



RAMAIAH
UNIVERSITY
OF APPLIED SCIENCES

Final Group Project Presentation

QR Enabled Domestic Waste Segregation Tracking

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Project Details

Title of the Project : QR Enabled Domestic Waste Segregation Tracking

Mentor: Dr Uday K Jagannathan

Group Details

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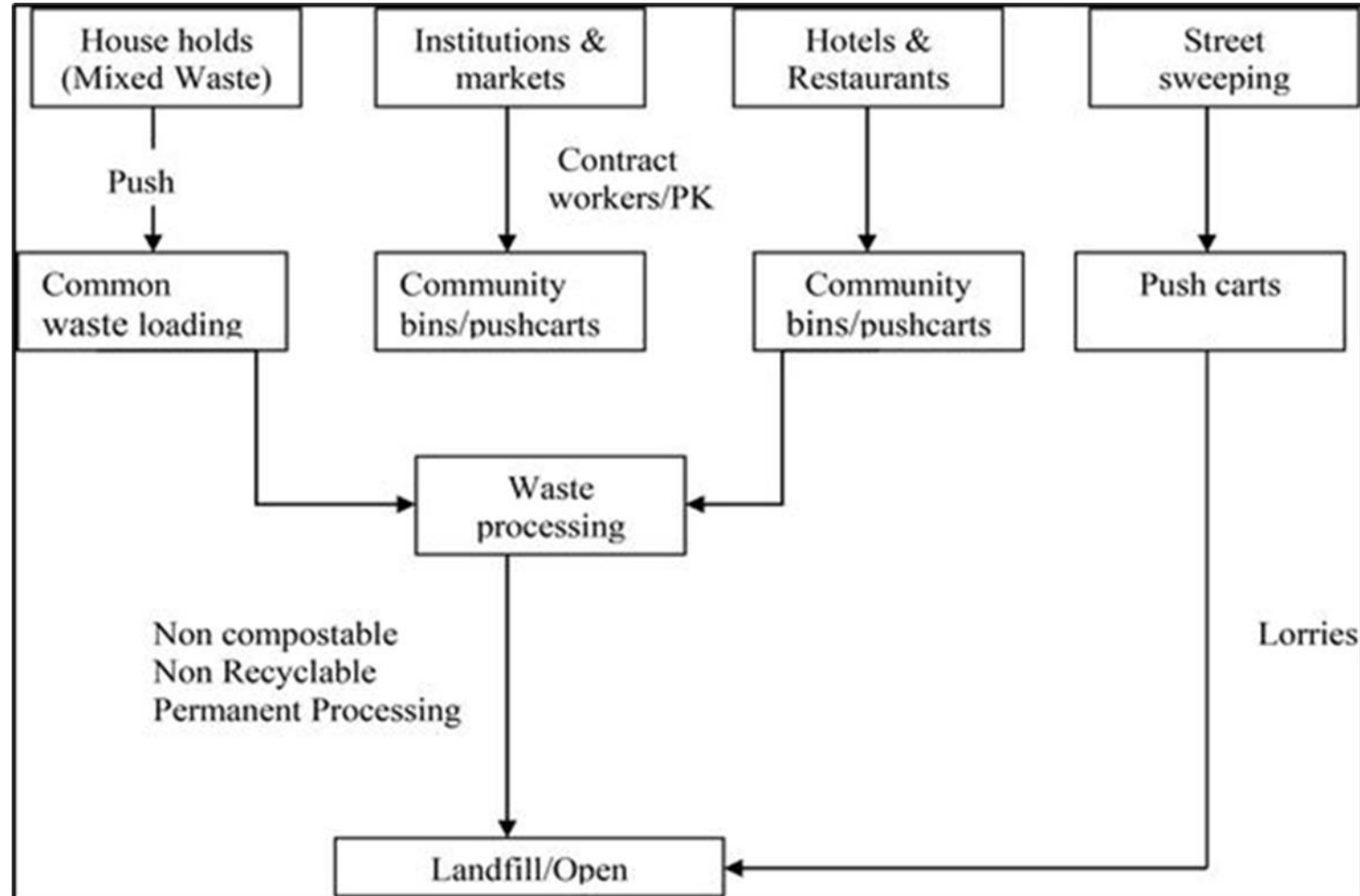
Content

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Introduction

- ❖ India stands as second highest population on earth after China, globally we produce approximately 2.01 billion tonnes of solid waste each year according to World Bank reports
- ❖ Bangalore city alone generates around 4500 Metric tonnes per day of waste.
- ❖ Currently BBMP is impeded by lack of budget, weak enforcement by laws, inadequate processing techniques and poor urban planning
- ❖ In many wards it is indicated that no norms/guidelines had been followed in setting up waste segregation practices. There is a lack of awareness among people that leads to confusion
- ❖ It is always better to segregate the waste at the source itself so that the segregated waste could be directly sent to the processing plant instead of sending it to the segregation plant thereby reducing a great amount of work

Waste Collection Process In A Typical Residential/Commercial Area



Literature Review

1	Year of Publication	2009
	Authors	T.E Hull
	Research focus	Incorporates the use of a drive-up window that is close to areas dealing in container preparation, delivery, pickup, and disposal.
	Methods, Methodology/ tools used	Waste definition database-transporter, disposal, waste stream storage Lot, printing labels, portable bar codes database. Using this program allows the operator to scan multiple container ID or OK/Accept to complete the list.
	Research Findings	The timeframe involved with design of the system, procurement of materials, assembly, prove-in, troubleshooting and implementation with timeline of development.
	Conclusion drawn by authors	Bar code scanning operation to be physically close to all aspects of container preparation, delivery, pickup and disposal. Because we designed the system for automation, that allowed our operators to concentrate on proper handling of waste while maintaining manual entry of data as a backup, should anything adverse happen to the bar code scanners.
	Limitations of the study	No evidence of enhanced value from this type of operation. With possible impact of diverse risks.

Literature Review (Cont....)

