NITS HACKS 5.0

Team - Bonkers

01

Problems

Problem Statement 01

Statement Title : Reduce carbon emissions from NIT Silchar Campus

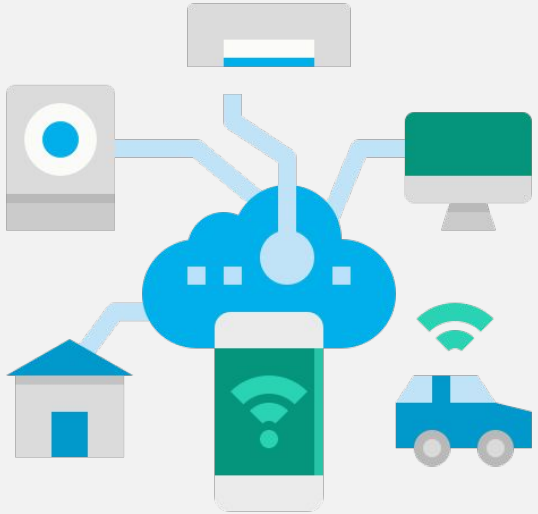
There are a multitude of people living on the NIT Silchar campus, be it students, guards or faculties. Naturally, this will generate a lot of waste. Waste is best treated when its properties are known. The management authority wants to obtain data on waste being generated on the campus as well as be able to provide selective data to third-party corporations who excel in treating waste.

02
Solution

Step into the future

with our world class software

Solution



IOT aided Dustbins

Solution

The expected solution in the problem statement was to involve the user in the task of scanning the wastes before dumping them, but the problem with that approach was that is was a manual task and will take a lot of time, also in a lot of situations it is not practical at all to scan all the wastes.

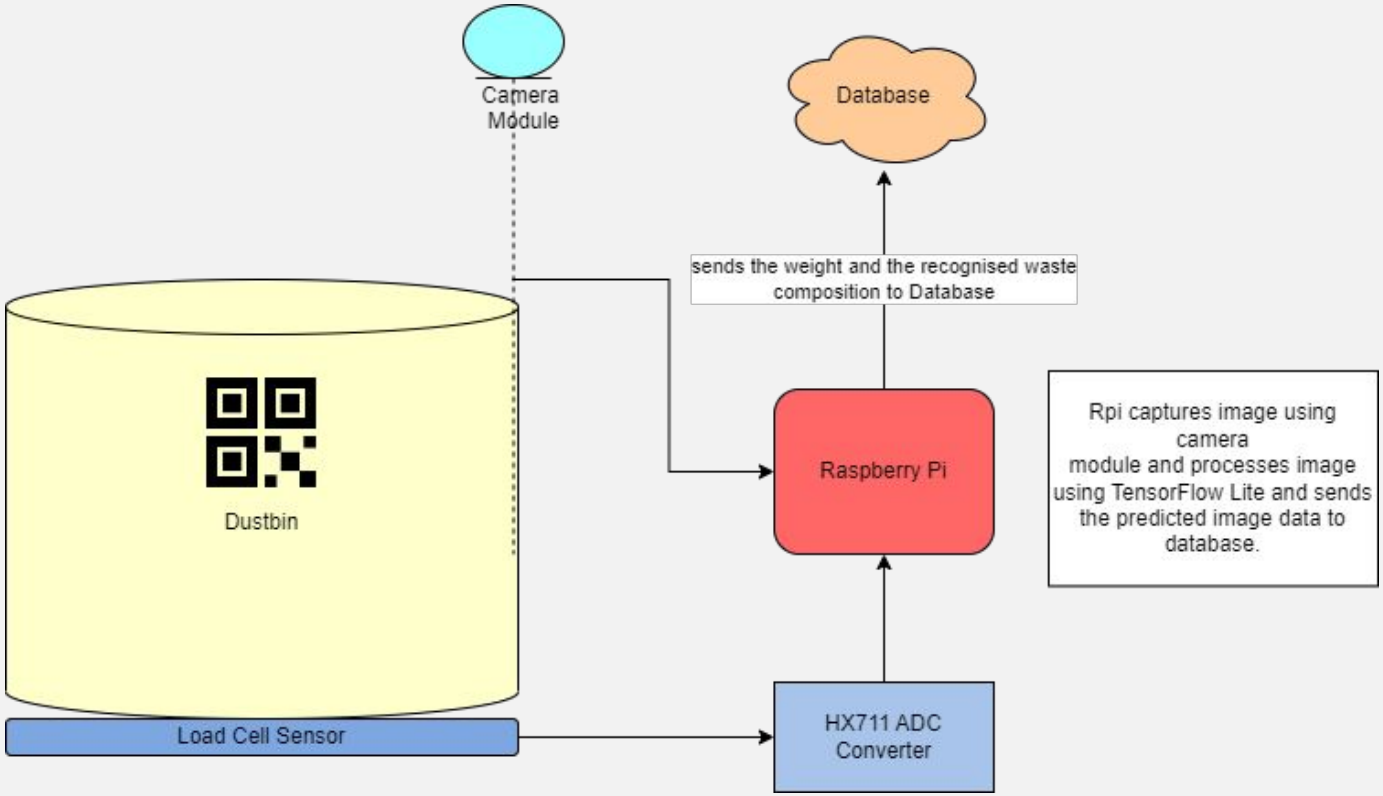
So, Our proposed solution is to setup an IOT equipped Dustbins, One for biodegradable materials and other for Non Biodegradable materials. All the dustbin will have a unique QR code.

