



Academy of
Engineering

School of E&TC Engineering

Presentation for BTECH Major Project

Metro Management System using Data Analysis and Machine Learning

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INTRODUCTION

Project Background

- Metros are playing an important role in urban transport media.
- It is important to keep passenger flow in mind.
- Congestion in the metro due to ever increasing population.

Motivation

- Traffic congestion is a growing source of worry in public transport .
- An essential component of the intelligent transport system is the forecast of passenger movement.
- The goal of this task is to forecast how many people will board and depart the metro and at which stops during the course of the specified period.



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- *Completion Status of the project*
- *Contribution*
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Problem statement

To implement passenger flow prediction using machine learning for metro management system.

Objectives to be achieved

- 1) *Ticket booking through app built*
- 2) *System for scanning a valid e-ticket*
- 3) *Collection of data of passengers travelling*
- 4) *Passenger flow analysis using the data collected*



CONTRIBUTION OF MEMBERS

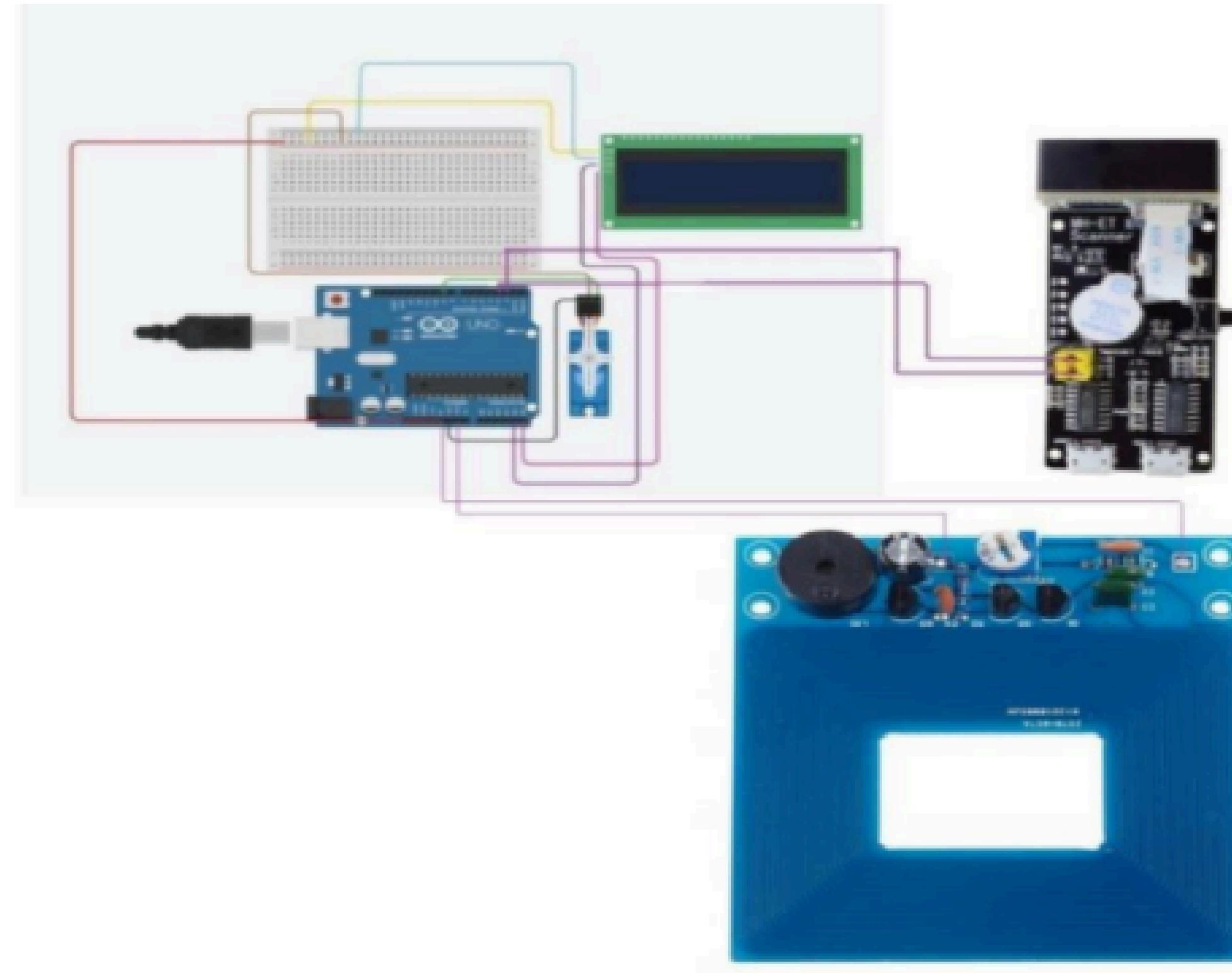
-Ramyata Rohan Mendhe: analyzing historical passenger flow data and applying the ARIMA model for time series forecasting.