2	Year of Publication	2020
	Authors	Kellow Pardini, Joel J.P.C. Rodrigue, Ousmane Diallo, Ashok Kumar Das.
	Research focus	The system follows an IoT-based approach where the discarded waste from the smart bin is continuously monitored by sensors that inform the filling level of each compartment, in real-time.
	Methods, Methodology/ tools used	The first step of the experiment was to validate the overall positioning of the My Waste Bin compartment relative to the mobile user using the My Waste App application. The second part of the experiment was designed to vary the amount of waste deposited inside the compartment and to validate its representation within the application.
	Research Findings	The society model of the 21st century has been increasingly influenced by cities in their context. According to the United Nations data, by 2050, approximately 70% of the population will live in urban centres, and this rapid growth of people living in cities has been of great concern, since towns do not always grow in a sustainable way.
	Conclusion drawn by authors	Taking into account the creation of a real prototype of the smart container and the implementation of a new waste management mobile application and corresponding Web version, and based on the case study experiments, it was concluded that the proposed system can efficiently improve the way people deal with their garbage and optimize economic and material resources.
	Limitations of the study	It is inefficient and practiced through large fleets of collection trucks that travel daily long distances, often by unnecessary routes, where others are discovered, and with daily or weekly service schedules.
	Scholar's Comments about the Research work	In future work, the application developed for this solution can be evolved by adding new facilities that can bring to the end user more significant interactions with the management system besides integration with a platform, to calculate the best path in collection routes, seeking efficiency with a lower cost of operating the fleet of trucks.

Literature Review (Cont....)

3	Year of Publication	2021
	Authors	B.P. Naveen
	Research focus	In this study, a comprehensive review of Bangalore's waste management has been provided to elaborate on the current status.
	Methods, Methodology/ tools used	The information was collected from Bruhat Bangalore Mahanagara Palike (BBMP) personnel with different responsibilities within the system.
	Research Findings	It identifies municipal solid waste management (MSWM) problems and limitations that hamper improvement in the current waste management practices.
	Conclusion drawn by authors	Bangalore needs a fool proof system to manage the solid waste generated. The system should have a strict monitoring mechanism for the implementation of waste management rules.
	Limitations of the study	The study concentrates on only waste management in Bangalore urban cities.
	Scholar's Comments about the Research work	For achieving environmental sustainability, "reduce and reuse" for recyclables wastes for further use and reduction of organic waste disposal.

Literature Review (Cont....)

4	Year of Publication	2020
	Authors	Samarth Verma, Simran Suri, Vaibhav pundir, Praveen
	Research focus	We will try to build a system which will notify the corporations to empty the bin on time. Add sensor on top of the garbage bin which will detect the total level garbage inside it according to the total size of the bin.
	Methods, Methodology/ tools used	When the waste undergoes in the dustbin the IR sensor are applied as soon it detect the garbage. The sensitivity of the IR sensor is turned using the potentiometer. Arduino with different sensors is used to detect and collect in particular bin.
	Research Findings	Decreases the distance between trash and sensor. The real time information is sent to micro controller of sensor.
	Conclusion drawn by authors	Saves time in segregation by human and affordably in domestic applications. Smart bin prototype will contribute to the society to provide a clean and hygienic environment.
	Scholar's Comments about the Research work	Using the conveyor belt makes system makes far more accurate, easier to install in domestic level.

Aim and Objectives

Title of the project: QR Enabled Domestic Waste Segregation Tracking.

Aim of the Project : The Aim of the project is to have track on domestic waste segregation.

Objectives :

1. To Survey Public on waste segregation
2. To Track the domestic waste segregation
3. To minimize the waste and ensure reduction in landfill space
4. To enable cleaner and more efficient waste segregation processing
5. To provide suitable suggestion to individuals regarding the waste segregation in their daily waste disposal



Methods and Methodology

Objective NO	Statement of objective	Methods / Methodology	Resources Utilized
1	To educate public on waste segregation	Filed survey	Interview, questionnaires
2	To Track the domestic waste segregation	QR code, smart phone application	Flutter flow and Firebase
3	To minimize the waste and ensure reduction in landfill space	Literature review, questionnaires	Google scholars and Survey
4	To enable cleaner and more efficient waste segregation processing	Survey and Literature review	Degradable plastic bags, leak prof Auto tippers and Compacters
5	To provide suitable suggestion to individuals regarding the waste segregation in their daily waste disposal	Based on Survey results	Primary data and secondary data

Product Concept

QR Tags

❖ Paper QR tags



Product Concept (Cont.....)