Solution

Whenever somebody puts waste in dustbin, the weight will trigger the load sensor which will trigger the camera module which will take picture of the waste, then using ML we will Classify the materials according to the materials and then estimate the approximate the weight of each materials.

The User then can scan the QR code (under a constrained time limit) and then the waste will be associated with the user and reward points will be credited to users account.

Then the data will be sent to the server, which will update it to the database. And the data can be used by admins for further necessity.


Camera Module
Database
sends the weight and the recognised waste composition to Database
Dustbin
Raspberry Pi
Rpi captures image using camera module and processes image using TensorFlow Lite and sends the predicted image data to database.
Load Cell Sensor
HX711 ADC Converter

IOT Component

Load Cell Sensor : A load cell (or loadcell) is a transducer which converts force into a measurable electrical output.

HX711 : HX711 is a precision 24-bit analog to-digital converter (ADC) designed for weigh scales and industrial control applications to interface directly with a bridge sensor.

Raspberry Pi : Raspberry Pi is a general-purpose computer, usually with a Linux operating system, and the ability to run multiple programs.Raspberry Pi is like the brain. Its primary advantage comes in processing higher level processing capability. It’s a single board computer.

Camera Module : Camera for capturing images for processing using tensorflow.

Dustbin : With a unique QR Code.

Working of IOT system

There will be two Dustbin one for **biodegradable waste** and the other for **Non Biodegradable waste**.

- The bin for Biodegradable waste will be equipped with a Load cell sensor and a HX711 for measuring the weight and QR Code for association the waste with the user.
- The bin for the Non Biodegradable waste will be equipped with a Camera module for capturing the image of Waste , a load Cell sensor and a HX711 for measuring weight and QR for associating the waste with user.

Raspberry Pi will be running **TensorFlow Image Recognition** whenever it is triggered and will send the real time estimated weight of the processed image data to the database by making api calls.

At the same time the user can scan the **QR code** and the waste will be associated with the the user and redeemable points will be credited to the users account.

Solution

Record and Analysis using ML

Record and Analysis

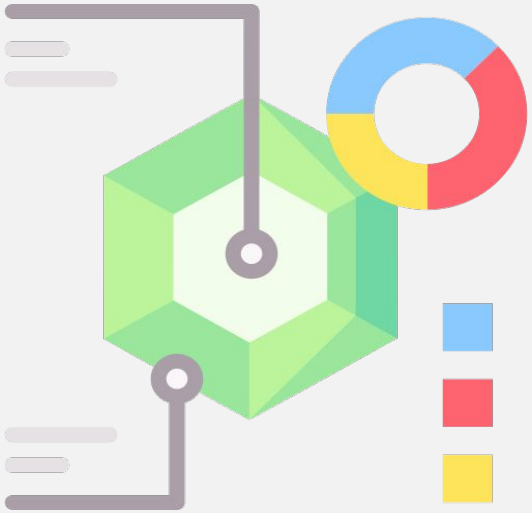
For the Record and analysis part we will be using the concept of edge computing to make the process efficient.

Edge computing is a distributed computing paradigm that brings computation and data storage closer to the sources of data. This is expected to improve response times and save bandwidth. This will help us scale the system and maintain the efficiency of the process.

The Raspberry pi will be running TensorFlow for real time image recognition.
What our Pi will be used for is to take the picture of the waste and recognise the material and estimate its weight and send it to the backend for further processing.

Eg. If a glass bottle and metal box is thrown in the Dustbin, the weight of the waste will trigger the system, the camera will capture the image of the waste and Tensorflow will recognise it as glass bottle and metal box and then it will estimate the individual weight and will send that data to the database.

