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CAR POOLING SYSTEM USING BLOCKCHAIN

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Abstract:

This article presents a carpooling application using blockchain technology to provide a decentralized, transparent, and secure platform for ride-sharing services. It employs a smart contract that facilitates direct connection between the rider and driver, eliminating any third-party involvement. At now, the majority of carpooling systems are managed by a single body. The proposed ride-sharing system will be implemented on a blockchain and will be really decentralized. This application enables drivers to provide ride-sharing services independently of a third party. Moreover, the use of blockchain technology guarantees trust and anonymity, hence improving the user experience and augmenting the application's adoption rate. This article focuses on creating a peer-to-peer, streamlined, and less error-prone ride-sharing service with blockchain technology.

Keywords: Blockchain, Carpoling.

1-INTRODUCTION:

The increased human mobility and high use of private cars increases the load on the environment and raises issues of high levels of air pollution in cities, parking problems, noise pollution, congestion and low transfer velocity. A solution to the problem of the increasing passengers and transport demands is to improve both the efficiency and quality of transport systems based on the development of systems that provide alternative solutions in terms of flexibility and costs between the public and the private ones. Car pooling is a collective transportation system based on a shared use of private cars (vehicles), whose objective is to reduce the number of cars in use by grouping people. There are several papers that provide a good survey of the studies on car pooling problem. Please refer to . Car pooling can be operated in two main ways: Daily Car Pooling Problem (DCPP) or Long-term Car Pooling Problem (LCPP). In the case of DCPP , each day a number of users (servers) declare their availability for picking up and later bringing back colleagues (clients) on that particular day.

PROBLEM STATEMENT

The problem statement for carpooling addresses the challenges and inefficiencies inherent in traditional transportation systems, highlighting the need for innovative solutions to improve mobility, reduce congestion, and minimize environmental impact. Here is a concise problem statement for carpooling.In urban and suburban areas, traditional modes of transportation, such as driving alone or using public transit, contribute to traffic congestion, air pollution, and inefficient use of transportation resources. Many commuters face challenges such as high commuting costs, long travel times, limited accessibility, and social isolation. Additionally, the reliance on single-occupancy vehicles exacerbates environmental degradation and exacerbates the impacts of climate change.Carpooling presents a promising solution to these challenges by facilitating shared rides among multiple individuals traveling along similar routes. However, widespread adoption of carpooling faces several barriers, including lack of awareness, social stigma, safety concerns, inefficient matching algorithms, and limited incentives for participation

2-LITERATURE SURVEY

Abdullah, A., Abawajy, J., & Xu, G. (2018). Carpooling and ride-sharing: A review. Transportation Research Part C: Emerging Technologies, 92, 116-132.

This comprehensive review provides an overview of carpooling and ride-sharing concepts, technologies, and applications. The authors analyze the evolution of carpooling services, discuss key challenges and opportunities, and examine the impacts of carpooling on transportation efficiency, environmental sustainability, and urban mobility.

Kucharski, R., & Nijkamp, P. (2018). The impacts of carpooling on urban mobility: A review of carpooling studies. Journal of Transport Geography, 68, 52-63.

This review synthesizes empirical evidence on the impacts of carpooling on urban mobility, including its effects on traffic congestion, air quality, travel behavior, and social dynamics. The authors analyze findings from various studies and discuss policy implications and future research directions for promoting carpooling as a sustainable transportation option.

Daganzo, C. F. (2017). Ride-sharing, car-pooling and autonomous vehicle routing under high demand. Transportation Research Part C: Emerging Technologies, 80, 731-746.

This research paper investigates ride-sharing and carpooling strategies under high-demand scenarios, considering factors such as vehicle occupancy, routing efficiency, and user preferences. The author proposes algorithms and optimization techniques to improve the performance and scalability of carpooling services in urban environments.

Martin, E., & Shaheen, S. A. (2011). Greenhouse gas emission impacts of carsharing in North America. IEEE Transactions on Intelligent Transportation Systems, 12(4), 1074-1086.

This study assesses the greenhouse gas emission impacts of carsharing programs in North America, including carpooling and other shared mobility options. The authors analyze data from carsharing operators and evaluate the environmental benefits of carpooling in terms of reduced vehicle miles traveled and emissions.

Zhang, Y., & Yin, Y. (2020). Carpooling and ride-sharing: A bibliometric analysis. Transportation Research Part C: Emerging Technologies, 111, 538-555.

