Sustainable Centralized Ride-Hailing Service: E-Flo

Ananya S Shetty, Department of Computer Science, Christ University, Bengaluru,

ananya.shetty@bca.christuniversity.in

Balaji P, Department of Computer Science, Christ University, Bengaluru,

balaji.p@bca.christuniversity.in

Yash P Mehta, Department of Computer Science, Christ University, Bengaluru,

yash.mehta@bca.christuniversity.in

Dr. Smitha Vinod, Department of Computer Science, Christ University, Bengaluru,

smitha.vinod@christuniversity.in

Abstract - In today's rapidly urbanizing world, the need for sustainable transportation solutions has become more urgent than ever. Urban dwellers are increasingly seeking alternatives to traditional modes of transport to reduce environmental impact, alleviate traffic congestion, and improve overall quality of life. E-Flo, a Sustainable Urban Transport Database Management System, emerges as a pioneering solution to address these pressing challenges. It is an innovative web-based platform designed to empower travelers and city residents with comprehensive information and intelligent recommendations regarding environmentally friendly transportation options. Leveraging real-time data from diverse sources, E-Flo provides users with insights into the availability, reliability, and environmental impact of various transport modes within a city. By merging an intuitive user interface with a dynamic database, E-Flo facilitates informed decision-making, fosters environmental awareness, and promotes sustainable urban living. The platform offers functionalities such as personalized recommendations, real-time updates on weather and air quality, and comparisons of price and time between transport modes. E-Flo also addresses the limitations of existing systems by integrating a recommendation engine that considers weather conditions and provides information on nearby charging points for electric vehicles.

Keywords - Cookies, Ride-hailing, Sustainable, Transportation, Urban, Web Application

I. Introduction

The Urban Transportation has had a transformation over the past centuries, in terms of the technological advancements which makes ways for people to navigate to cities. During the 20th century the automobiles has challenged the dominance of traditional modes of transportation such as horse-drawn carriages and public transit systems. However, the technology truly began to revolutionize the urban transportation with the introduction of communication systems like facilitating the booking of rides through phone calls. [1] [2]

The urban residents relied on landline telephones to arrange transportation. This involved calling a taxi service or a car rental company to request a ride to their desired destination. While this was more convenient than flagging down a taxi on the street. Passengers were to give a lot of information about where they were and where they wanted to go to meet the person taking the call. [1]

The Urban Transportation happened with text-based bookings. Where People could book rides by sending a text message using mobile phones and SMS technology. This made booking easier and reduce talking over calls. Users had option of texting anytime without waiting. Mobile Technology helped passengers communicate better with the services pried. However, text-based systems still had limits, like scalability and real-time tracking. Then came smartphone apps, like Uber and Lyft. These apps let users book rides easily with a tap on their phone. They showed real-time driver information, wait times, and fare estimates. Also, they introduced cashless payments for convenience and security for both passengers and drivers.

The use of GPS technology helped the drivers find the best routes which helps them to reduce the travel time of passengers. The digital maps also give users an accurate traffic information helping them to find a closest location. These efforts aim to make urban transportation more efficient and eco-friendlier as cities grow. Overall, technology has driven urban transportation from phone calls

to smartphone apps and smart infrastructure, making it easier, greener, and more accessible for everyone. [3]

A research paper is academic writing also aims at addressing the need for user-friendly platform for an eco-friendly transportation. Current systems like Uber and Google Maps lack an approach towards sustainability. There are multiple questions that are unanswered when it comes to improvement of these ride hailing apps in general.

1. How many modes of transport do they support?

2. Do the services allow for an eco-conscious choice?

3. Do the current ride hailing apps comply with the local regulations.

4. Do the applications support the use of public modes of transport?

5. How much information about the transport mode is conveyed to the passenger?

Our focus is to address some of these existing gaps in transportation also provides users with comprehensive platform for eco-friendly commuting. Our system will provide users with detailed information on environmentally conscious transportation modes, helps them to choose greener options.

