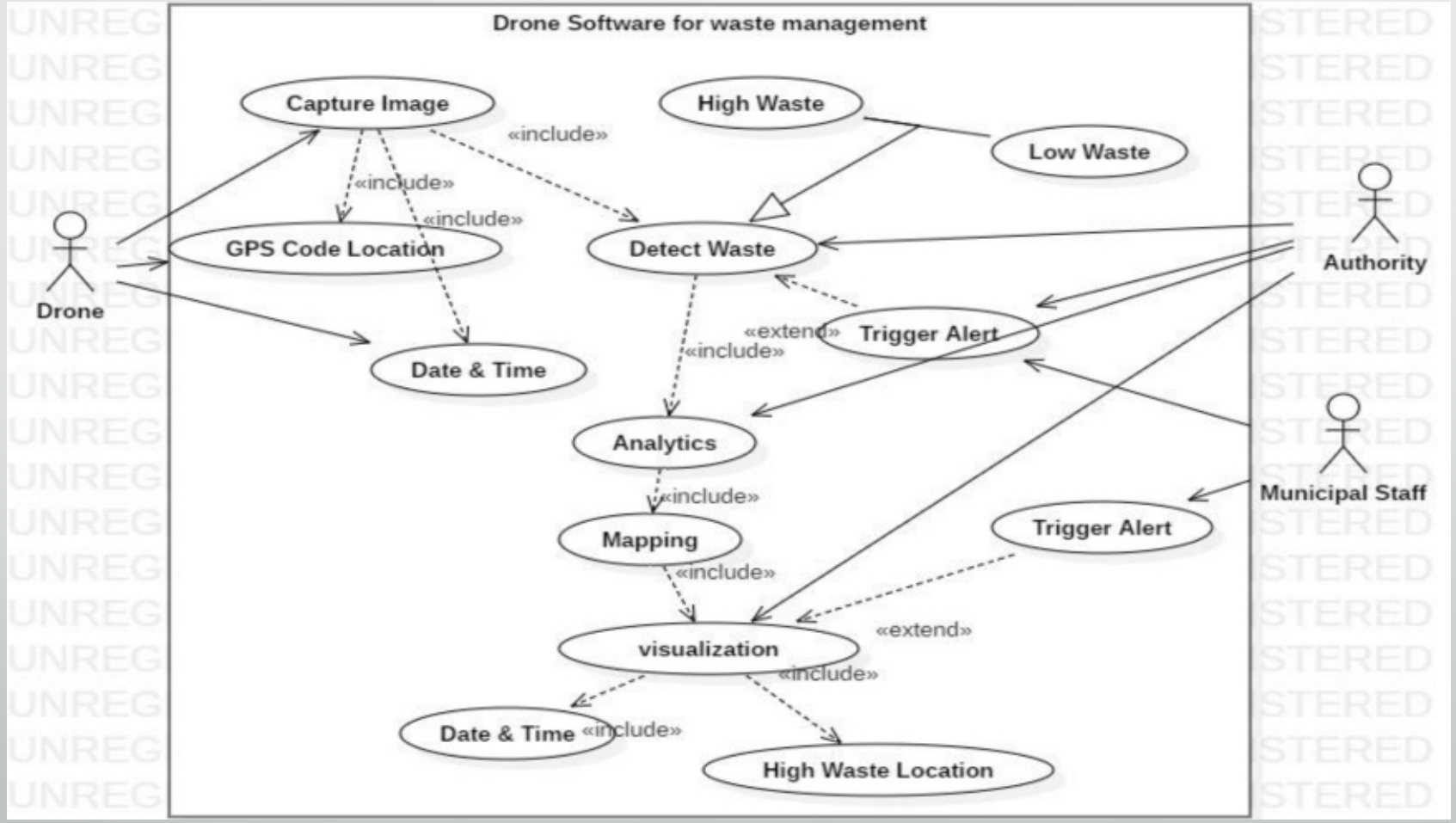
Database

Deployment

Use Cases

- The immediate Geo Tagging of waste and alerting the authorities would help them to take quick action.
- The visualization would help to detect the areas with High waste, so that authorities can allot the manpower accordingly for different areas.
- The visualization with variable time would also help to evaluate the performance of the waste management authorities.

Use Cases...


Drone Software for waste management
Capture Image
High Waste
Low Waste
«include»
«include»
«include»
GPS Code Location
Detect Waste
Drone
Authority
«extend»
Trigger Alert
«include»
Date & Time
Analytics
«include»
Mapping
Trigger Alert
Municipal Staff
«include»
«extend»
visualization
«include»
Date & Time
«include»
High Waste Location

Dependencies

- An image dataset is required for training to come up with really good results in terms of accuracy.
- It is possible to create a dataset by collecting the images from internet and create a dataset. But the dataset could be way different from the real test images. Which would have a negative impact on the final accuracy.