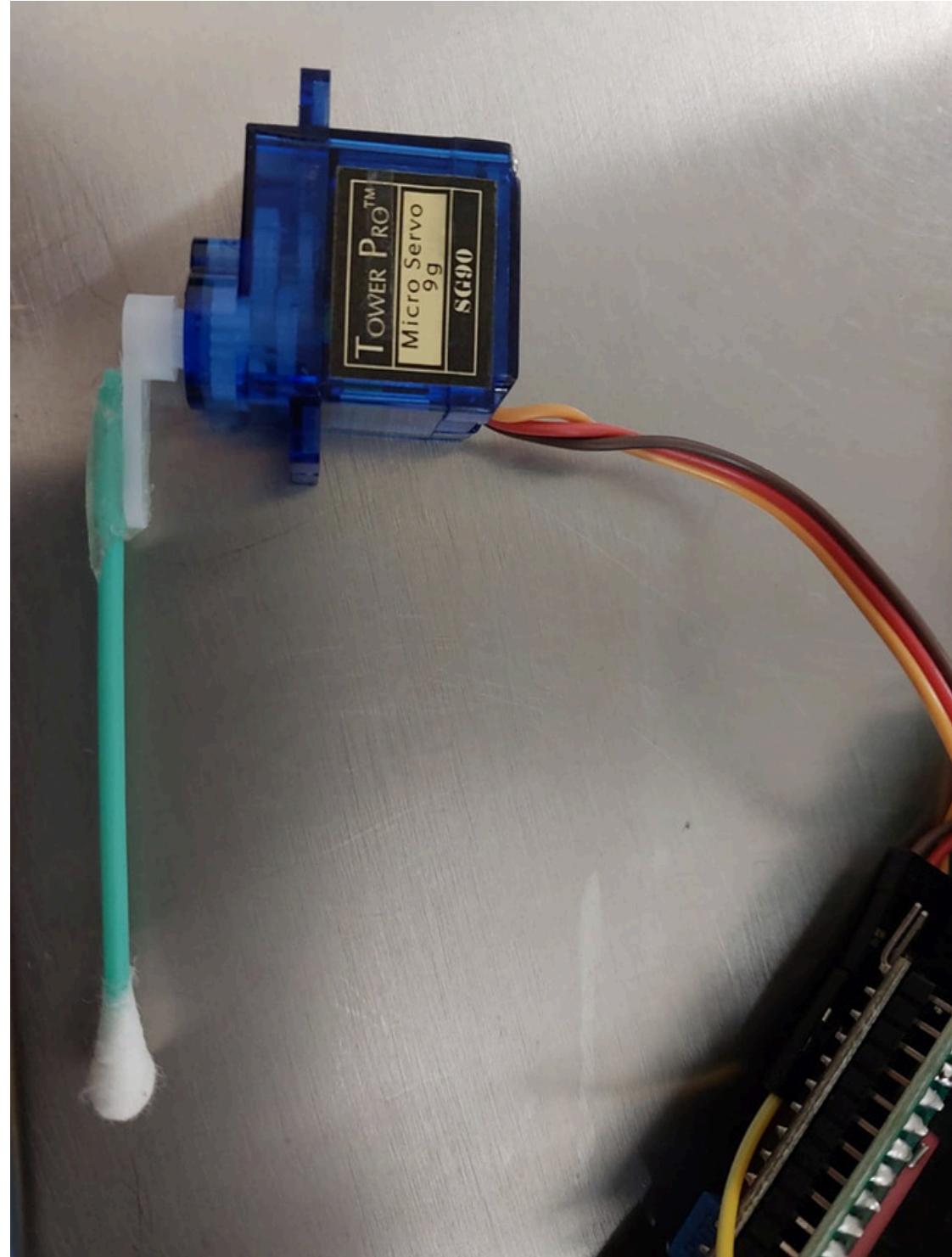
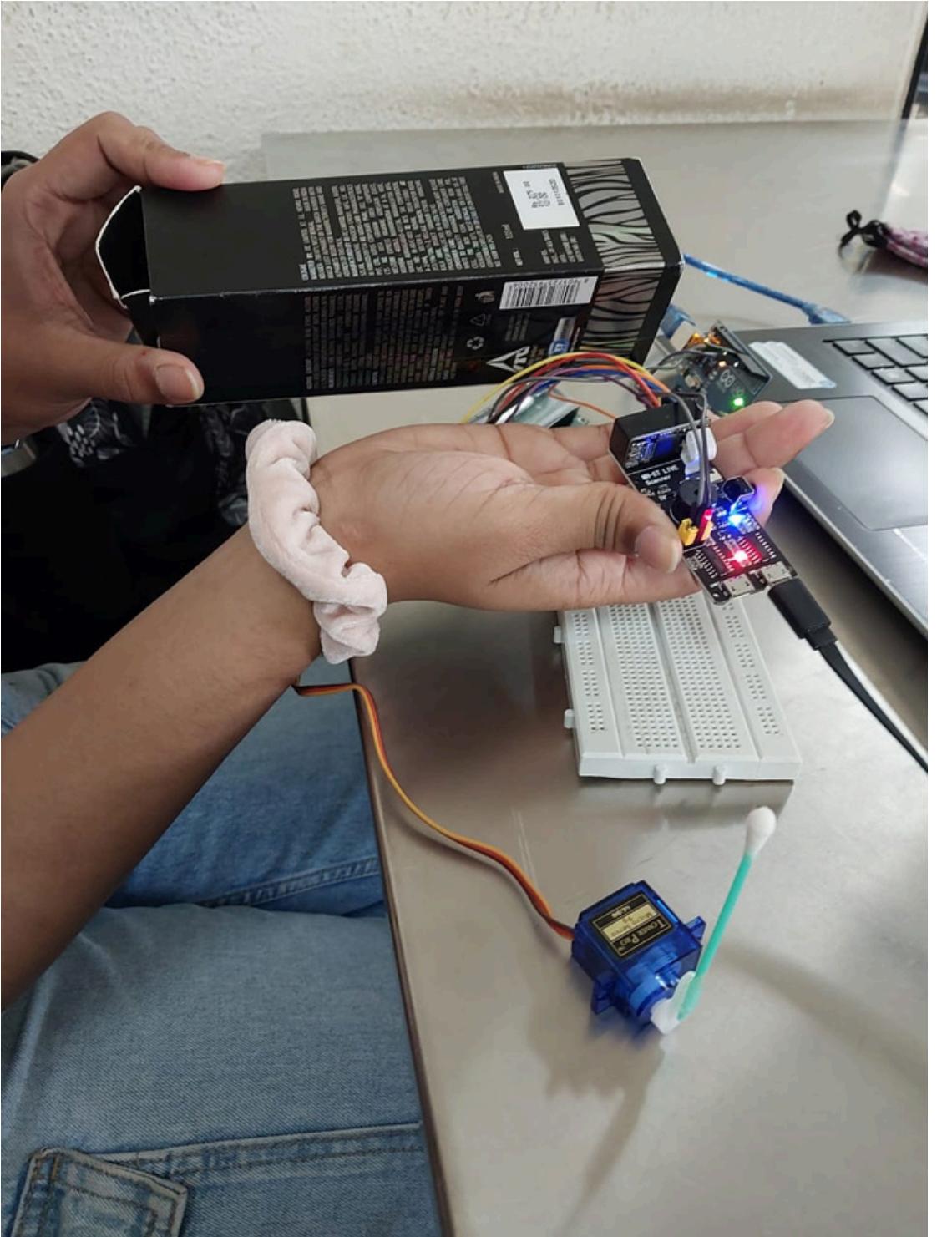
- Sarvesh Shingare: Led the design and development of the mobile application interface, ensuring a user-friendly experience and seamless access to real-time passenger flow data and metro schedules

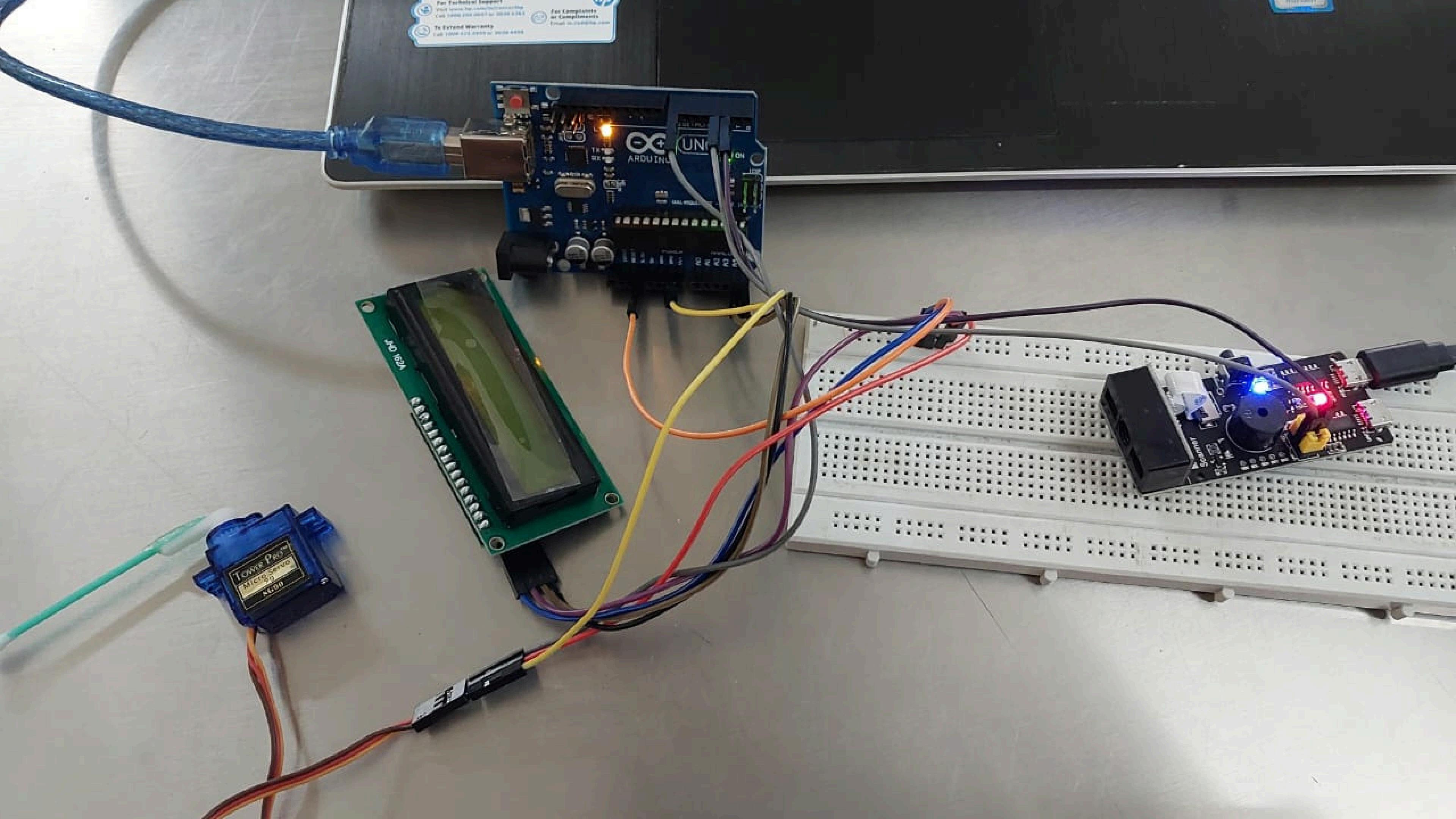
-Dipak Shinde: Instrumental in handling the hardware aspects by setting up data collection systems, such as sensors and ticketing systems, to gather real-time passenger data.