Solution



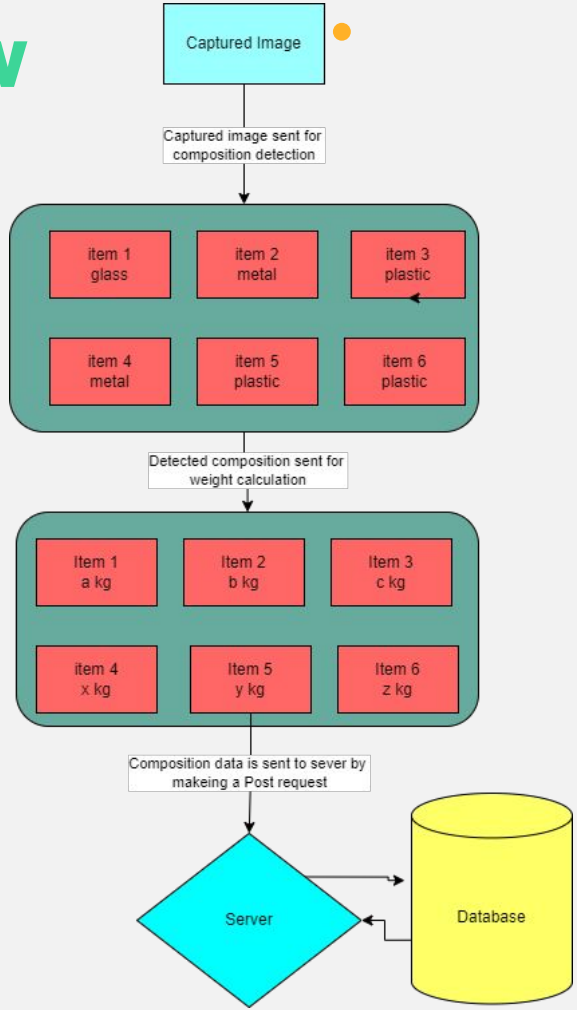
Composition estimation of waste

Composition estimation

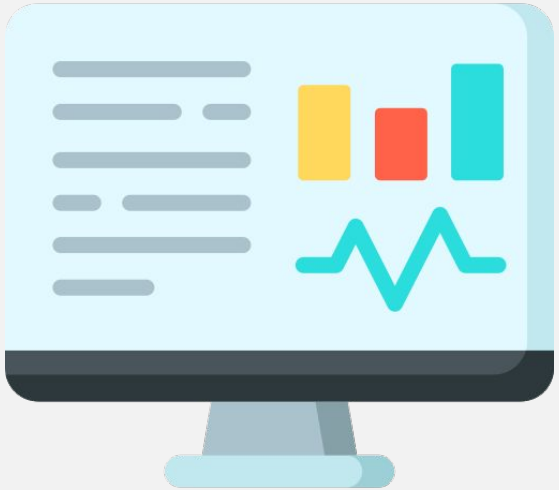
Composition estimation is done using TensorFlow Lite Model-maker. The TensorFlow Lite Model Maker library simplifies the process of training TensorFlow Lite models using custom datasets. It uses transfer learning to reduce the amount of training data required and shorten the training time.

The custom trained model was inspired by ssd mobilenet model which uses coco dataset to determine the composition of different waste.