This bibliometric analysis examines trends and patterns in carpooling and ride-sharing research based on a comprehensive review of academic literature. The authors identify key research themes, influential authors, and emerging topics in the field, providing insights into the evolution and trajectory of carpooling research.

These studies offer valuable insights into the concepts, challenges, impacts, and opportunities associated with carpooling. By synthesizing existing knowledge and identifying gaps in the literature, they contribute to the ongoing discourse on sustainable transportation solutions and inform policy decisions, planning efforts, and technological innovations in the field of carpooling and shared mobility.

An Exact Method for the Car Pooling Problem Based on Lagrangean Column Generation, Car pooling is a transportation service organized by a large company which encourages its employees to pick up colleagues while driving to/from work to minimize the number of private cars travelling to/from the company site. The car pooling problem consists of defining the subsets of employees that will share each car and the paths the drivers should follow, so that sharing is maximized and the sum of

the path costs is minimized. The special case of the car pooling problem where all cars are identical can be modeled as a Dial-a-Ride Problem. In this paper, we propose both an exact and a heuristic method for the car pooling problem, based on two integer programming formulations of the problem. The exact method is based on a bounding procedure that combines three lower bounds derived from different relaxations of the problem. A valid upper bound is obtained by the heuristic method, which transforms the solution of a Lagrangean lower bound into a feasible solution. The computational results show the effectiveness of the proposed methods.

The smart classroom: Merging technologies for seamless tele-education, he Smart Classroom project, by applying smart space technologies in a real classroom, bridges the gap between tele-education and traditional classroom activities in terms of the teacher's experience. The classroom has two wall-size projector screens, the MediaBoard, a touch sensitive SmartBoard screen for displaying teaching material and the StudentBoard to display remote student's images and computer-animated virtual assistant. A number of component technologies are used to to make the interaction between teacher and remote students smooth. Further, numerous software modules such as SameView, provide classroom functionality.

Ride-sharing and Carpooling Platforms: Various ride-sharing and carpooling platforms have been developed to facilitate shared mobility, including UberPOOL, Lyft Line, BlaBlaCar, and Waze Carpool. These platforms use mobile applications and online platforms to connect passengers with drivers who are traveling along similar routes, enabling cost-effective and efficient shared rides.

Government Initiatives and Policies: Many governments and transportation agencies have implemented initiatives and policies to promote carpooling and shared mobility as part of broader efforts to reduce traffic congestion, improve air quality, and enhance transportation sustainability. These initiatives include carpool lane programs, congestion pricing schemes, and incentives for carpooling participants.

Research and Development Projects: Academic researchers and industry partners have collaborated on research and development projects to advance carpooling technologies, algorithms, and strategies. These projects focus on optimizing ride-matching algorithms, integrating carpooling with public transit systems, and exploring the impacts of carpooling on urban mobility and environmental sustainability.

Public Transit Integration: Carpooling has been integrated with public transit systems in some regions to provide seamless multimodal transportation options for commuters. Transit agencies and transportation planners work to coordinate schedules, fares, and information services to encourage modal shift from single-occupancy vehicles to shared mobility options.

Employer-based Carpooling Programs: Many employers offer carpooling programs and incentives to encourage employees to share rides to work. These programs may include preferential parking for carpoolers, financial incentives such as subsidies or rewards, and employer-sponsored carpool matching services.

Community-based Carpooling Initiatives: Community organizations, neighborhood associations, and advocacy groups often spearhead grassroots carpooling initiatives to address local transportation needs and promote sustainable mobility options. These initiatives may involve community outreach, organizing ride-sharing events, and providing resources and support for carpooling participants.

3-SYSTEM ANALYSIS

In this chapter, discussion about Existing System, Disadvantages of the Existing System and Techniques used in Proposed System and Advantages of Proposed System.

EXISTING SYSTEM :

The rising auto usage deriving from growth in jobs and residential population is making traffic congestion less tolerable in urban and suburban areas. This results in air pollution, energy waste and unproductive and unpleasant consumption of people's time. Public transport cannot be the only answer to this increasing transport demand. Car pooling has emerged to be a viable possibility for reducing private car usage in congested areas. Its actual practice requires a suitable information system support and, most important, the capability of effectively solving the underlying combinatorial optimization problem. This paper presents an application of the ANTS approach, one of the approaches which follow the Ant Colony Optimization (ACO) paradigm, to the car pooling optimization problem. Computational results are presented both on datasets derived from the literature about problems similar to car pooling and on real-world car pooling instances.