-Aditya Surve: Collaborated with Dipak on hardware implementation and system integration, troubleshooting hardware-related issues, and ensuring smooth functionality.

HARDWARE







PUNE_METRO 2024 Dataset

August 24 DATA

	E	F	G	H	I
	Date	Total Ride	Total Revenue		
	1/8/2024	117571	1990777		
	2/8/2024	115343	1943965		
	3/8/2024	110031	1393686		
	4/8/2024	85681	1088689		
	5/8/2024	121062	2045897		
	6/8/2024	121583	2050993		
	7/8/2024	119957	2023906		
	8/8/2024	118493	1995192		
	9/8/2024	115719	1948586		
	10/8/2024	115318	1469154		
	11/8/2024	122416	1545963		
	12/8/2024	123823	2075369		
	13/8/2024	123414	2071608		
	14/8/2024	126568	2142348		
	15/8/2024	120041	2101865		
	19/8/2024	117580	2059283		
	16/8/2024	108588	1847360		
	17/8/2024	110437	1413079		
	18/8/2024	96255	1244979		

29/08/2024	128894	2154364
30/08/2024	125434	2098443
31/08/2024	130661	1660074
Total	3665479	57924387

July 24 DATA

	C	D	E	F
	Date	Total Ride	Total Revenue	
	1/7/2024	111812	1898120	
	2/7/2024	95151	1634505	
	3/7/2024	102720	1761159	
	4/7/2024	102224	1753188	
	5/7/2024	97230	1659801	
	6/7/2024	100630	1297163	
	7/7/2024	99258	1274769	
	8/7/2024	103524	1752624	
	9/7/2024	96841	1663579	
	10/7/2024	103968	1763665	
	11/7/2024	102152	1730347	
	12/7/2024	100162	1702813	
	13/07/2024	92559	1180630	
	14/07/2024	81834	1041025	
	15/07/2024	106138	1791353	
	16/07/2024	105736	1788872	
	17/07/2024	89714	1552845	
	18/07/2024	106362	1798313	
	19/07/2024	105556	1783230	

29/07/2024	113629	1914940
30/07/2024	110946	1873317
31/07/2024	110744	1869613
Total	3118616	49804823

June 24 DATA

	A	B	C	D
	Date	Total Ride	Total Revenue	
1	1/6/2024	92016	1188493	
2	2/6/2024	90893	1196314	
3	3/6/2024	90243	1565133	
4	4/6/2024	84900	1470520	
5	5/6/2024	90611	1579926	
6	6/6/2024	90586	1579932	
7	7/6/2024	91689	1595850	
8	8/6/2024	97919	1252751	
9	9/6/2024	91350	1175836	
10	10/6/2024	98405	1713168	
11	11/6/2024	96194	1681730	
12	12/6/2024	94170	1647461	
13	13/06/2024	95643	1662144	
14	14/06/2024	94307	1636854	
15	15/06/2024	96848	1247314	
16	16/06/2024	97905	1265818	
17	17/06/2024	90672	1592665	
18	18/06/2024	99158	1728055	
19	19/06/2024	95394	1652544	

28/06/2024	93354	1612454
29/06/2024	97991	1259967
30/06/2024	199437	2415693
Total	2924162	45965380

Methodology

1. Data Collection
2. Data Preprocessing
3. Feature Engineering
4. Machine Learning Methods
5. Model Training and Validation
6. Data Visualization