Many websites use cookies to store information about the user for better understanding of the user. What are cookies and why is it necessary? Cookies are a small text field in a data folder. A cookie is only a short line of text. They contain certain information which allows the site to display selected settings or some user-specific content. Cookies are necessary as they help developers give personal and convenient website visit. What is transportation application? A transportation application is a web or a desktop application which asks and requests rides from drivers. [4]

II. LITERATURE REVIEW

Although, applications for transportation, or Ride-Hailing applications have been around for a while. They still have a lot of potential to improve and a lot of gaps to cover. But since this is not the first application that helps in transportation, it's important to look at the existing systems and what they provide.

A. Google Maps

Google maps is an application or service provided by the company Google, which is the largest and most popular tech company that focuses on multiple fields, smart navigation being one of them.

Google Maps has over 1 billion active monthly users globally. [5] But this is not a ride-Hailing service but rather an information guide for transport. It is a digital map which also helps with choosing the best mode of transport from one destination to another.

There are a lot more features in this system such as road view or immersive view which allows for a better experience in terms of using a map. But focusing on the parts that pertain to ride hailing or empowering the user with information. It also integrated a feature called "Street View" in 2007, this brilliant innovation proved to be a milestone in the history of navigation and GPS. [6]

Google Maps is affiliated with some ride hailing applications like Uber, Lyft and some local providers and can compare their prices and their services. [7] This helps the user in making a cost-efficient decision.

Google maps also integrates public transit information. This gives the user a comprehensive view of transportation options and helps them be decisive about their trips. But the juxtaposition of using public transit with private transport might encourage a user to pick a cab over a sustainable option. [8]

B. BluSmart

BluSmart is India's first and largest EV based ride hailing app. In terms of sustainability BluSmart would be the best current option in the market. According to the firm, they have over 10,000 EV vehicles while operating only in New Delhi and Bangalore. And their current user base stands over 2.4 million users as of 2023. [9] Their app is based on the fact that they centralize E.V. Transport especially cabs being their most used service.

BluSmart allows three services specifically, "Rides within the city", "Rent out rides", and "Rides to the airport". They also have other features like Blu Assure where you rent out your electric car to the company for their use, and Blucharge in which an electric charging business can affiliate with the company. [10]

Specifically speaking about the Ride within the city feature they allow the user/passenger to book their rides in advance or get instant rides and allow the user to add two or more stops to the ride. This attracts the user towards this service, showing them how flexible the service is. [10]

BluSmart has dedicated drivers and vehicles under the firm and unlike other ride hailing firms that depend on the service provided cab drivers to join and become affiliated with the company.

C. Uber

Uber is a transportation application which provides ride-hailing services. Uber reduces the usage of public transport and has no impact on ownership of vehicles. In 2009, Garrett Camp(co-founder) came up with the idea of creating Uber to make the transportation easier and cheaper to produce direct transport.

Availability of Uber is over 10,00 cities worldwide. Uber has a special feature compared to other applications, Uber provides us with various ride options, like sharing your trip people you would to keep in the loop to know where you are, and the user can also choose up to 5 contacts who would immediately receive your trip data. Split a fare, is a feature of the application where you can ask your friends for their share if they took their ride with you. And the multiple

destination lets you pick multiple points making it efficient and feasible to drop off your friends. The user modify stops once you're in a ride using the app. The schedule a ride Uber app feature means that you don't have to stress about booking your ride ahead of time, you can book it up to 30 days in prior.

There are 137 million people who use Uber once a month with an increase of 11% year-on-year. Uber drivers completed 9.44 billion trips in 2023. [11]The main purpose of Uber is that they are a tech company which connects the physical and digital worlds to help make movement happen at the tap of button.

III. METHODOLGY

Given the gaps in the current form of transportation systems, E-Flo works towards bringing a solution to these problems.

A. Source of Transport

The sources of transport in the traditional medium are very niche. They are either the common public transport or the common cabs and taxis that are popularized. A new traveler to a city faces the issue of figuring out the best mode of transportation to their destination. And in the case of a native of the city the options are the ones which they have been exposed to in their lifetime, that is the popularized modes of transport like Uber or Ola. And in both cases sustainability is a question that is left unanswered.