PROPOSED SYSTEM :

Based on the algorithm proposed previously, we develop a prototype car pooling system for assigning passengers to drivers. To acquire the trajectories of drivers, a smart phone platform is used. Android is the world's most popular mobile platform. In this paper, we adopt Android as our platform as the Android's application framework lets one create extremely rich and innovative apps using a set of reusable components. Android applications are written in Java programming language. The Android SDK tools compile the code—along with any data and resource files—into an Android package. The Android platform makes it easy to use sensors on the device to add rich location and motion capabilities to the app. Android gives the applications access to the location services supported by the device through classes in the android.location package. The central component of the location framework is the LocationManager system service, which provides APIs to determine location.

4-SYSTEM DESIGN

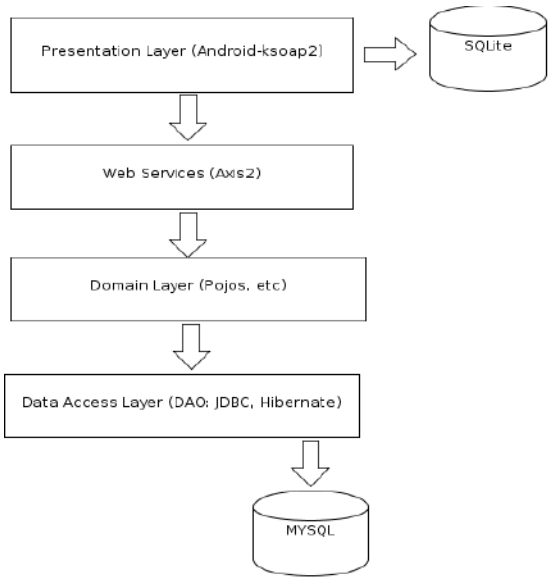
In this chapter, discussion about System Architecture, the design of the proposed system is done by using Unified Modeling Language. The UML design work is done for this project by using component diagram use case diagram, and sequence diagram.

IMPLEMENTATION:

mplementing a carpooling system involves a multifaceted approach encompassing various technological, logistical, and regulatory considerations. Firstly, the development of the carpooling platform necessitates the selection of an appropriate technology stack, including backend infrastructure, database management systems, frontend frameworks, and mobile application development tools. This stack should be chosen with scalability, reliability, security, and compatibility in mind to ensure seamless operation and user satisfactioN.A critical aspect of the implementation process is the design and deployment of a robust database schema capable of efficiently storing and managing user profiles, ride requests, trip history, and other pertinent information. This database serves as the backbone of the platform, facilitating smooth data retrieval and

manipulation essential for effective ride matching and user interactions.

5-SYSTEM ARCHITECTURE



UML DIAGRAMS :

UML stands for Unified Modeling Language. UML is a standardized general-purpose modeling language in the field of object-oriented software engineering. The standard is managed, and was created by, the Object Management Group.

The goal is for UML to become a common language for creating models of object oriented computer software. In its current form UML is comprised of two major components: a Meta-model and a notation. In the future, some form of method or process may also be added to; or associated with, UML.

The Unified Modeling Language is a standard language for specifying, Visualization, Constructing and documenting the artifacts of software system, as well as for business modeling and other non-software systems.

The UML represents a collection of best engineering practices that have proven successful in the modeling of large and complex systems.

The UML is a very important part of developing objects oriented software and the software development process. The UML uses mostly graphical notations to express the design of software projects.

6- SYSTEM TESTING

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub assemblies, assemblies and/or a finished product It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each test type addresses a specific testing requirement.

Unit testing

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application .it is done after the completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction and is invasive. Unit tests perform basic tests at component level and test a specific business process, application, and/or system configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.

Functional test

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.

Functional testing is centered on the following items:

Valid Input : identified classes of valid input must be accepted.

Invalid Input : identified classes of invalid input must be rejected.

Functions : identified functions must be exercised.

Output : identified classes of application outputs must be exercised.