Application for Metro Ticket Booking

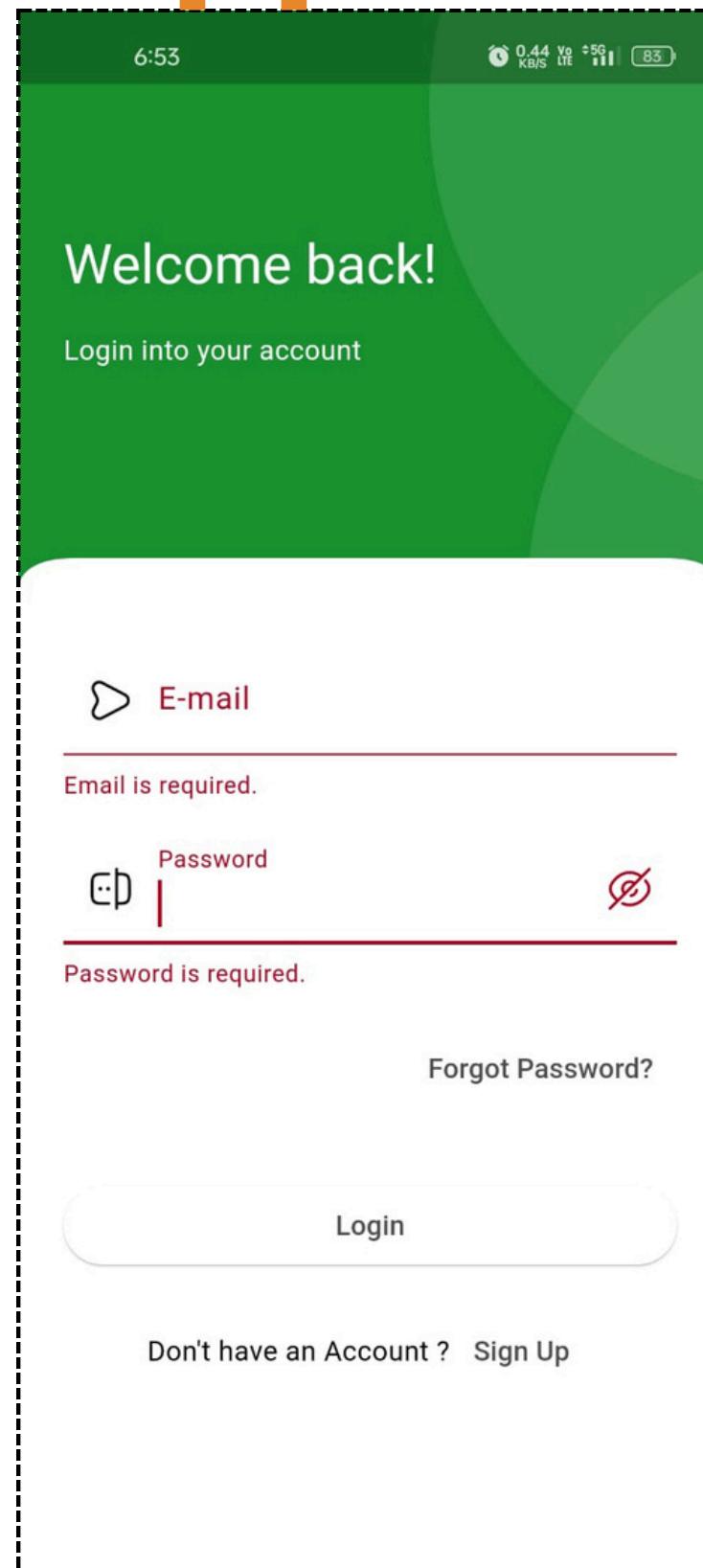


Fig : Login Screen

The signup screen has a header "Let's create your Account" with a back arrow. It contains fields for "First Name" and "Last Name", both marked as required with red error messages. Below these are fields for "E-mail" and "Phone Number", also marked as required. A "Create Account" button is at the bottom.

Fig : Signup Screen

The forgot password screen has a header "Forgot Password" with a back arrow. It includes a text message about password resets and a field for "E-mail". A "Submit" button is at the bottom.

Fig : Forgot Password

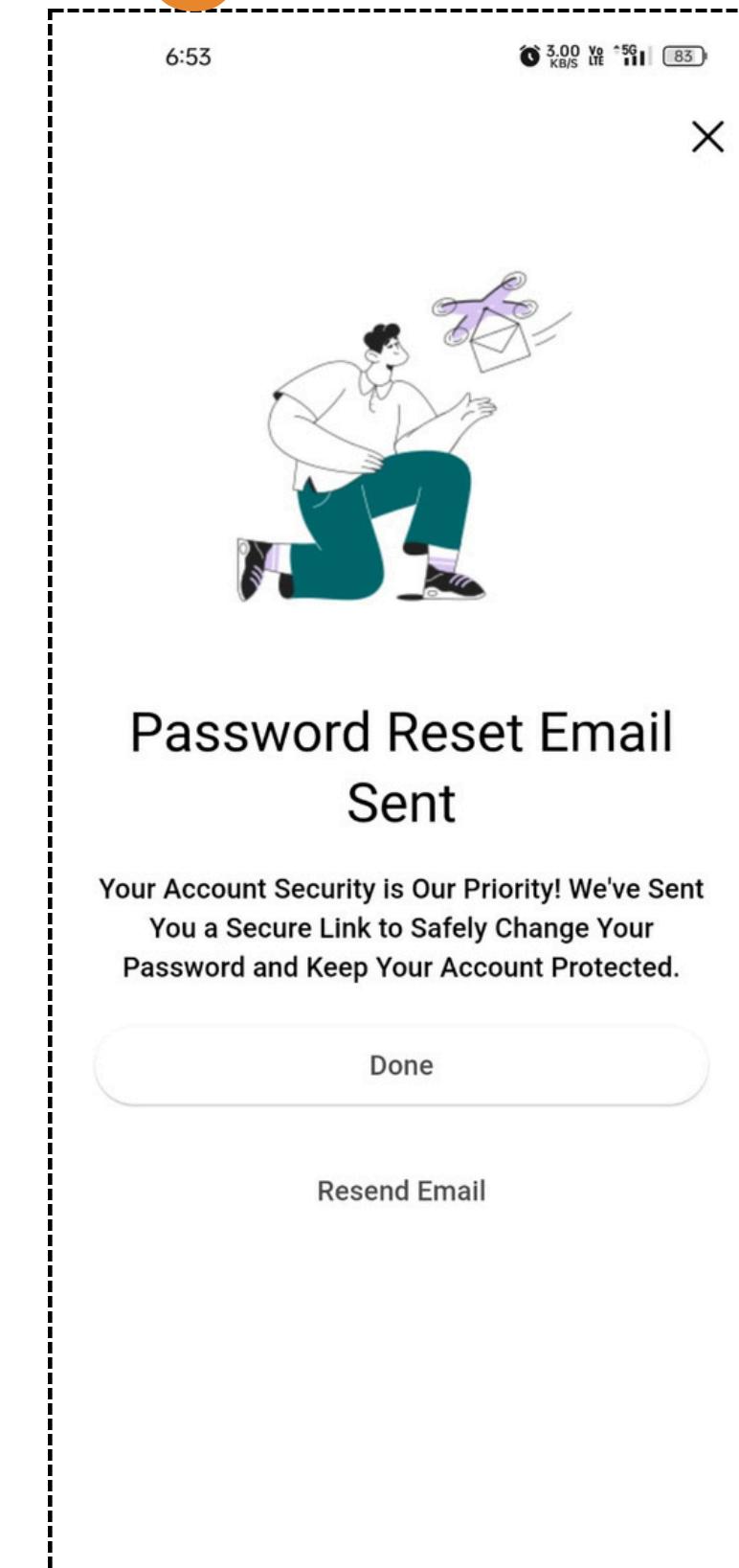


Fig : Password Reset Successfully

6:55 0.02 Yo 5G 82

← Register Lost & Found Item

Item Name:
Enter the name of the item

Description:
Enter a description of the item

Date Lost/Found:
Enter the date (e.g., 2024-05-23)

Location:
Enter the location where the item was lo...

Contact Information:
Enter your contact information

Register Item

6:55 0.84 Yo 5G 82

← Central Station

Location:
Bhosari

Details:
Main hub connecting all metro lines.

Operational Hours:
05:00 AM - 11:00 PM

Contact Info:
+1 234 567 890

Facilities:

- ✓ Restrooms
- ✓ ATM
- ✓ Shops
- ✓ Food Court

Back

6:55 0.00 Yo 5G 82

← About Metro

Introduction

The Metro system is a fast, reliable, and efficient mode of transportation designed to ease urban commutes. Our metro system connects the city through multiple lines, ensuring convenient travel for all passengers.

History

Established in 2000, the Metro system has undergone significant expansions and upgrades over the years. With state-of-the-art infrastructure and modern amenities, it has become a backbone of urban transportation.

Services

Our services include:

- Frequent trains with minimal wait times.
- Comfortable and air-conditioned coaches.
- Accessibility features for differently-abled passengers.
- Real-time updates and passenger information systems.