ML model flow

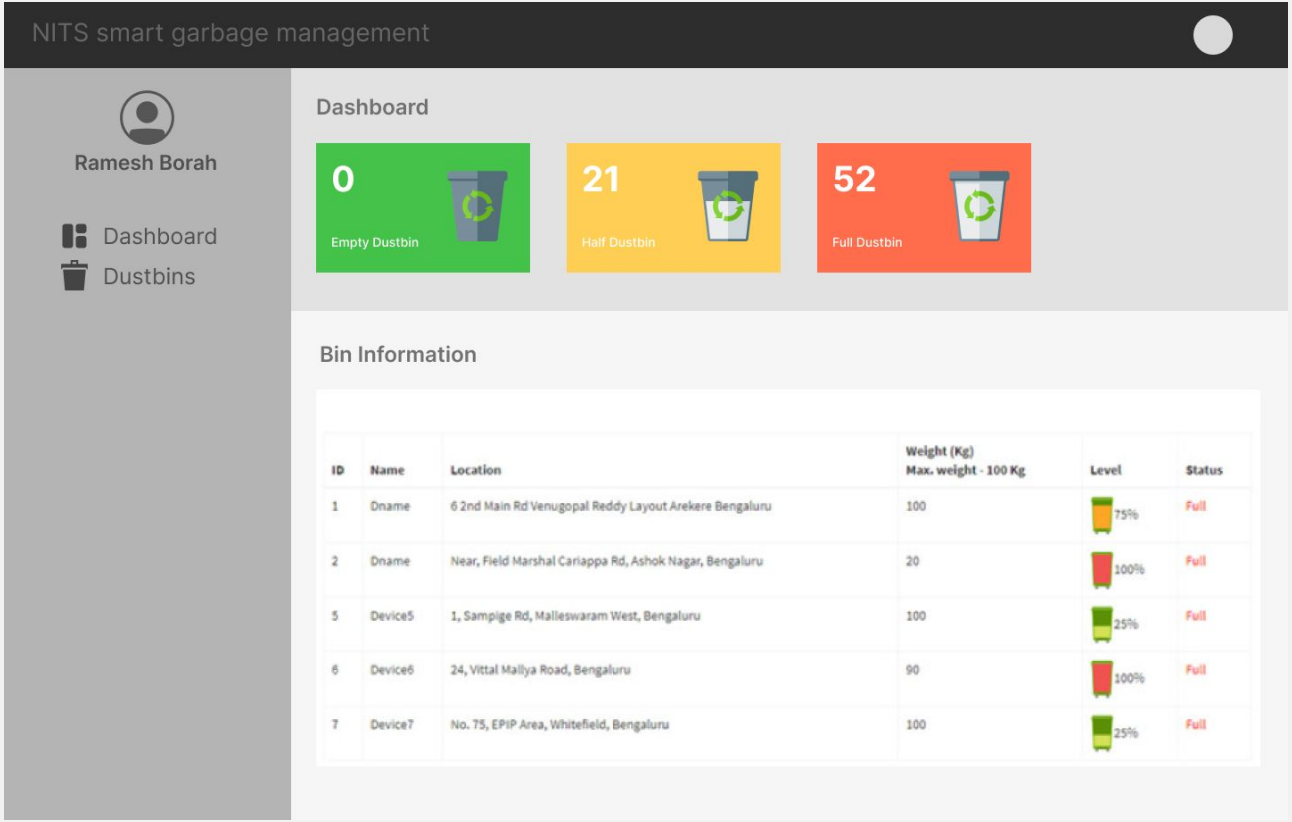


Solution

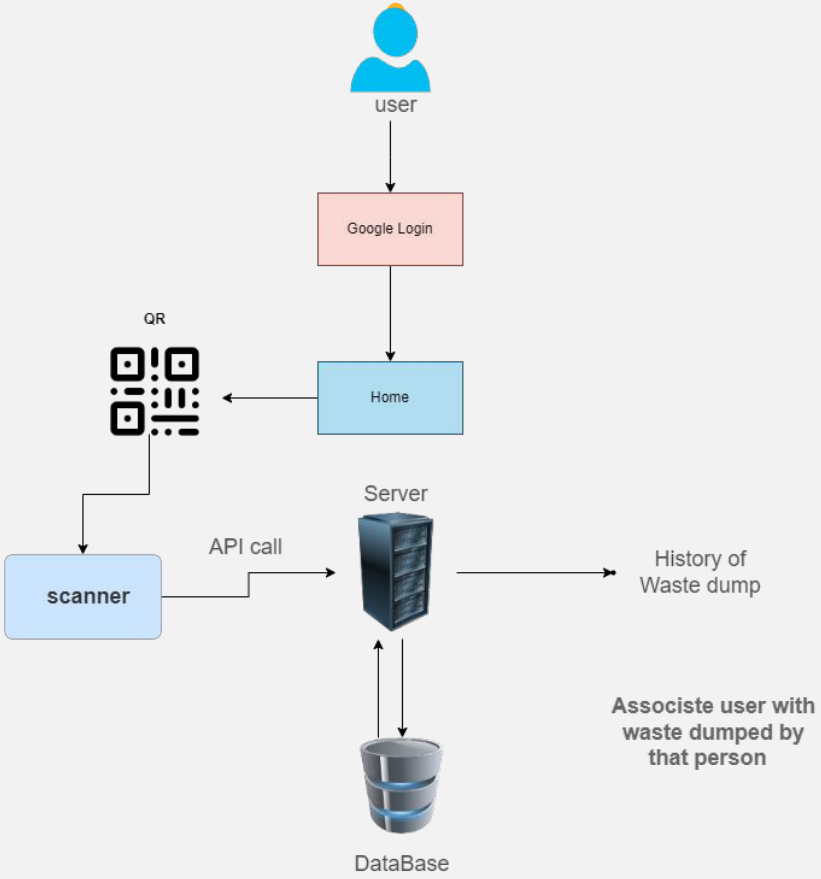


Dashboard with insightful records

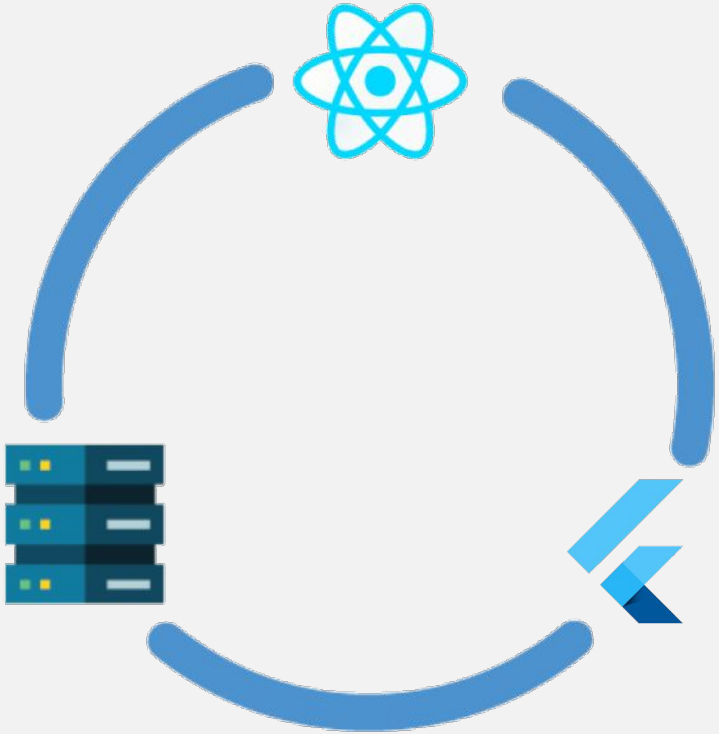