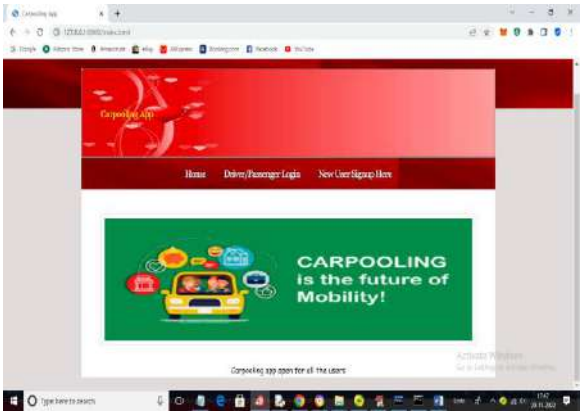
Systems/Procedures : interfacing systems or procedures must be invoked.

Organization and preparation of functional tests is focused on requirements, key functions, or special test cases. In addition, systematic coverage pertaining to identify Business process flows; data fields, predefined processes, and successive processes must be considered for testing. Before functional testing is complete, additional tests are identified and the effective value of current tests is determined.

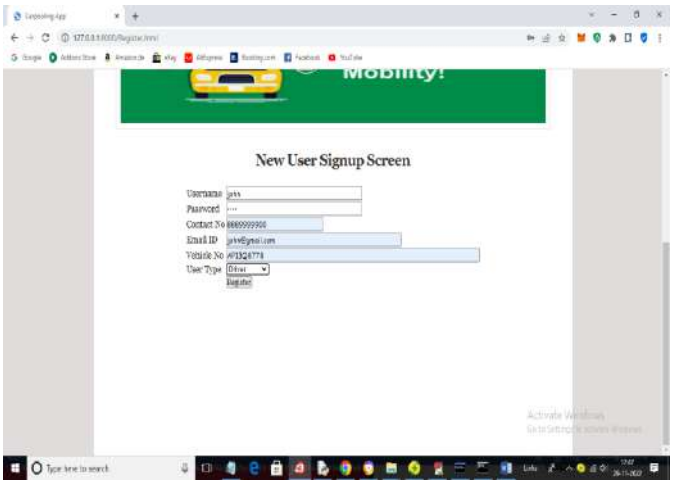
7.SCREENSHOTS :

Note: run both driver and passenger module in different browsers or different tab means driver in one browser and passenger in other browser or other tab

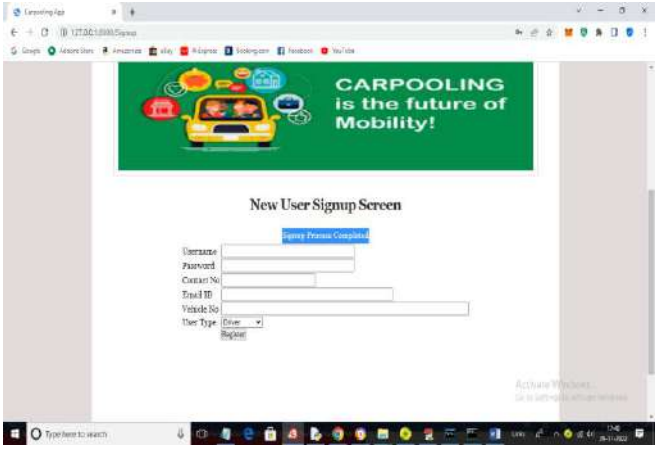
Now double click on 'runServer.bat' file to start python WEB SERVER and then open browser and enter URL as 'http://127.0.0.1:8000/index.html and press enter key to get below page



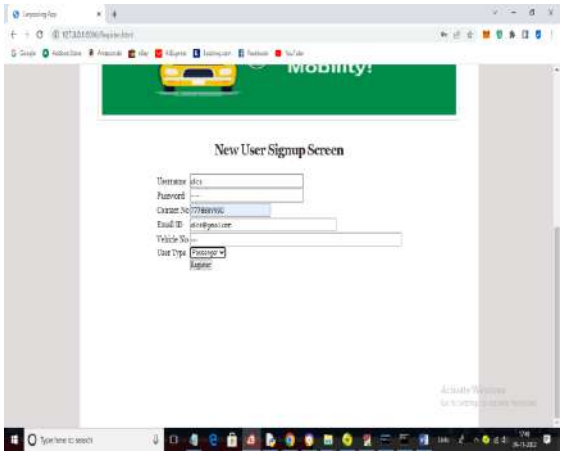
In above home page click on 'New User Signup Here' link to add new users like driver and passenger