Operational Details

Operational Hours: 5:00 AM - 11:00 PM

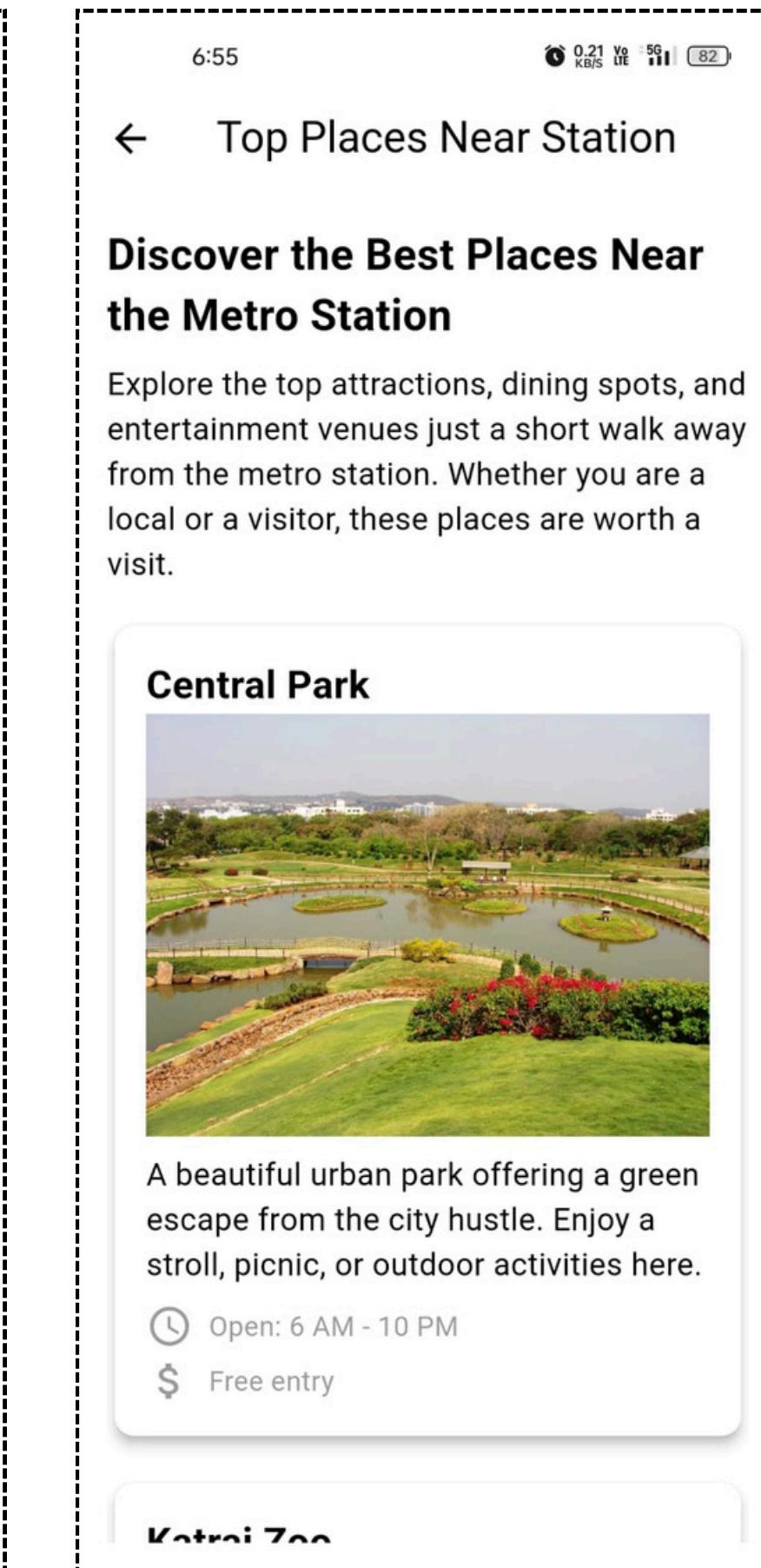


Fig : Register lost & found

Fig : Station information