Reasons why we are not using object detection ...

Initial Process

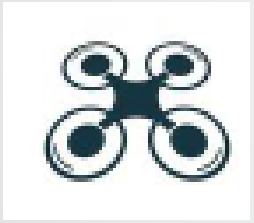
Image Source

Detect Waste

Classify Waste

Cost Comparison

Detection



Drone with Camera

+

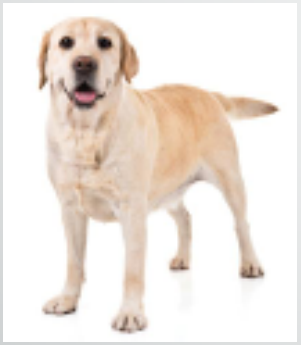
~ 6000 Rs.

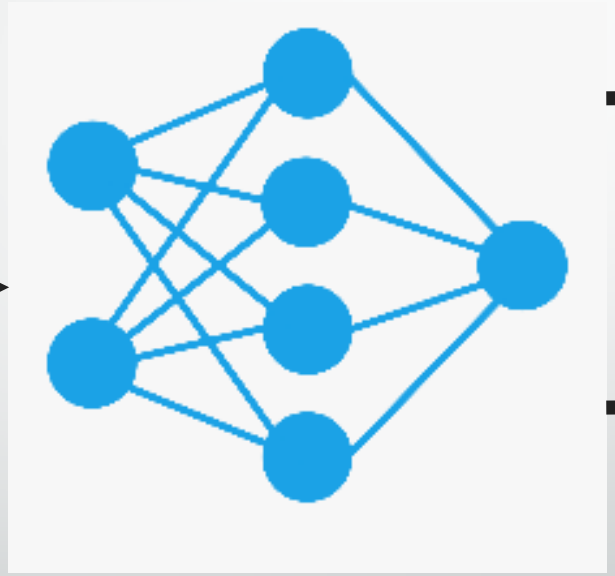
Classification

Drone with Camera only

~ 4000 Rs.