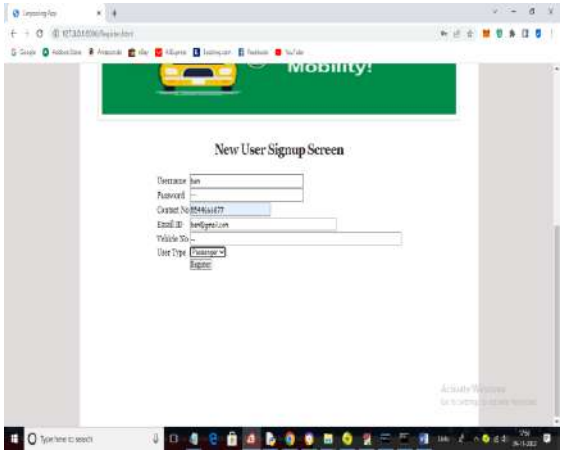
In above screen I am adding one user 'John' as driver by selecting user type as Driver and then press button to complete signup process and get below output



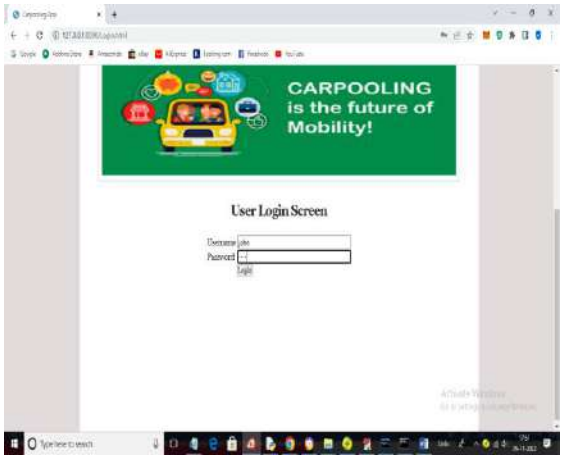
In above screen in blue colour text we can see signup completed and similarly you can add other drivers and passenger



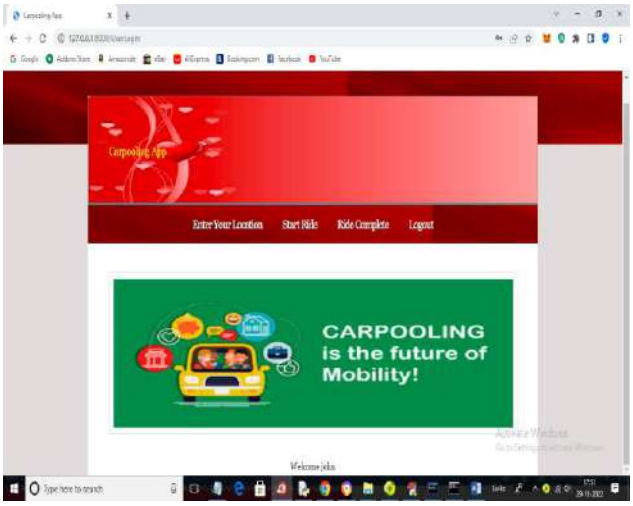
In above screen I am adding 'alice' as the passenger



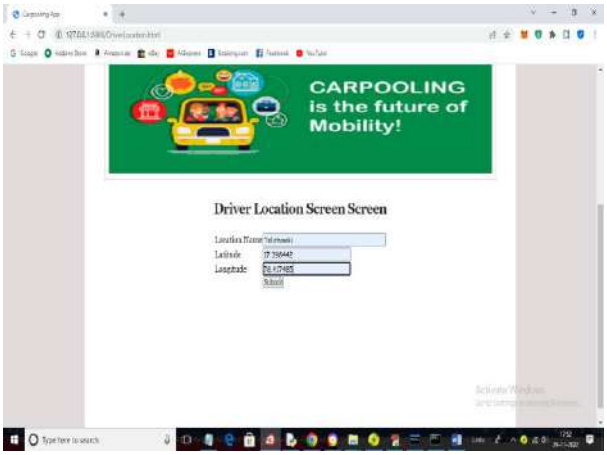
In above screen I am adding 'ben' as the passenger so total 3 user added where one is driver and other 2 are the passenger and now click on 'Driver/Passenger Login' link to login as Driver