Fig : About metro

Fig : Top places

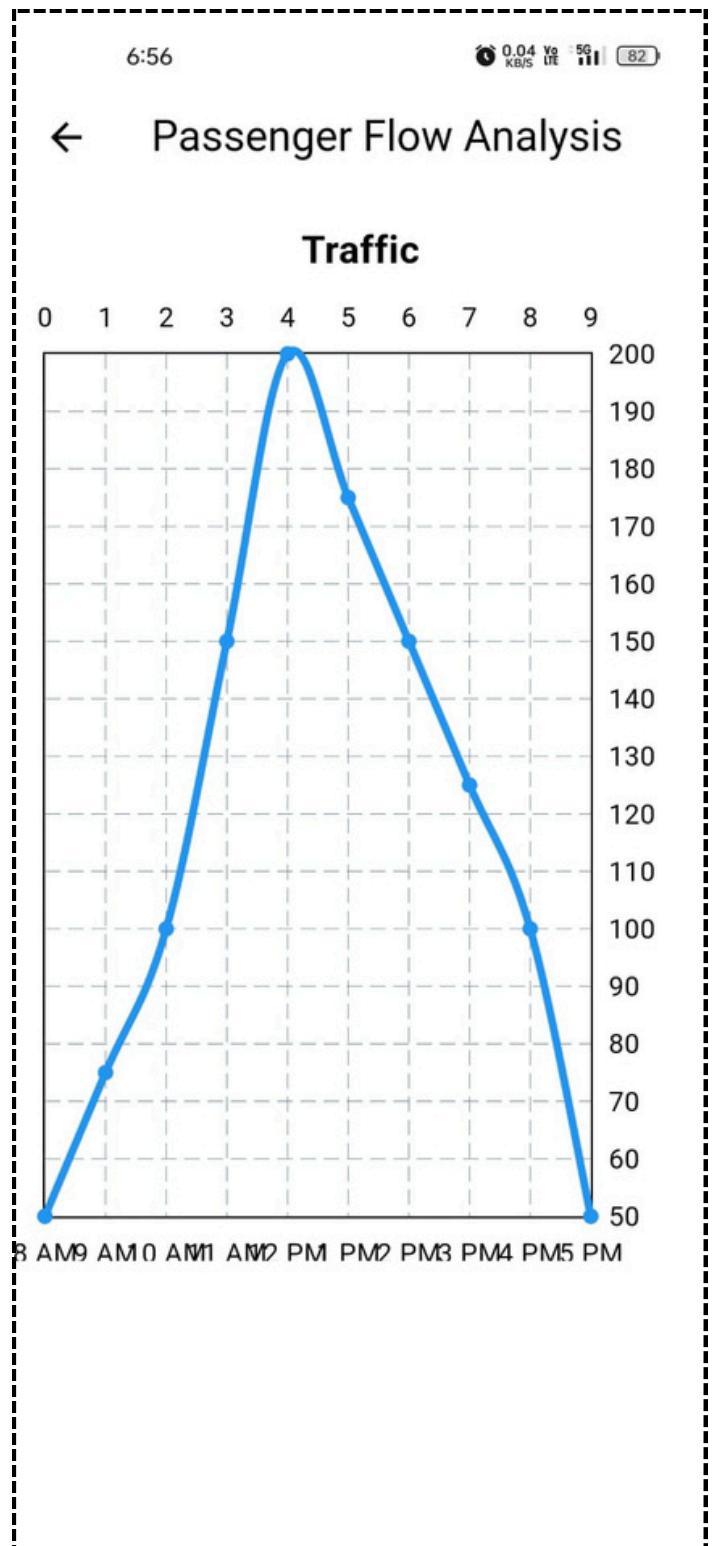
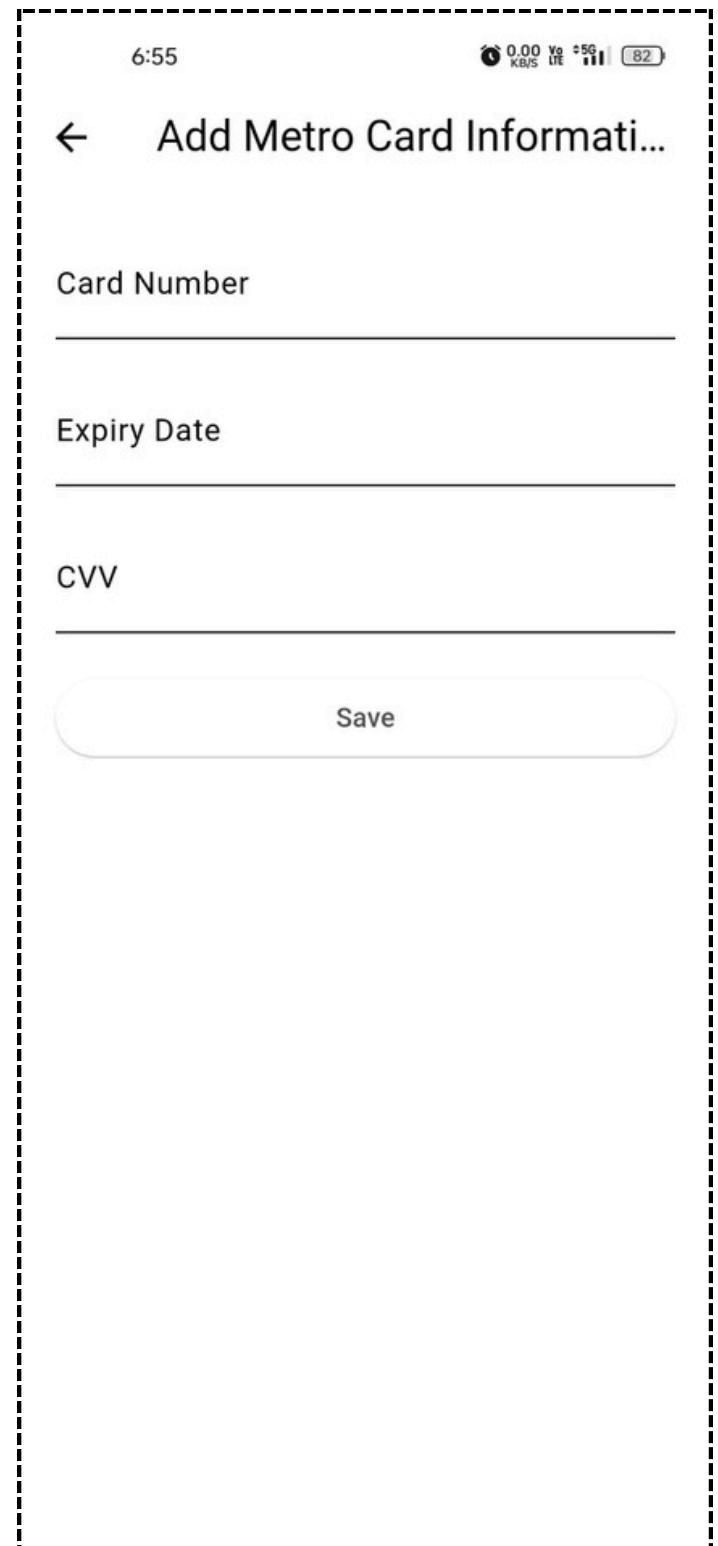
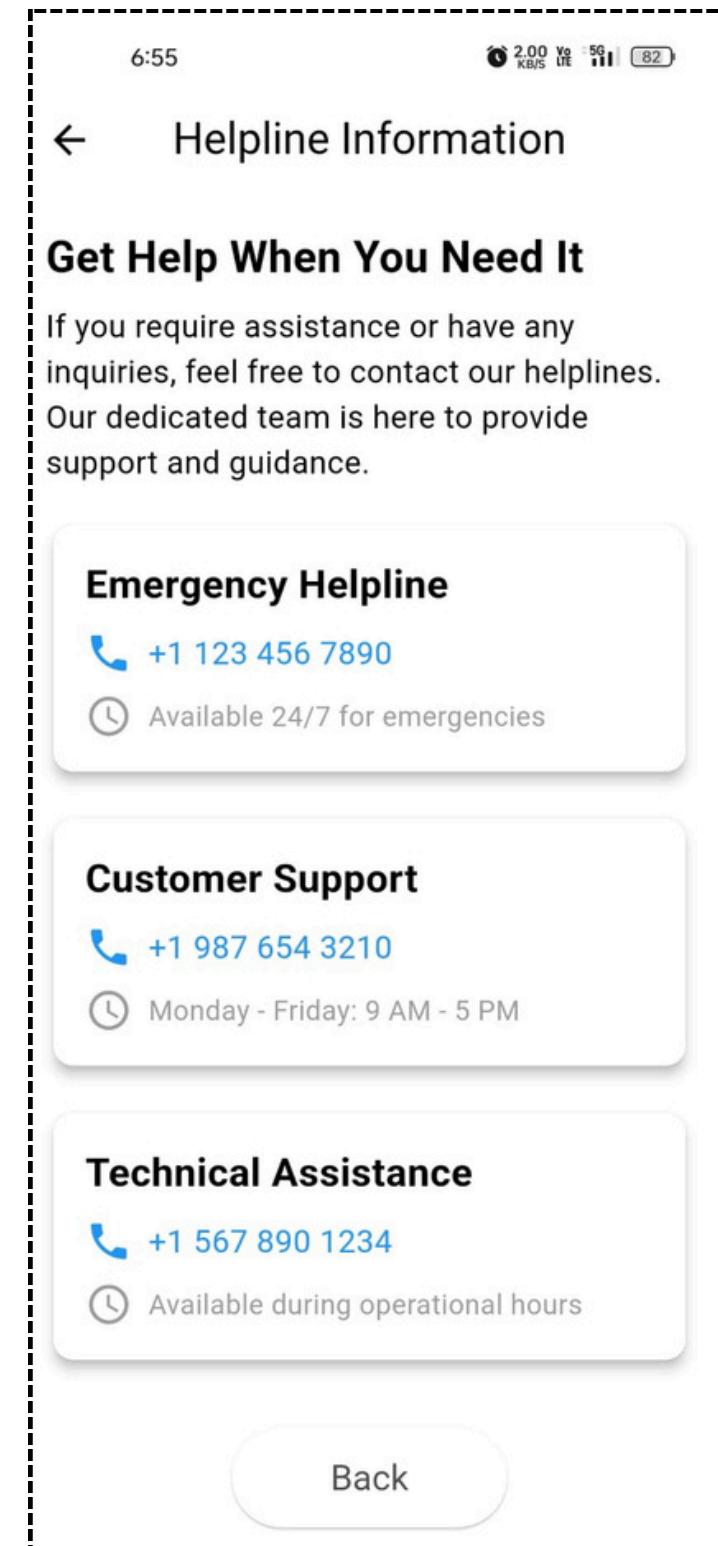