E-Flo aims to solve this problem by collecting information about a few ride-hailing firms and types of transport methods and empowers the user with this information to make an informed decision. And it centralizes this system to be within the bounds of the one web application, hence making the accessibility easier. In the traditional methods, to learn about services provided and the information about the transportation application, installing the application is usually necessary and this clutters the device and confuses the user in making a clear decision. E-Flo provides all the information that a user would require in the home screen and the user just needs to click on the transport method to avail additional information on the same. E-Flo, instead of using the applications redirects the user to the website from which the user can book, and uses the cookies or Json tokens, on the website to allow the user to have a seamless experience in booking their transport.

And the matter of sustainability is tackled with the feature to filter out the transport with criteria such as "Single Traveler", "Electric mode", "Family", etc. in a click of a button. This filters out the transport that fits the needs of the user. This simple option helps in being cost efficient, fuel efficient and most importantly reduces the carbon footprint compared to making an uninformed decision. This ultimately leads into pushing the consumer/the user to pick the most efficient ride for them at the time, hence reducing the carbon footprint in most scenarios. And cookies and

saving information helps it to ease their user experience and makes them want to use the application more, thus reducing carbon footprints more on the longer term, by making them active users of the application.

E-Flo also focuses on putting the spotlight on firms that provide sustainable methods of transportation. In the case that there are upcoming small-time firms or start-ups that aim on providing a sustainable method of transport, the administrators of E-Flo have an option of adding it to their database without having the need to hard-code it or must change the database manually using query languages such as SQL or NOSQL.

The whole database is hosted on MongoDB and communication from the client side to the server side is performed by Mongoose, an Object Data Modeling (ODM) Library that is used to define the schema and connect Node.js and MongoDB on which the web application is based on. And the frontend as cited earlier is based on Node.js but more specifically in React.

B. Rewards and Verification

A user usually doesn't lean towards actively being sustainable.

"We asked residents of urban India about the modes of transport they used. Walking (more than 500 m) and public transport use were reported by a large share of respondents. However, motorbikes are the second-most used mode of transport – a worrying sign" [12]
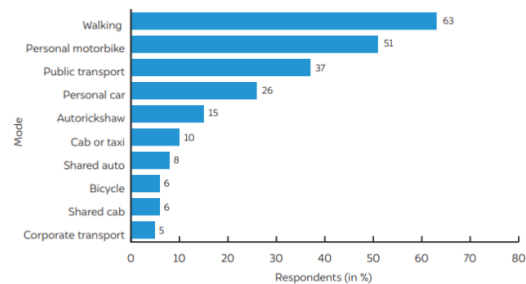

Fig. 1: Source Report: How Urban India Moves Sustainable Mobility and Citizen Preferences (CEEW)

"While a range of factors make the different regions of India non-homogenous, at least 60 per cent of the population walks and nearly the same share uses motorbikes across all geographical regions." [12]
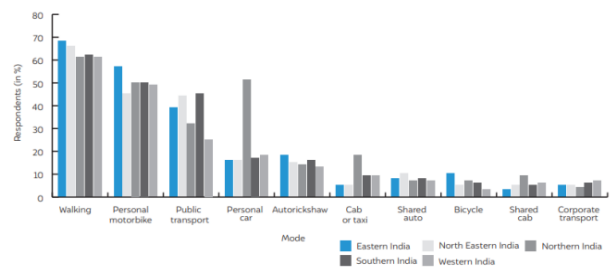

Fig. 2: Source Report: How Urban India Moves Sustainable Mobility and Citizen Preferences (CEEW)

These are quotes from a report provided by CEEW (The

Council on Energy, Environment and Water). And Fig. 1 And Fig. 2 clearly visualize and show us the preference of the common public to lean towards their personal transportation method, only second to walking. Although second might not seem bad in the first glance, it is still duly a huge problem. And seen in Fig. 2 shows us that in northern India specifically the common public uses their personal cars as much as their personal car. And this would significantly contribute to the carbon emissions cause by the same. As a result, to motivate the passenger/user to pick a more sustainable option, E-Flo rewards the user with points, for picking a transport. The number of points rewarded increases regarding how sustainable the transport method is. The more sustainable the transport, the more points that is earned and vice versa. A user picking the least sustainable option, is also rewarded with points, just lesser. This is done to encourage the user to continue using the application.