In above screen driver is login and after login will get below page

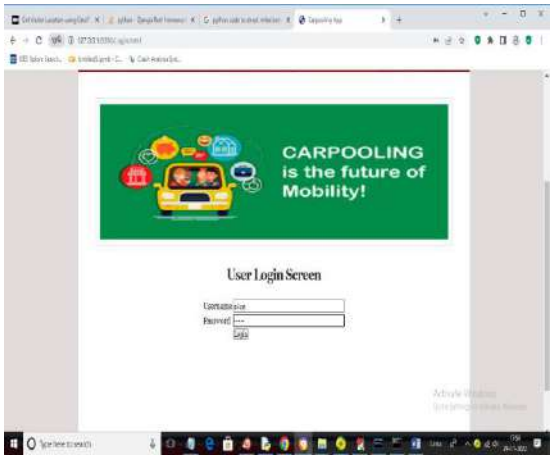


In above driver home page click on 'Enter Your Location' link to allow driver to publish his locations so passenger can book ride

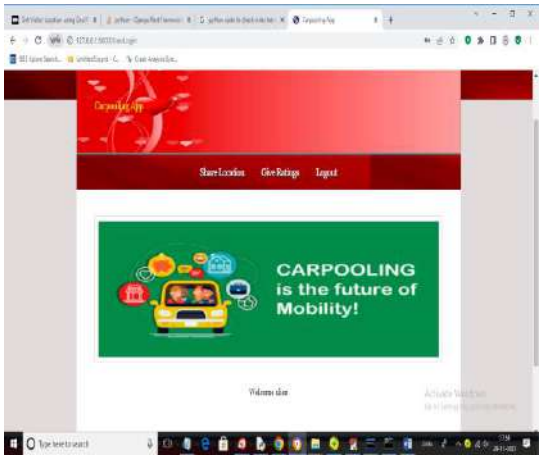


In above screen driver entering his location with latitude and longitude and then press button to get below page

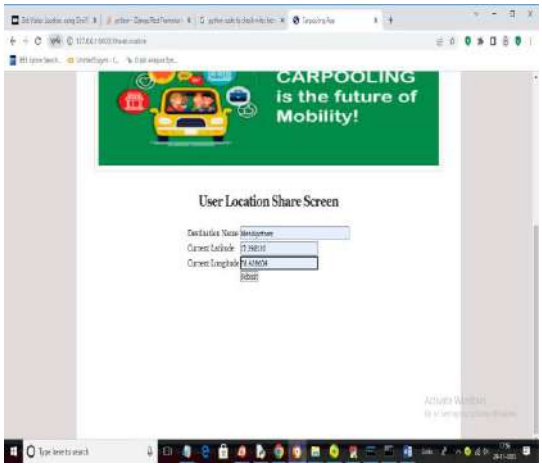
In above screen we can see driver ride details added with ID 1 and all passenger request will arrived here so let this screen running and no open other browser or tab and login as user



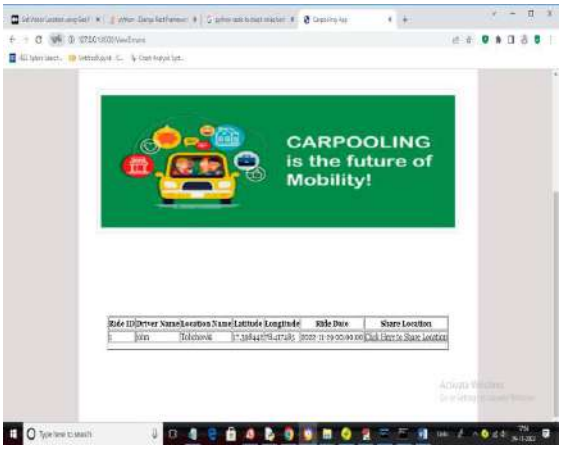
In above screen passenger is login and after login will get below page



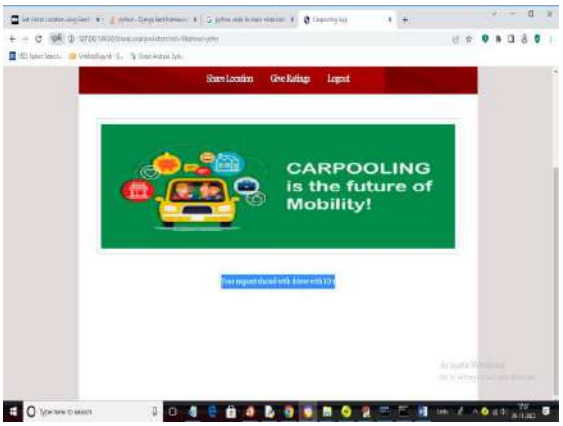
In above passenger home page click on 'Share Location' link share location with diver and get below page