Dashboard UI



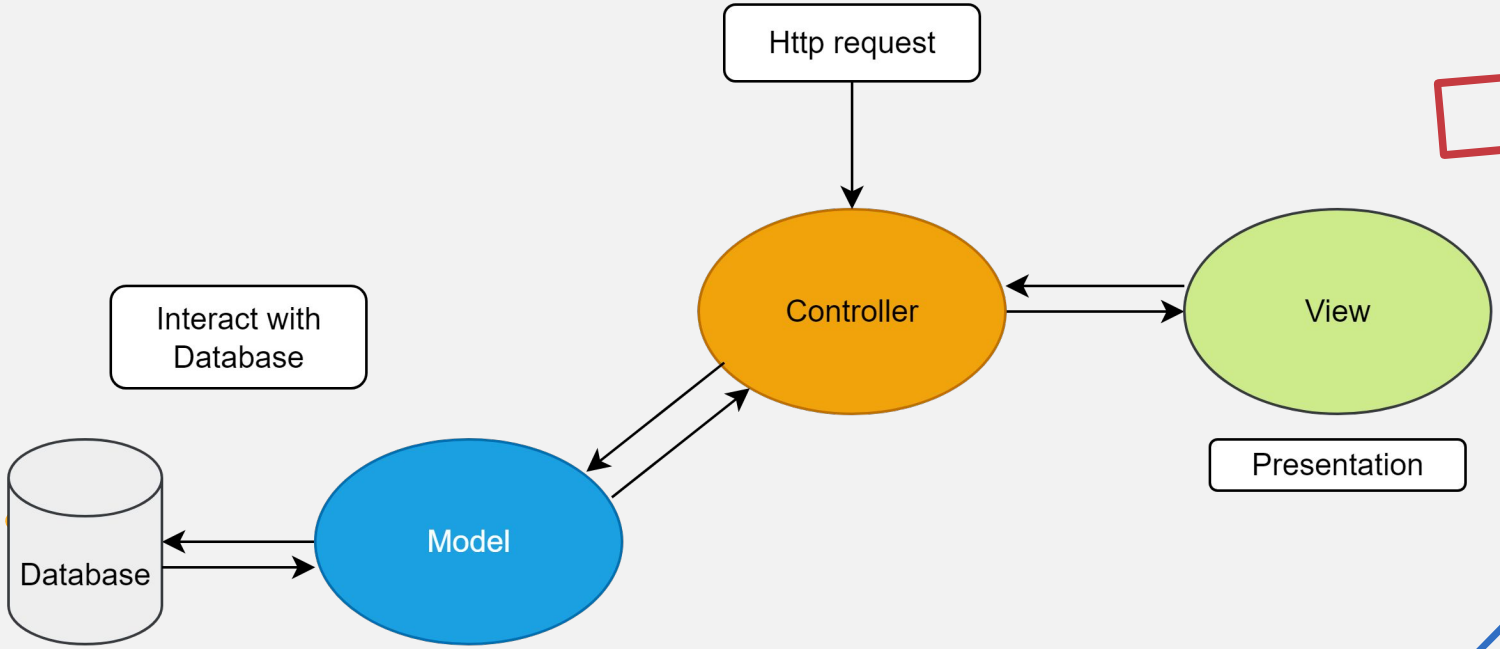
App Flow


user
Google Login
QR
Home
Server
API call
scanner
History of
Waste dump
Associste user with
waste dumped by
that person
DataBase