Since the booking is done via the ride-hailing service and not the application, to verify that a user used the mode of transport and didn't misguide the system. A verification process is put in place.

Every transport method that has been "booked" by the user from the application and has been redirected to the service providing website in the past 24 hours, will be given in a section provided in the application called "Recent Trips". In this section, the user can choose to verify that they used the mode of transport to receive the points. The user can verify this by providing proof such as an image of the ticket or bill received, a screenshot of the invoice of booking or a simple selfie of them in the mode of transport. Any of these proofs can be uploaded in the given option and will be considered valid. The proof will be uploaded to the AWS S3 bucket, and a button link will be provided in the same place. The administrator could investigate the activity of any user, and when a trip is sent for verification by the user, the administrator can verify it by looking into the proof. This proof will be fetched from the same cloud as mentioned earlier and once the proof is viewed the administrator can either choose to verify or reject the request. In the case of a rejection the administrator can even write a comment regarding the reason for rejection. In a case as such the user will be provided with the option to re-upload the proof in case there was an error made previously.

As soon as a request is verified, the allotted reward points for the specific transport method is added to the user's profile. After collecting a certain amount of reward points the user can choose to redeem them in the form of amenities, for example, a gift card in a service or a free ride with an affiliated ride-hailing firm.

This system encourages the user to choose a more sustainable mode of transport to collect more points and enjoy their incentive. By giving them an incentive it slowly converts the user into possibly thinking at least slightly more sustainable than they did before using the application, this is not only good for the environment by them being

sustainable but ultimately for the application to since they would be a recurring user for the same.

C. Public transport data

Sustainable mode of transport encourages public transport the best to a user. But it is important to provide the user with valid information. For example, a bus can't be recommended to a user, in a location where there are no bus stops nearby.

E-Flo, which is based in Bangalore, a metro city of India, which has the provision of having Metro and Buses as primary modes of public transportation.

But the problem arises when, the government websites which are supposed to provide information about the bus routes, or the dedicated application called "Tummoc" also rolled out by the government doesn't provide us with the bus routes or the bus stops that are present currently. The reason this is a problem that needs to be solved is mainly the fact that a passenger/ user would be recommended a public transport but might be hesitant to if they don't get the exact details such as time and cost, or even if a bus exists to the destination they need to go to. This would lead them to choosing a less sustainable option which is the opposite of the application's motive.

Google Maps, the existing system discussed in the previous section has the feature of checking bus routes, but this isn't in direct access to the public so booking this bus via the application is not possible. Even the new updates for Google Maps doesn't address the issue. [13]

This was addressed by scrapping data from previously existing APIs made on BMTC (Bengaluru Metropolitan Transport Corporation), which is the transport that manages buses in the city. Previous records of renting out buses, or the government websites that provided us with limited information. By scrapping all the data, cleaning it manually and making it into a database while also collecting the latitude and longitude values of the bus stop creation of a database was achieved. This database contained all the bus stops, with the bus ID that each bus route has, if it passes through that place.

When a user tries to use the application, their coordinates are gathered using the Google Maps Places API. And this will be compared to database which have the bus stop coordinates. Compared using the Distance Matrix API also developed by Google Maps, we figure out the minimum distance, or the nearest bus stop. And if this distance is below 500 meters it is recommended to the user to walk to the bus stop while also redirecting them to book a ticket if they want to use that mode of transportation.

To find the right bus and provide the user with the right information. The name of the location the user is at, and the location of the destination is collected from the user. And these names are searched for in the created database. After matching that, using a simple pattern matching algorithm the matching bus route ID. And then the successful matches

are returned to the user. In case, there are no matches, two locations "Majestic" and "Corporation" are picked to be the middle ground as while analysing the dataset it was found that these two locations are the most common point among all the bus routes. Almost 300+ bus IDs pass through both these locations each. Now pattern matching is done between the location of the user and the middle ground locations. And the middle ground locations and the destination. The user will be asked to get done at the middle ground bus stop and switch buses with the help of the provided information, that is matching bus route IDs. And as for destinations that are not exactly near a bus stop it would be great to recommend to users to walk from the dropped off bus stop to the location, this decision was made keeping in mind from the analysis made from Fig. 1 and Fig. 2 mentioned earlier, that walking was the highest most used mode of mobility.