❖ Plastic QR tags



Design, Development and Implementation

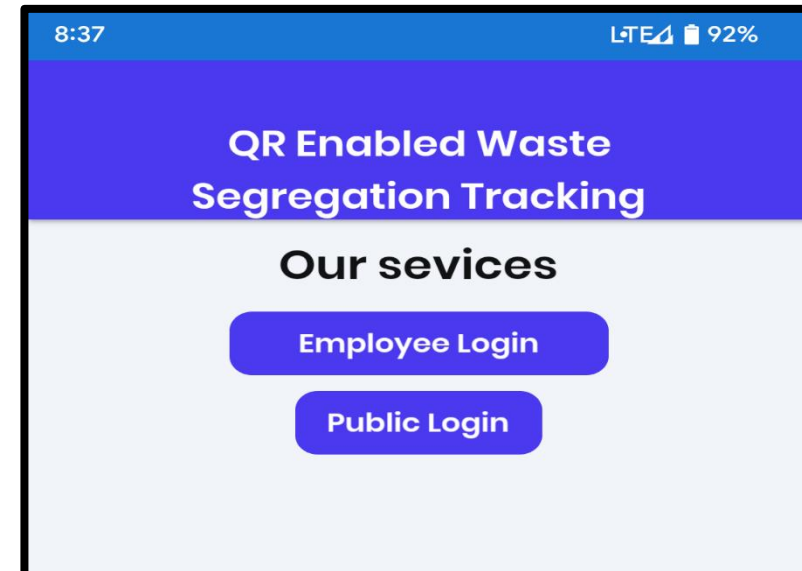
Requirements

- ❖ QR Code
- ❖ Smart Phone Application



Tools Used

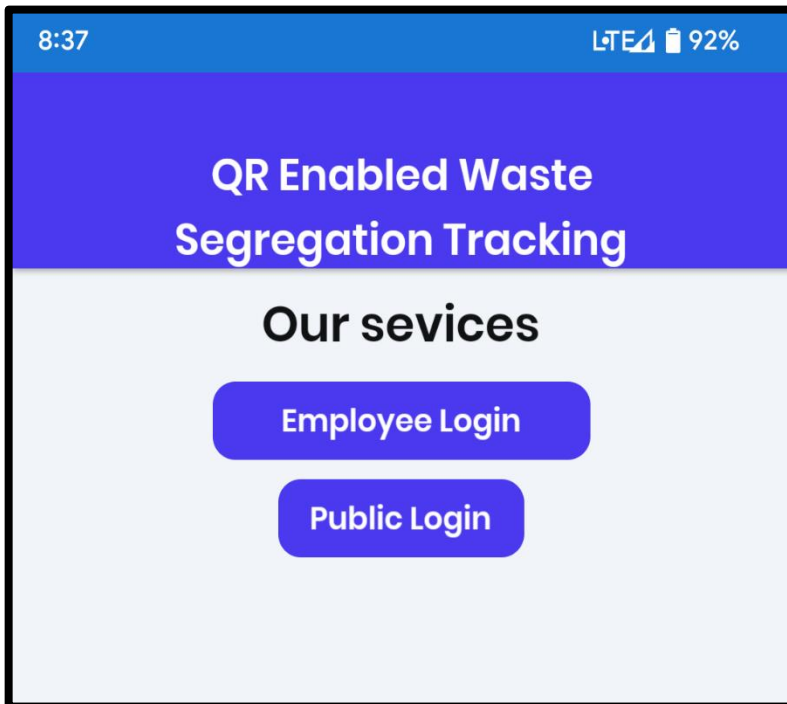
- ❖ QR Code Generator
- ❖ Flutterflow
- ❖ Firebase



Design, Development and Implementation (Cont..)

Application Design

Home Page



8:37 LTE 92%

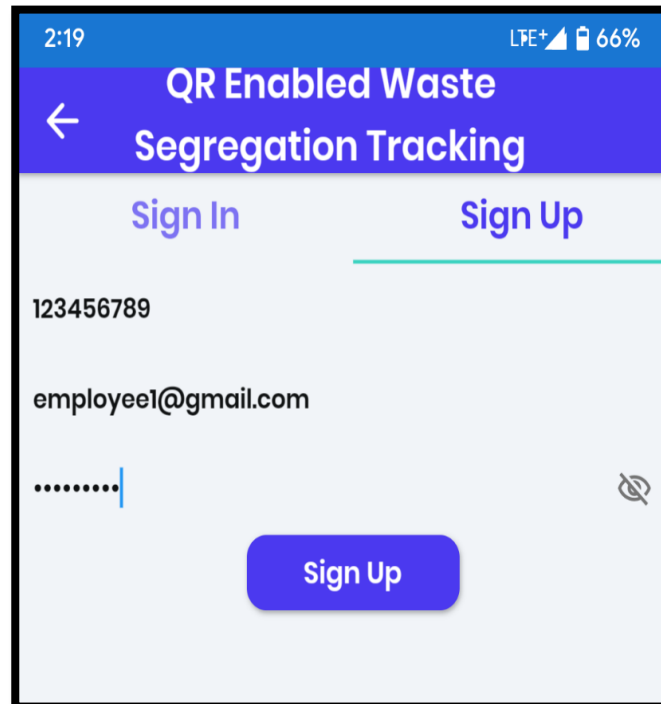
QR Enabled Waste Segregation Tracking

Our services

Employee Login

Public Login

Employee Sign Up Page



2:19 LTE+ 66%

QR Enabled Waste Segregation Tracking

Sign In **Sign Up**

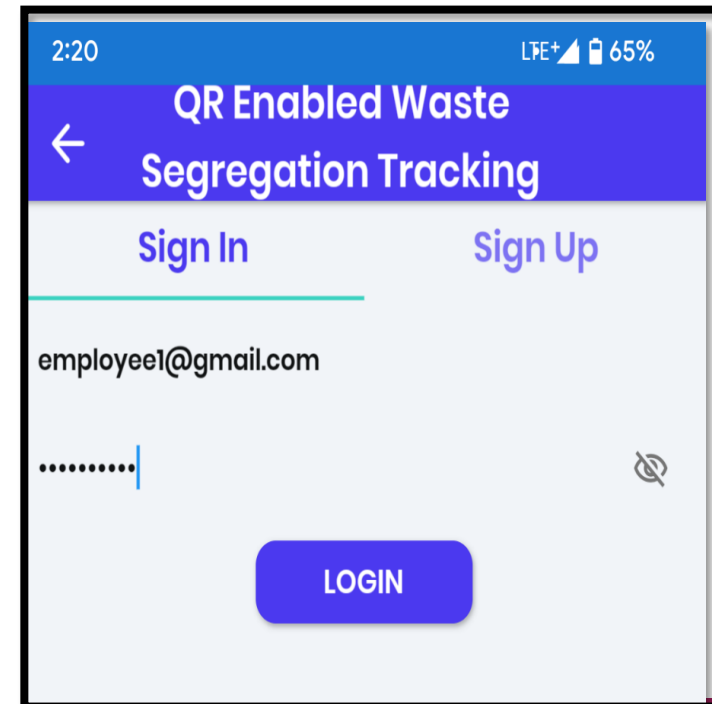
123456789

employee1@gmail.com

.....