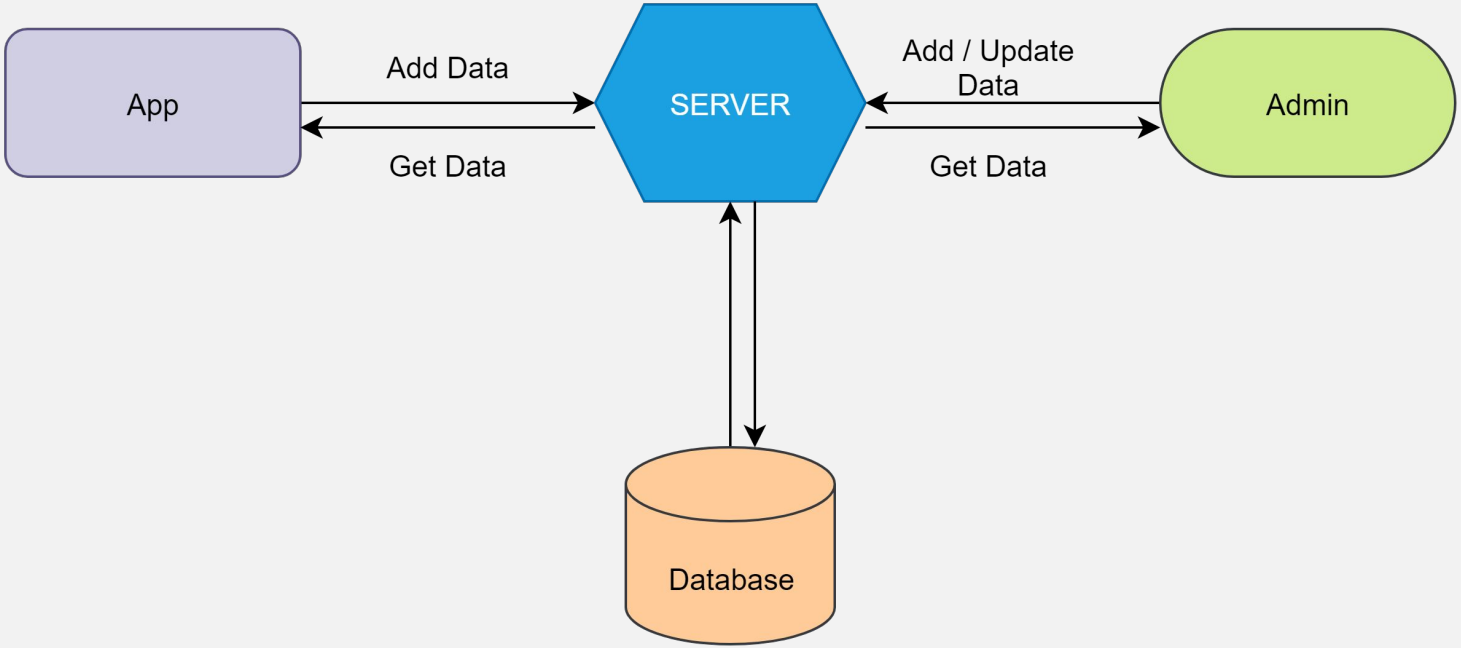
Architecture



Server Architecture



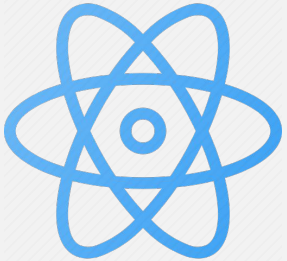
Data Flow


App
Add Data
Get Data
SERVER
Add / Update Data
Get Data
Admin
Database

Tech Stack

Flutter

Nodejs



React

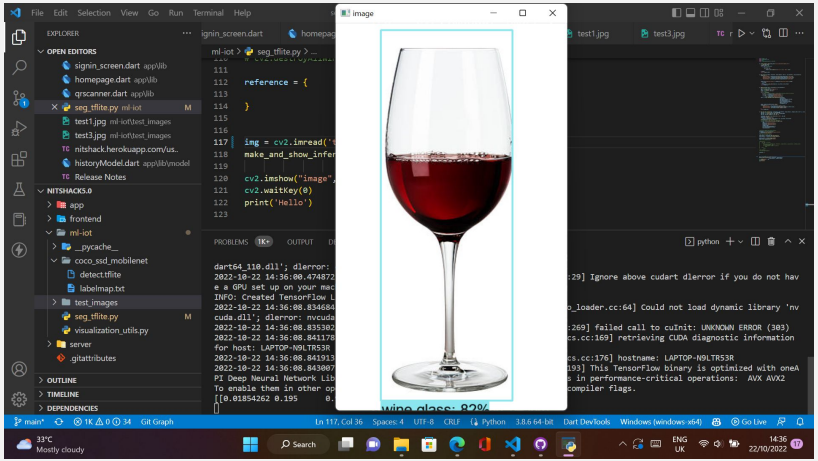
Tech Stack

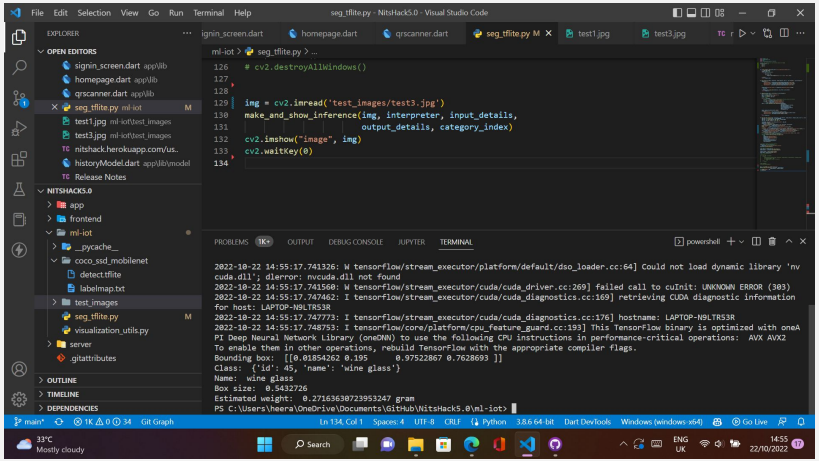
Firebase

Tensor Flow