IV. CONCLUSION

In essence, E-Flo stands as a progressive realm of sustainable urban transportation, aiming a future where environmentally conscious choices are not just possible but readily accessible. By equipping users with the tools and information necessary to make environmentally responsible choices. And this paper speaks about the ways we can achieve that along with surrounding features that would be necessary to keep it working. The rewards given for usage and availability of the data or information about public transport could lead to better choices from the user. Not to forget the personalization and ease of use and wide variety of options and filters makes sure the leave the least amount of carbon footprint while also in some cases satisfying their immediate transport needs such as reduction on cost and time. E-Flo actively contributes to the achievement of Sustainable Development Goals 7, 9, 11, and 13, marking a significant stride towards a greener and more sustainable future. As cities worldwide grow with the challenges of rapid urbanization and environmental degradation, E-Flo play a pivotal role in shaping a smarter and greener idea of urban mobility. The journey towards sustainable urban living is ongoing, and the continued efforts on research and development of initiatives like E-Flo is important ensuring sustainability for generations to come.

REFERENCES

[1] B. Knight, "Of Transport and Transportation," *The Eighteenth Century,* vol. 57, no. No. 4, pp. 433-449, 2016.

[2] G. W. Hilton, "Transport Technology and the Urban Pattern," *Journal of Contemporary History,* vol. 4, no. No. 3, pp. 123-135, 1969.

[3] D. S. Silverman, "Green Transportation: Roadblocks and Avenues for Promoting Low-Impact Transportation Choices," *The Urban Lawyer,* vol. 43, no. No. 3, pp. 775-788, 2011.

[4] GeeksforGeeks, "Understanding Cookies in Web Browsers," GeeksforGeeks, 18 October 2023. [Online]. Available: https://www.geeksforgeeks.org/understanding-cookies-in-web-browsers. [Accessed 05 April 2024].

[5] A. Nagaraj and S. Stern, "The Economics of Maps," *The Journal of Economic Perspectives,* vol. 34, no. No.1, pp. 196-221, 2020.

[6] H. Mehta, P. Kanani and P. Lande, "Google Maps," *International Journal of Computer Applications,* vol. Volume 178, no. No. 8, 2019.

[7] F. Lardinois, "Google Maps' redesigned ridesharing feature lets you hail an Uber without ever leaving the app," 12 January 2017. [Online]. Available: https://techcrunch.com/2017/01/12/google-maps-redesigned-ridesharing-feature-lets-you-hail-an-uber-without-ever-leaving-the-app/. [Accessed 05 April 2024].

[8] X. Fageda, "Measuring the impact of ride-hailing firms on," in *Regional Science Association International*, Barcelona, 2021.

[9] Economic Times, "BluSmart crosses annual revenue run rate of Rs 400 crore," 25 September 2023. [Online]. Available: https://economictimes.indiatimes.com/tech/technology/ev-firm-blusmart-crosses-annual-revenue-run-rate-of-rs-400-crore/articleshow/103382922.cms. [Accessed 5 April 2024].

[10] BluSmart, "Book CIty Rides," [Online]. Available: https://blu-smart.com/en-IN/rider. [Accessed 05 April 2024].

[11] M. Iqbal, "Uber Revenue and Usage Statistics (2024)," Business of Apps, 1 March 2024. [Online]. Available: https://www.businessofapps.com/data/uber-statistics/. [Accessed 5 April 2024].

[12] A. Soman, H. Kaur and K. Ganesan, "How Urban India Moves: Sustainable Mobility and Citizen Preferences," CEEW, New Delhi, 2019.

[13] A. Duchi, "3 Maps updates to make summer travel a breeze," Google, 27 March 2024. [Online]. Available: https://blog.google/products/maps/google-maps-updates-summer-travel-2024/. [Accessed 03 April 2024].