Sign Up

Employee Sign In Page



2:20 LTE+ 65%

QR Enabled Waste Segregation Tracking

Sign In **Sign Up**

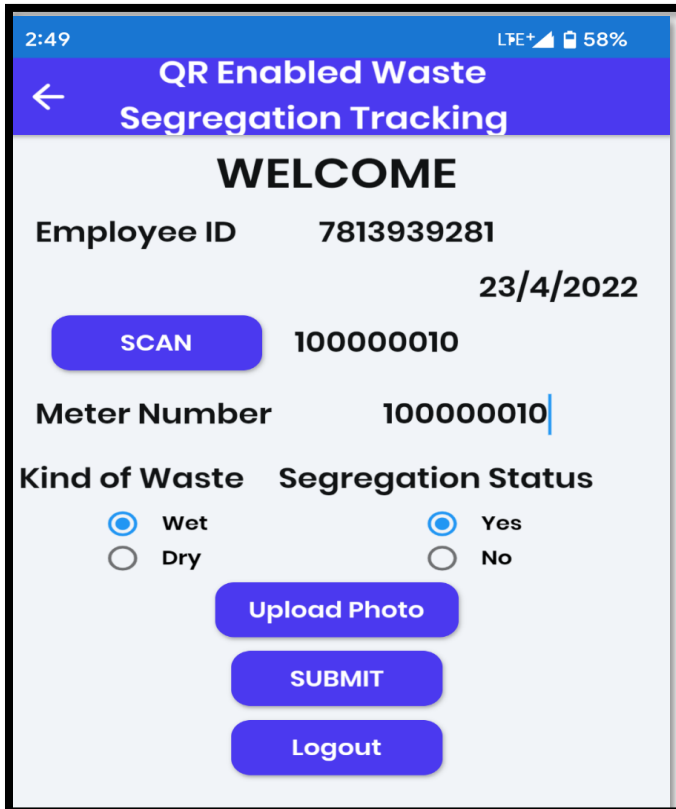
employee1@gmail.com

.....

LOGIN

Design, Development and Implementation (Cont..)