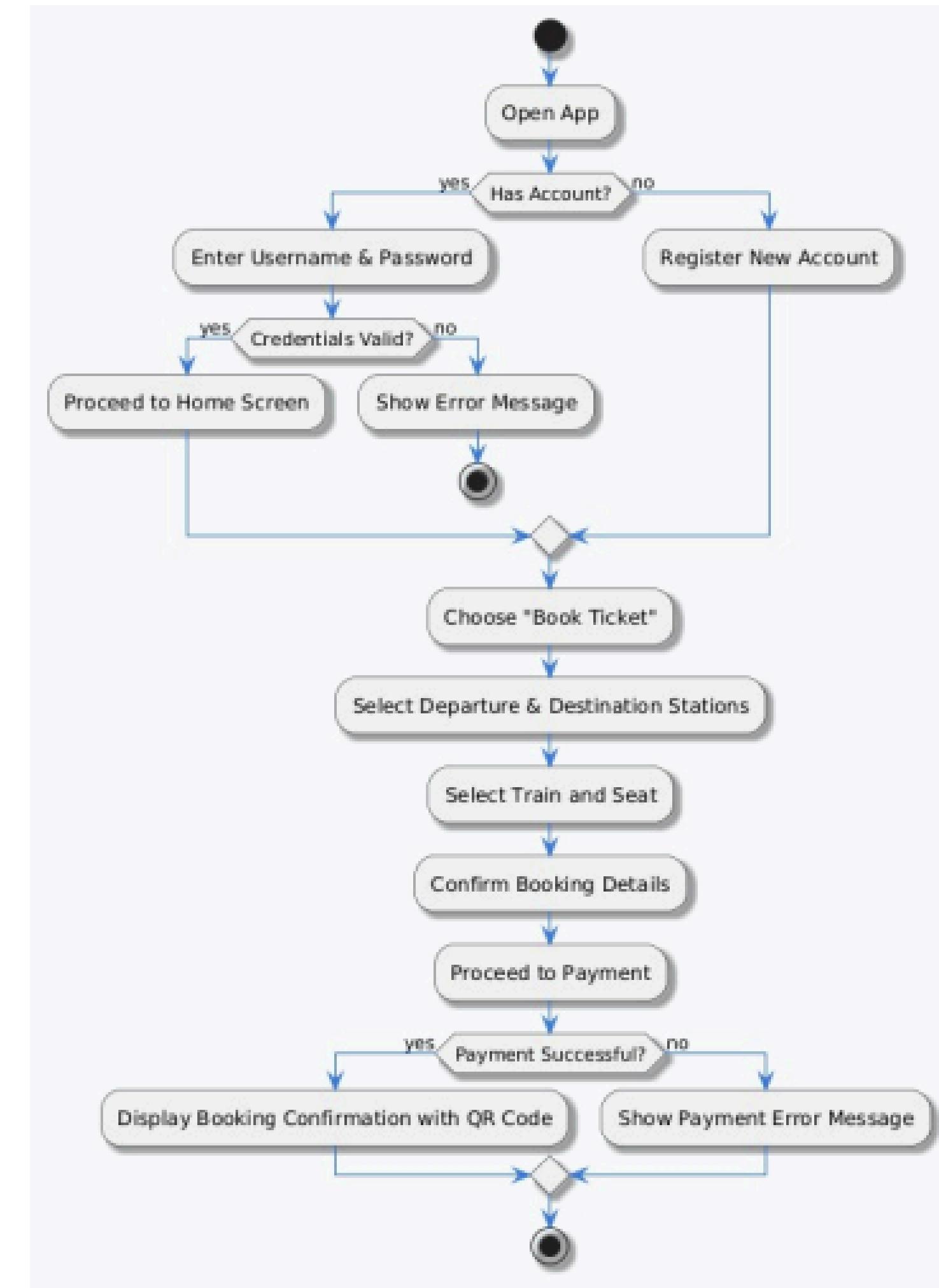
Fig : COVID-19 precautions

Fig : Helpline

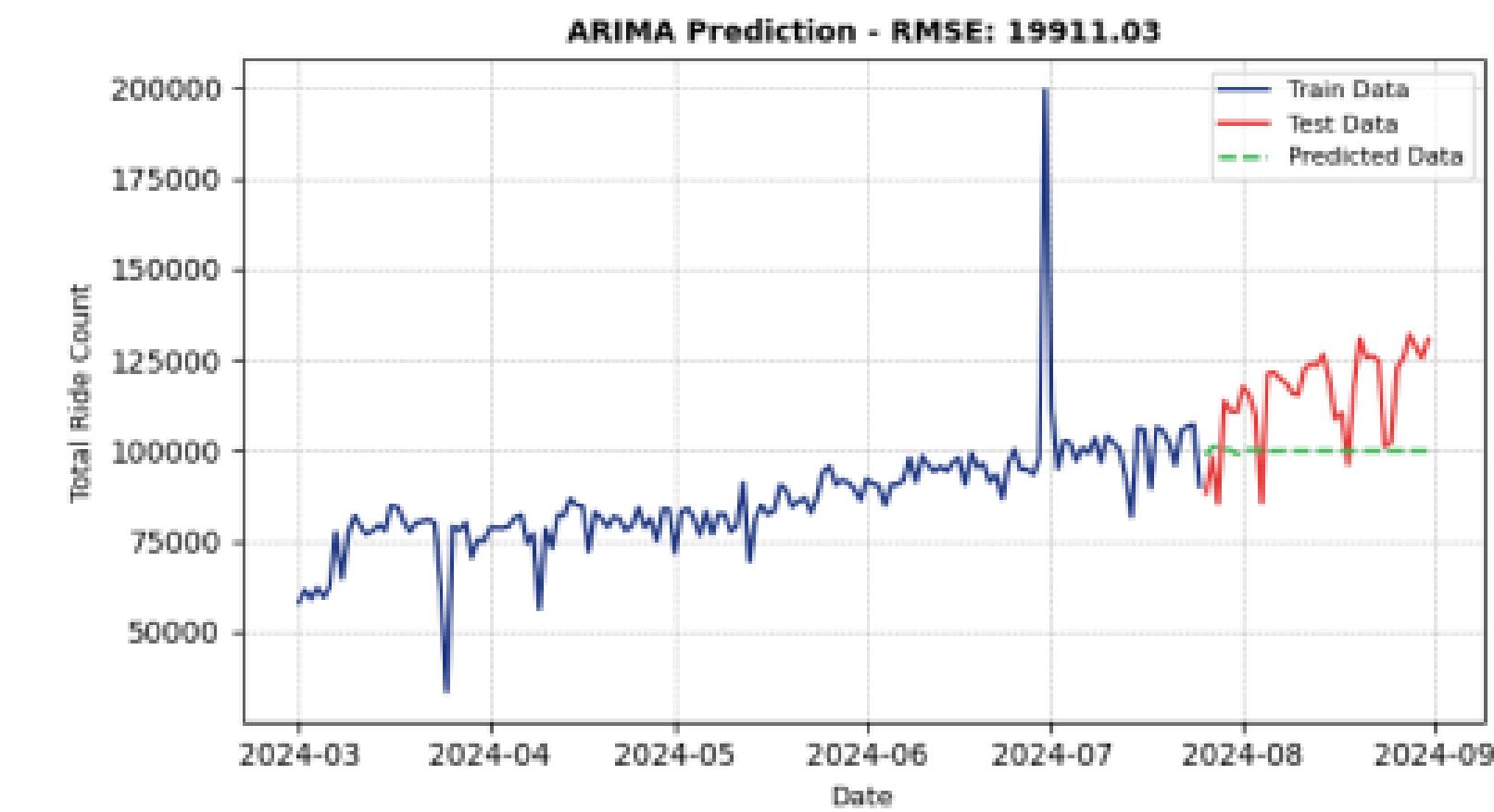
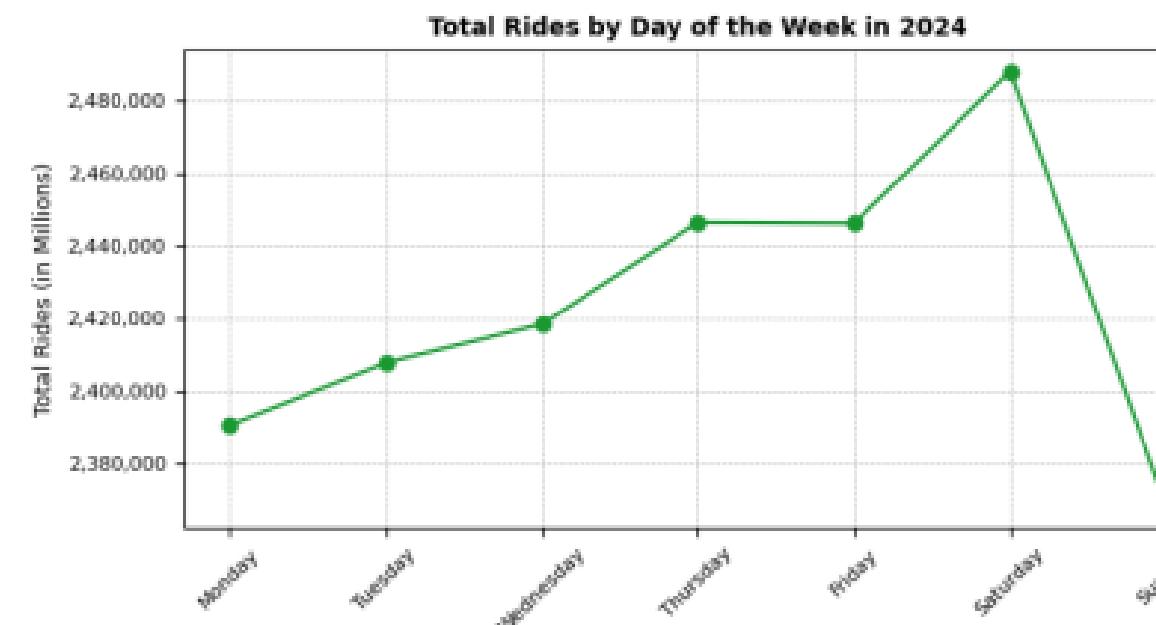
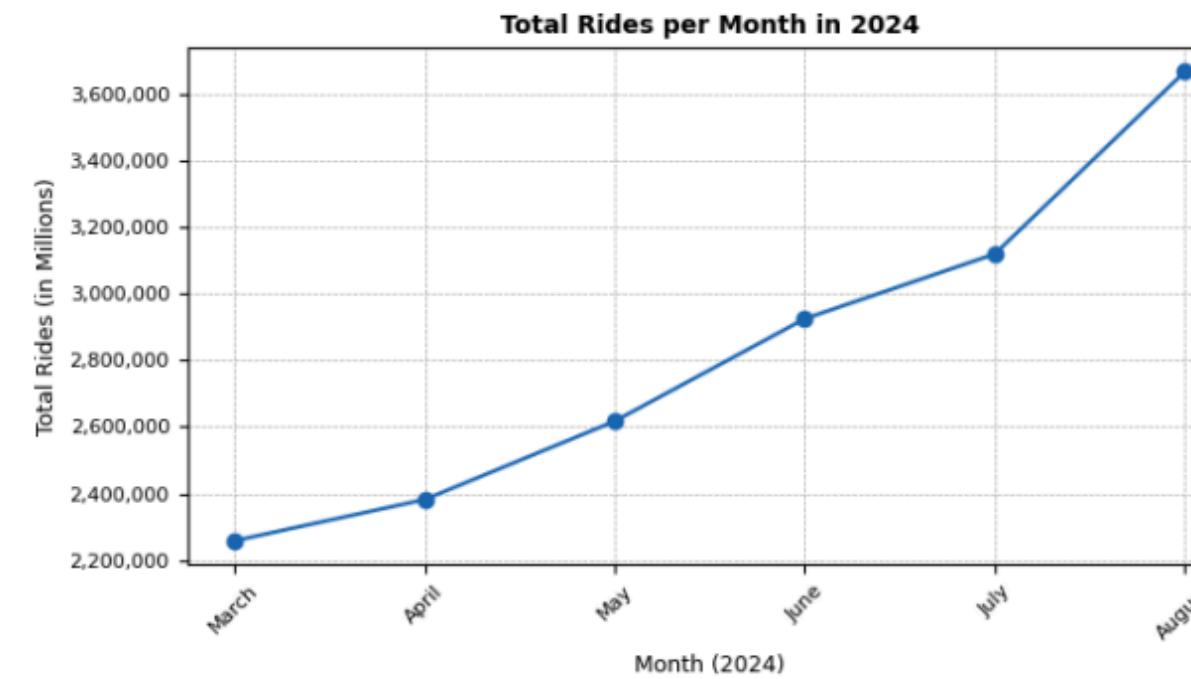
Fig : Metro Map