Dog/Cat Classifier

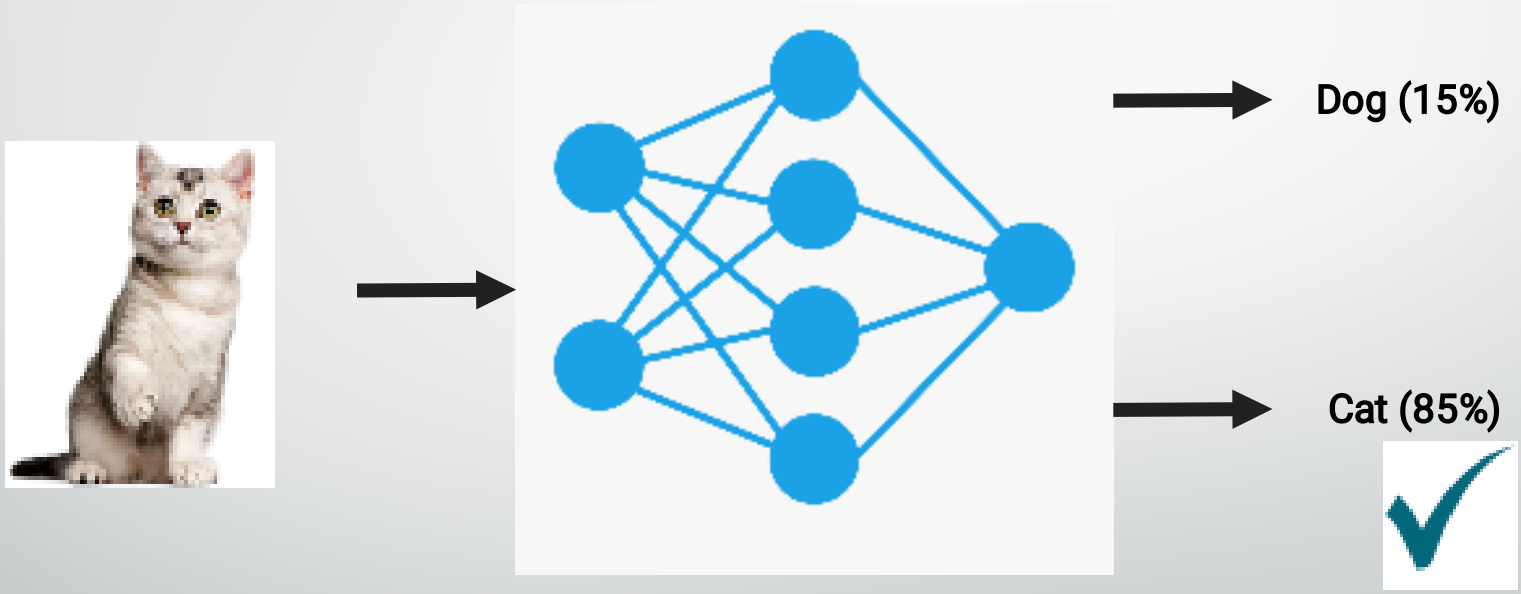




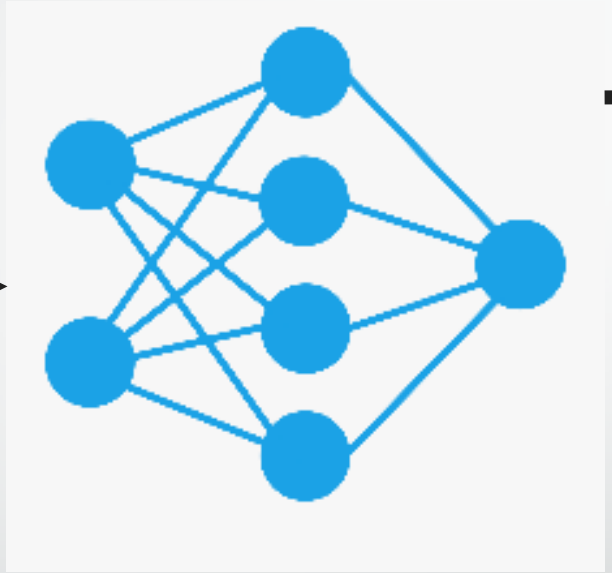
Dog (90%)

Cat (10%)

Dog/Cat Classifier



Dog/Cat Classifier

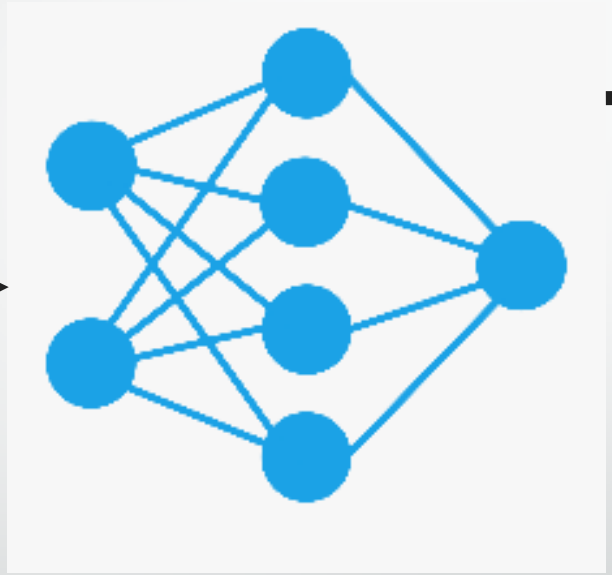


Dog (53%)

Cat (47%)

Confused Model

Dog/Cat Classifier

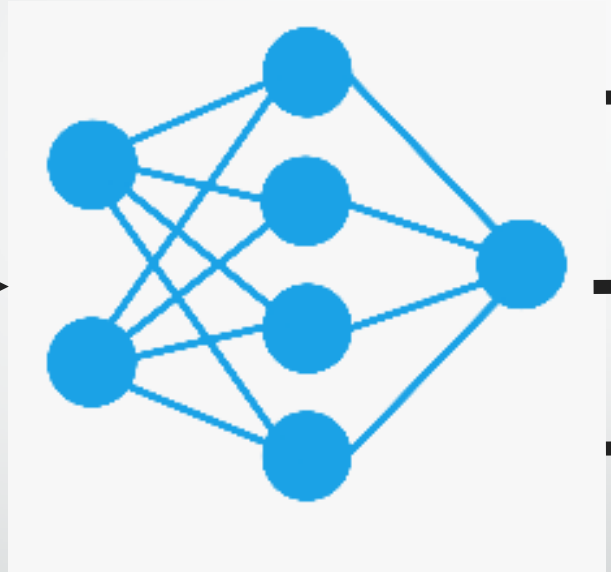


Dog (45%)

Cat (55%)

Confused Model

Dog/Cat Classifier



Dog (45%)

Not so sure!

Cat (55%)

When no object crosses the surety level of 70%

Conclusion

- A good classification model is sufficient to perform detection also along with classification.
- Not using a dedicated model for detection can reduce the cost by at least 20%.

Thank You