Employee Dashboard



2:49 LTE+ 58%

QR Enabled Waste Segregation Tracking

WELCOME

Employee ID 7813939281

23/4/2022

SCAN 100000010

Meter Number 100000010

Kind of Waste Segregation Status

☒ Wet ☒ Yes

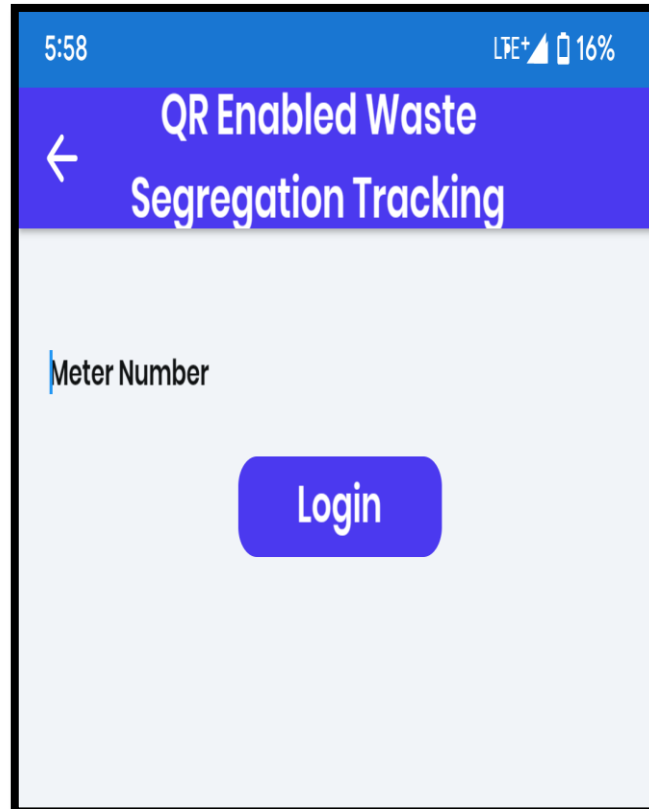
☐ Dry ☐ No

Upload Photo

SUBMIT

Logout

Public Login



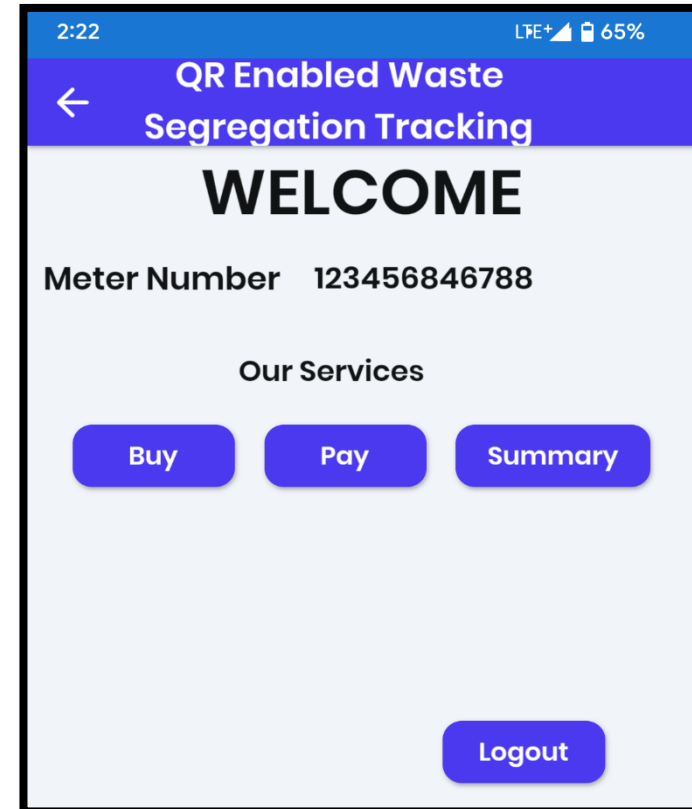
5:58 LTE+ 16%

QR Enabled Waste Segregation Tracking

Meter Number

Login

Public Dashboard



2:22 LTE+ 65%

QR Enabled Waste Segregation Tracking

WELCOME

Meter Number 123456846788

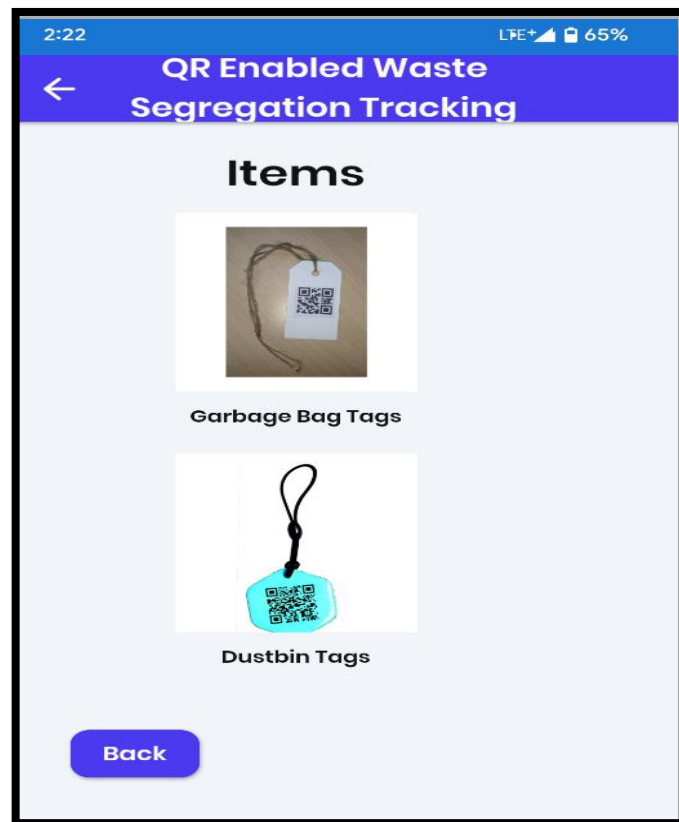
Our Services

Buy Pay Summary

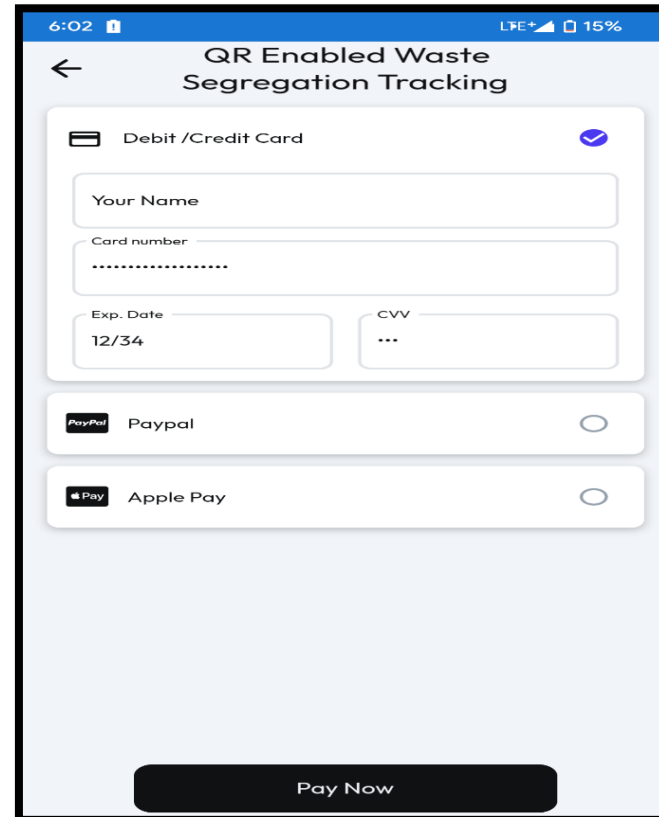
Logout

Design, Development and Implementation (Cont..)

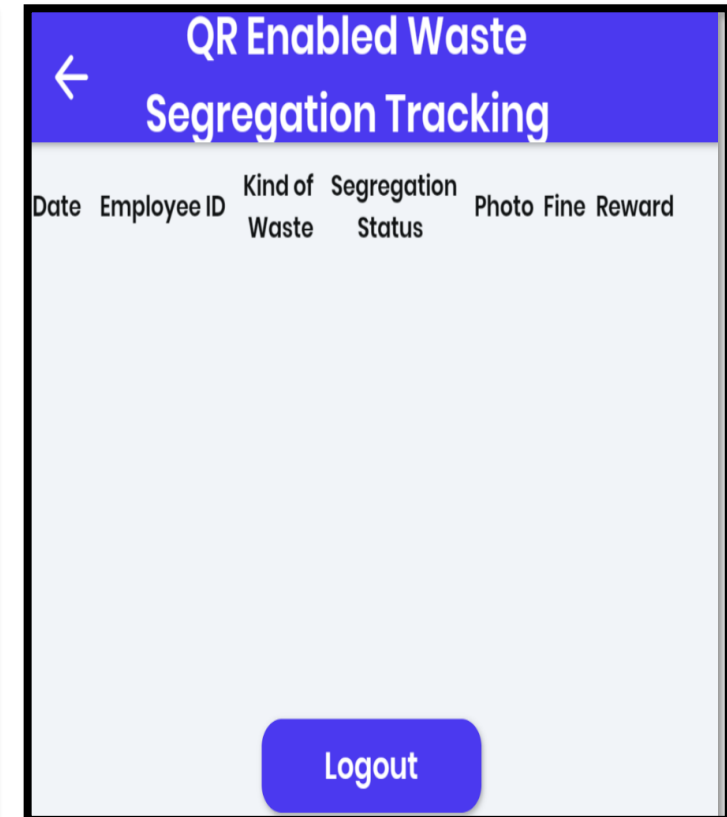
Buy Page



Pay Page








Summary Page



Design, Development and Implementation (Cont..)