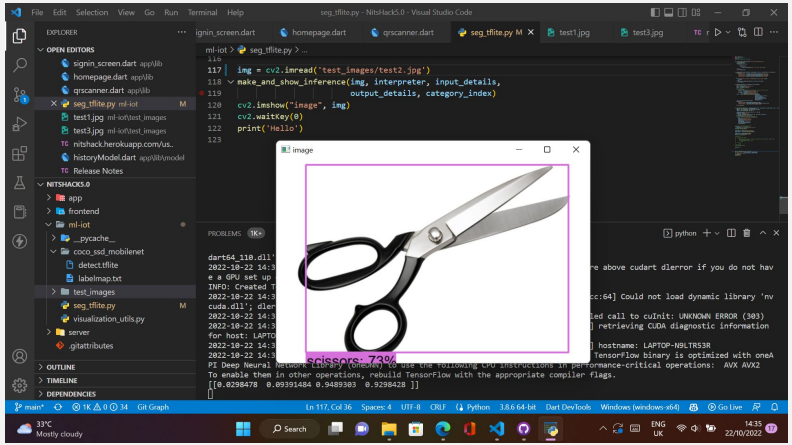
Express

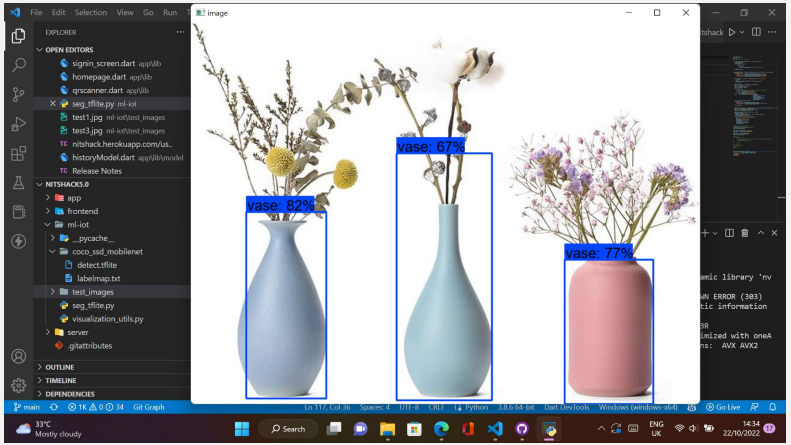
ML model demo



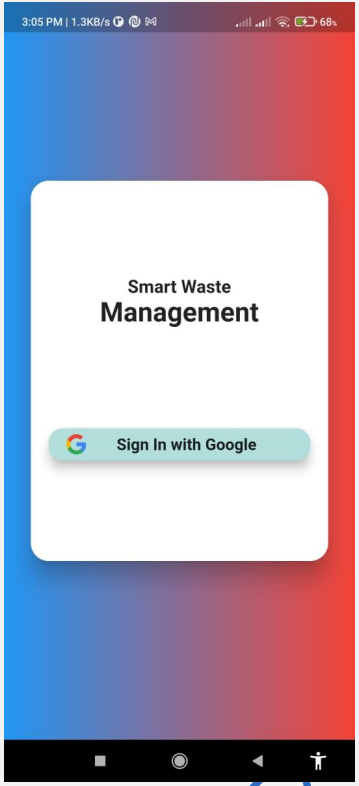


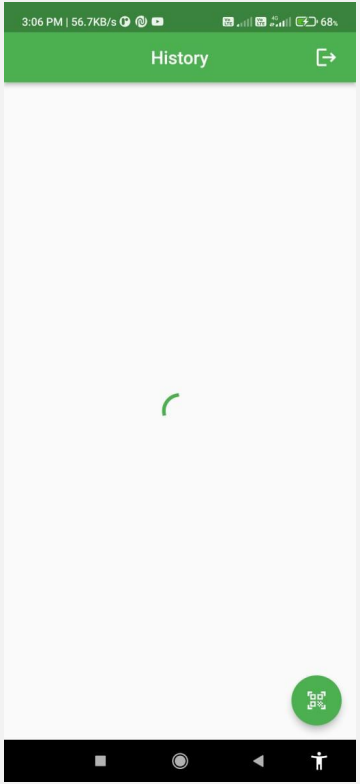
ML model demo

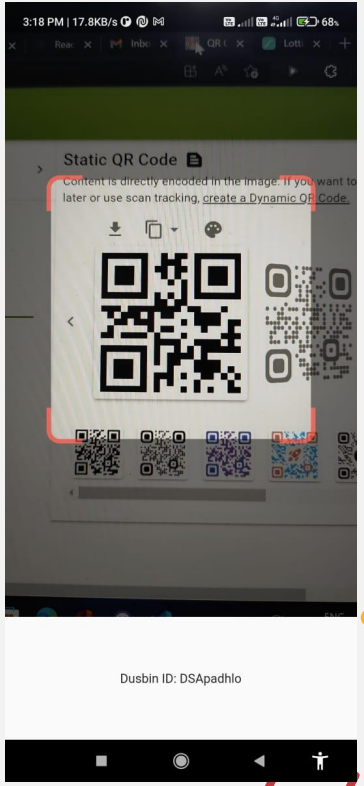




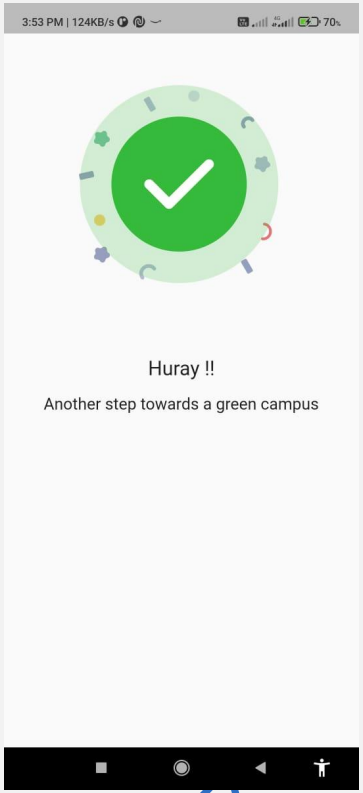
Flutter demo

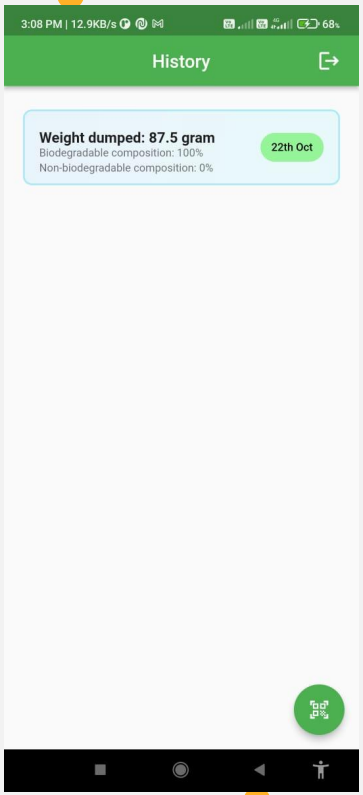






Flutter demo





Future Scope:

- Scaling :

  Server - AWS Elastic Beanstalk
  Database - AWS RDS

- Can be easily scaled in terms of number of Dustbins in NITS Campus.
- Users can be rewarded with cryptocurrency like Bitcoin while minimize cost of the reward transaction with using protocols like Lightning network.
- Higher accuracy can be achieved.

Thank You