Fig : Card Registration

Fig : Passenger analysis



Passenger Flow Analysis using machine learning



Predicted Passenger Count Info Table

Date	Predicted passenger count
2024-09-01	99854.00
2024-09-02	99854.12
2024-09-03	99854.30
2024-09-04	99854.25
2024-09-05	99854.48
2024-09-06	99854.60
2024-09-07	99854.55
2024-09-08	99854.70
2024-09-09	99854.85
2024-09-10	99855.00
2024-09-11	99855.15
2024-09-12	99855.10
2024-09-13	99855.30

Related References

- [1] Nagaraj N, Gururaj HL, Swathi BH, Hu YC. "Passenger flow prediction in bus transportation system using deep learning." *Multimed Tools Appl.* 2022;81(9):12519-12542. doi: 10.1007/s11042-022-12306-3. Epub 2022 Feb 19. PMID: 35221777; PMCID: PMC8857630.
- [2] Jie Zeng, Jinjun Tang, "Combining knowledge graph into metro passenger flow prediction: A split-attention relational graph convolutional network," *Expert Systems with Applications*, Volume 213, Part A, 2023, 118790, ISSN 0957-4174.
- [3] Veloso, B., Ribeiro, R.P., Gama, J. et al. The MetroPT dataset for predictive maintenance. *Sci Data* 9, 764 (2022).
- [4] Hisyam Azhar, Badrul and Adli Ismail, Saiful, "A Systematic Literature Review of Metro's Passenger Flow Prediction" (July 13, 2020). The 1st International Conference on Information Technology & Business ICITB2020.
- [5] Asakura, Y., T. Kusakabe, L. X. Nguyen, and T. Ushiki. 2015. "Incident detection methods using probe vehicles with on-board GPS equipment." *Transp. Res. Procedia* 6 (3): 17–27.

Related References

- [6]Habtemichael, F. G., and M. Cetin. 2016. "Short-term traffic flow rate forecasting based on identifying similar traffic patterns." *Transp. Res. Part C: Emerging Technol.* 66 (May): 61–78.
- [7]Lin C, Wang K, Wu D, Gong B. , "Passenger Flow Prediction Based on Land Use around Metro Stations: A Case Study. *Sustainability.*" 2020; 12(17):6844.
- [8]Yin, J., Tang, T., Yang, L., Gao, Z., Ran, B., 2016. "Energy-efficient metro train rescheduling with uncertain time-variant passenger demands: An approximate dynamic programming approach". *Transportation Research Part B: Methodological* 91, 178–210.
- [9]Niu, H., Zhou, X., Gao, R., 2015. "Train scheduling for minimizing passenger waiting time with time-dependent demand and skip-stop patterns: Nonlinear integer programming models with linear constraints." *Transportation Research Part B: Methodological* 76, 117–135.
- [10] J. Zhang et al., "A Real-Time Passenger Flow Estimation and Prediction Method for Urban Bus Transit Systems," in *IEEE Transactions on Intelligent Transportation Systems*, vol. 18, no. 11, pp. 3168-3178, Nov. 2017, doi: 10.1109/TITS.2017.2686877.



STUDIO SHODWE

Thank You