Data Collection

QR Waste Segregation Track ▾ Cloud Firestore		
 qr-waste-segregation-track	 euser  	 0b8pFi19YzfC2dyUtcReV21jSNY2
+ Start collection	+ Add document	+ Start collection
data	0b8pFi19YzfC2dyUtcReV21jSNY2 >	+ Add field
euser >	ETBkoHvubbeYV43MYi6n4qjVmR42 KOMQ5TX5F5gcseD41l01u2QbjCG2 PocrX2kiRvWtAZ8dxGDbIBTsX0X2 ZwW7TisWYRRXRMgrGo8bIybk2Ex2 aVswcQVmudbTYHYr5oGV0NkuIIR2 dASGrZw8mHe55K2mxJm6wdbeSPR2 v3fnkDfB7KSQqzrtxdb9W0Su0nx1	created_time: April 20, 2022 at 5:35:25 PM UTC+5:30 email: "abcd@gmail.com" employeeid: 1234 uid: "0b8pFi19YzfC2dyUtcReV21jSNY2"

Design, Development and Implementation (Cont..)

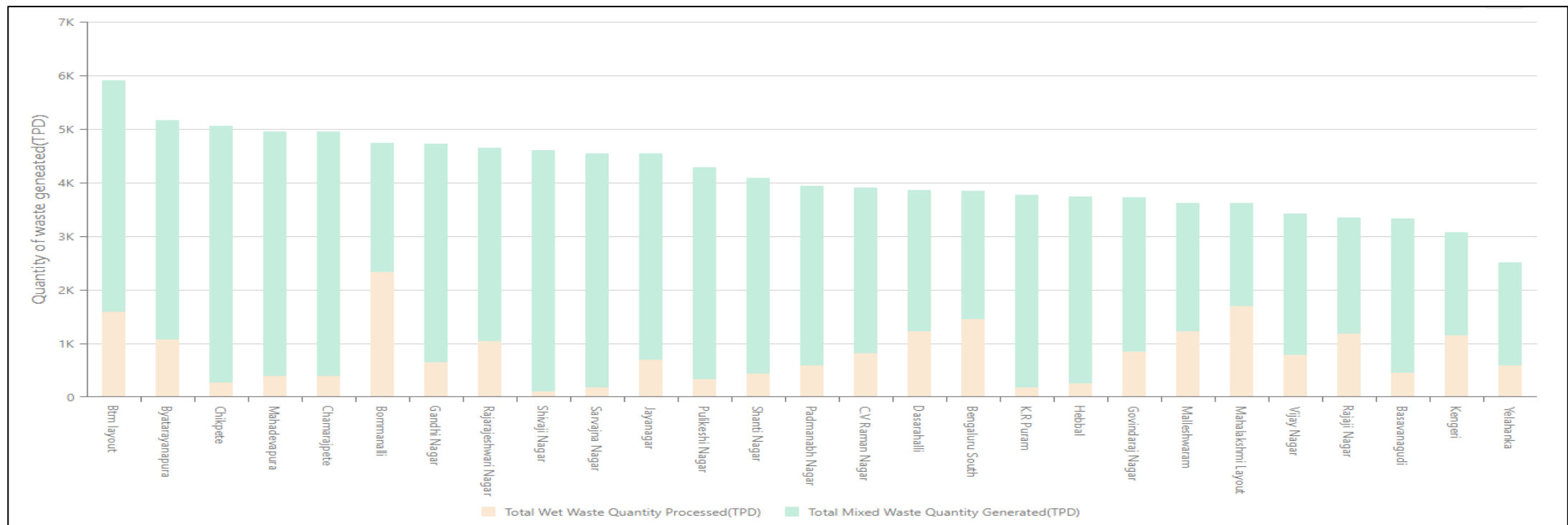
Data Collection (Cont....)

QR Waste Segregation Track ▾ Cloud Firestore

qr-waste-segregation-track	data	0E1pOuRo7BIw60Z6MuYA
+ Start collection	+ Add document	+ Start collection
data >	0E1pOuRo7BIw60Z6MuYA >	+ Add field
euser	1ZWEAGriz1EFs7ydSzW2 2oPE9UpuPdLD8YY0Wtfw 51WDW02xdYVqop8Fw66o M7BsU49m1SxtZIUQQ0iz M1aDkEe40Tg2cvEhki9p 05PxPG8xVfA4gwRERBQD U1zamu7tqtrm0DIPJ4TS	date: April 20, 2022 at 10:38:43 PM UTC+5:30 employeeid: 7813939281 kindofwaste: "Wet" meternumber: 85451555855 photo: "" segregationstatus: "No"

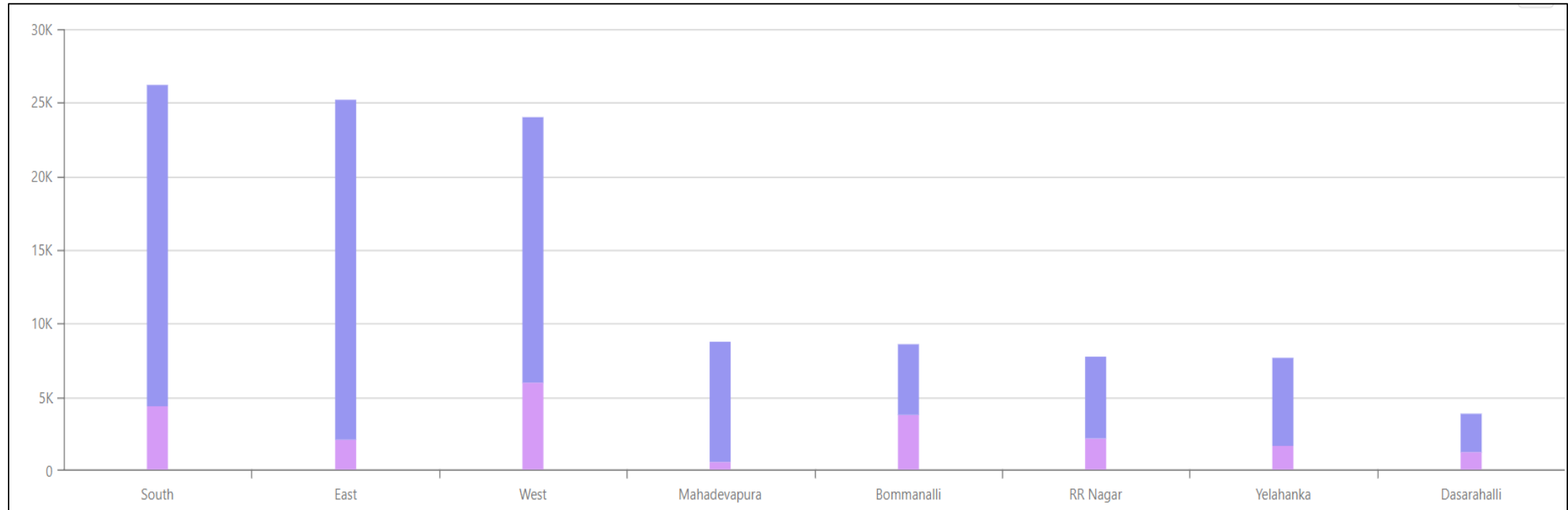
Data Analysis

The below given figures are the graphs from BBMP website of the year 2020



Division wise comparison of collection of wet to mixed waste

Data Analysis (Cont....)



Zone wise generation status

Data Analysis (Cont....)

Correlation matrix: A correlation matrix is a table showing correlation coefficients between variables. Each cell in the table shows the correlation between two variables

	<i>Are_you</i>	<i>Do_you</i>	<i>Collector</i>	<i>Collector_inform</i>	<i>Sep_bins</i>	<i>Fine_local</i>	<i>Days_Garbage</i>	<i>Wet_Waste</i>
<i>Are_you</i>	1							
<i>Do_you</i>	0.118624327	1						
<i>Collector</i>	0.365066287	-0.00509	1					
<i>Collector_inform</i>	0.260812814	-0.00509	0.334526473	1				
<i>Sep_bins</i>	0.192297594	-0.03541	0.383128976	0.43274648	1			
<i>Fine_local</i>	0.167968482	0.00406	0.206360463	0.329013435	0.447773475	1		
<i>Days_Garbage</i>	0.092439681	-0.0231	0.33715695	0.359711588	0.260380984	0.296199089	1	
<i>Wet_Waste</i>	0.219367521	0.049899	0.526323289	0.239184037	0.271585501	0.288869226	0.288560863	1

Correlation matrix for the obtained data

Data Analysis (Cont....)

Logistic regression:

- ❖ Logistic regression is one of the most popular Machine Learning algorithms, which comes under the Supervised Learning technique
- ❖ It is used for predicting the categorical dependent variable using a given set of independent variables

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline

# You can safely ignore the warning:
# Please use the pandas.tseries module instead. from pandas.core import datetools
import statsmodels.api as sm
QR_code = pd.read_csv('QR_Code_Logistic_Regression.csv')
```

C:\ProgramData\Anaconda3\lib\site-packages\statsmodels\compat\pandas.py:56: FutureWarning: The pandas.core.datetools module is deprecated and will be removed in a future version. Please use the pandas.tseries module instead.
from pandas.core import datetools

Libraries imported

Data Analysis (Cont....)

QR_code												
	Name	Age	Local	Prof	Are_you	Do_you	Collector	Collector_inform	Sep_bins	Fine_local	Mandatory_QR	Days_Garbage
0	abhishek	23	Bangalore	1	1	1	1	1	1	0	1	2
1	Gagan	24	Kalyan nagar	1	0	1	0	0	0	0	1	3
2	Nalinakshi H S	24	Yelahanka	1	1	1	1	1	1	1	1	3
3	Girish K S	22	Peenya	1	1	1	1	1	0	0	1	3
4	Anusha MG	22	Rajajinagar	1	0	1	1	1	0	0	1	2
5	Shobha	49	Yelahanka	2	1	1	1	1	1	0	1	3
6	Rathna	55	Yelahanka	3	1	1	1	1	1	0	1	2
7	Sanjay K S	22	Gandhi Nagar	1	1	1	1	1	1	1	1	2
8	abhishek	23	Bangalore	1	1	1	1	1	1	1	1	2
9	Sanjay K S	22	Gandhi Nagar	1	1	1	1	1	1	1	1	2

```
# defining the dependent and independent variables
```

```
Xtrain = QR_code[['Age', 'Prof', 'Are_you', 'Do_you', 'Collector',  
                  'Collector_inform', 'Sep_bins', 'Fine_local',  
                  'Days_Garbage', 'Wet_Waste']]
```

```
ytrain = QR_code[['Mandatory_QR']]
```

```
# building the model and fitting the data
```

```
log_reg = sm.Logit(ytrain, Xtrain).fit()
```

```
Optimization terminated successfully.
```

```
Current function value: 0.469459
```

```
Iterations 6
```

Data Analysis (Cont....)

```
# printing the summary table
print(log_reg.summary())
```

```

Logit Regression Results
=====
Dep. Variable:          Mandatory_QR      No. Observations:          194
Model:                  Logit             Df Residuals:              184
Method:                  MLE              Df Model:                  9
Date:                   Fri, 22 Apr 2022   Pseudo R-squ.:            0.06450
Time:                   15:49:29          Log-Likelihood:           -91.075
converged:               True             LL-Null:                  -97.355
                                   LLR p-value:              0.1836
=====
               coef      std err          z      P>|z|      [0.025      0.975]
-----
Age              0.0445      0.024      1.862      0.063      -0.002      0.091
Prof            -0.4548      0.263     -1.728      0.084      -0.971      0.061
Are_you         0.2965      0.548      0.541      0.588      -0.777      1.370
Do_you          1.0095      0.584      1.729      0.084      -0.135      2.154
Collector       -0.8040      0.605     -1.329      0.184      -1.989      0.381
Collector_inform 0.0246      0.514      0.048      0.962      -0.984      1.033
Sep_bins       -0.1404      0.459     -0.306      0.760      -1.040      0.759
Fine_local      0.2151      0.442      0.486      0.627      -0.652      1.082
Days_Garbage    0.0458      0.187      0.244      0.807      -0.322      0.413
Wet_Waste       0.4099      0.532      0.770      0.441      -0.633      1.453
=====

```

Logistic Regression result

Findings

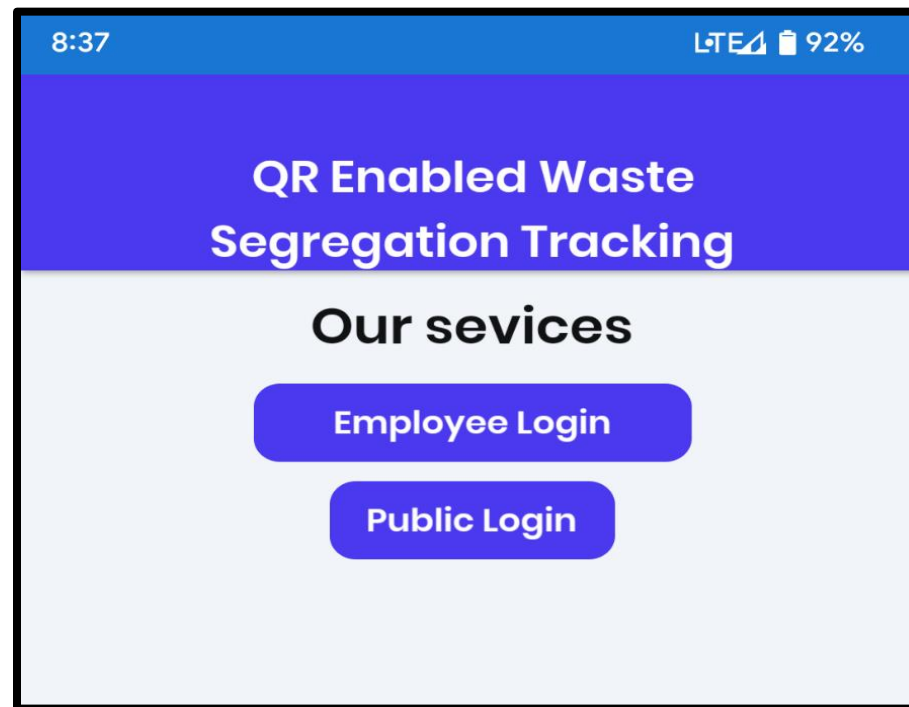
- ❖ Door to Door step of collecting waste from people by sending BBMP vehicles separate for both dry and wet waste has not been completely effective
- ❖ Because of the mixed waste it is difficult to recycle and reusing
- ❖ It is leading to piling up of wastes in the landfills and more illegal dumpsites in the city consuming more space to dump the waste
- ❖ Mixed waste makes it difficult to worker, as it requires much manual or mechanical sorting this puts workers health in danger especially hazardous waste can cause long term health problems
- ❖ Communities surrounding landfills are facing issues with their drinking water due to leaking landfills

Conclusion

- ❖ Our project mainly concentrates on tracking the Domestic waste which is not segregated by the public mainly households
- ❖ We propose this idea “**QR Enabled Domestic Waste Segregation Tracking**”. Through which we can find the house which is not segregating the waste and impose the fine on them so that in future same mistakes in not repeated by them
- ❖ The citizen can buy QR code tags. Once waste is segregated effectively, treatment of waste will be easy
- ❖ The QR code tag will be provided by BBMP to track the segregation by using Electric meter number

Conclusion (Cont.....)

- ❖ Application Developed can be used by both BBMP and Public
- ❖ Application provides all the details just by logging in with their ID or meter number



Conclusion (Cont.....)

Limitations

- ❖ Technical glitch due to large amount of data stored
- ❖ Employee need to be trained on developed application
- ❖ Network issues in certain localities
- ❖ Time was the main constraint
- ❖ This Study concentrate on waste segregation only limited to Bangalore urban

Conclusion (Cont.....)

Future suggestions

- ❖ It can also be carried out at various geographical areas
- ❖ The collected sample size for the project undertaken is less, in the future, it would be more suitable to collect larger sample size
- ❖ It is suggested to use Convolutional Neural Network to achieve segregation. This can be designed to reduce human intervention in segregating waste
- ❖ Image processing capability can be used to determine the kind of waste using machine learning.
- ❖ It is suggested to introduce smart bin concept
- ❖ The current application require internet, in future it can be implemented in offline mode

Field Survey



Acknowledgement

We express our deep sense of gratitude and indebtedness to our esteemed university “M S Ramaiah University of Applied Sciences” which has provided us an opportunity to fulfil the most cherished desire to reach our goals. We express our foremost regards to “Dr. K M Sharath Kumar” HOD, Faculty of Management and commerce, M S Ramaiah University of Applied Sciences, Bengaluru.

We express special gratitude to our guide “Dr. Uday. K. Jagannathan” Asst. Prof, Faculty of Management and commerce, M S Ramaiah University of Applied Sciences, Bengaluru for his guidance, inspiration, directions, encouragement and discussions in successful completion of the Group project.

Finally, we express our deep love to our respective family members for their consistent support and would also thank all of them who have either directly or indirectly rendered help to complete the group project.

References

- ❖ Rumana Hossain, Md Tasbirul Islam, Riya Shanker, Debishree Khan, Katherine Elizabeth Sarah Locock, Anirban Ghose, Heinz Schandl, Rita Dhodapkar and Veena Sahajwalla (2022) “Plastic Waste Management in India: Challenges, Opportunities, and Roadmap for Circular Economy”, published in Journals Sustainability Volume 14 Issue 8 10.3390/su14084425
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THANK YOU