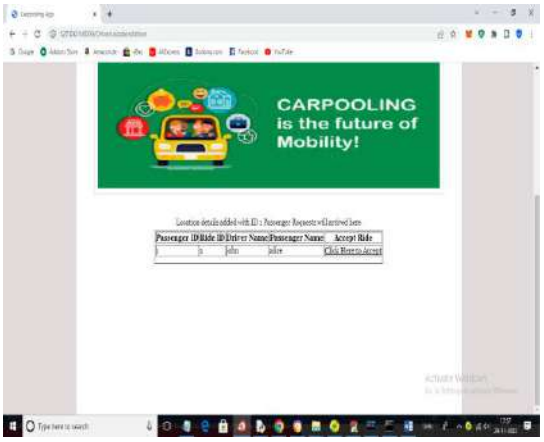
In above screen user is entering his location and press button to get list of drivers in 3 miles distance and get below page



In above screen user got one drive as 'John' in 3 miles distance and user can click on 'Click Here to Share Location' then driver will get this chat notification

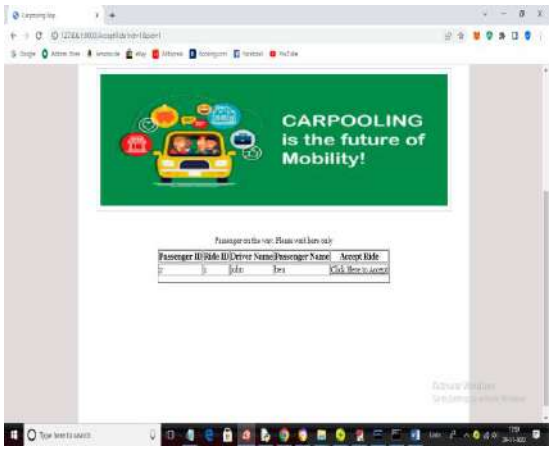


In above screen user ride request is booked with ID 1 and this request will sent to driver at below driver page

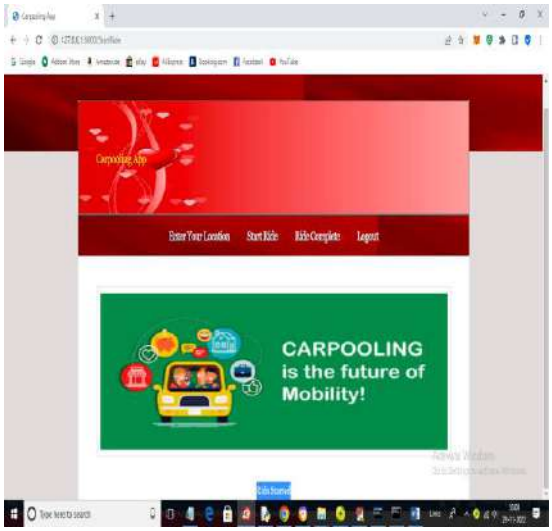


In above screen driver can see 'Alice' is requesting for ride and now driver can click on 'Click Here to Accept' link to accept request and get below page

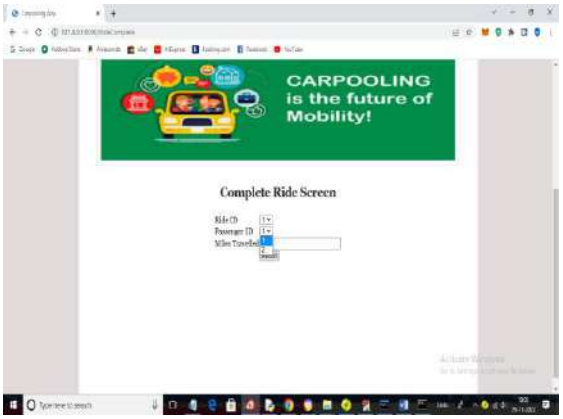
In above screen alice request accepted and driver will wait for other users and now will send request from Ben



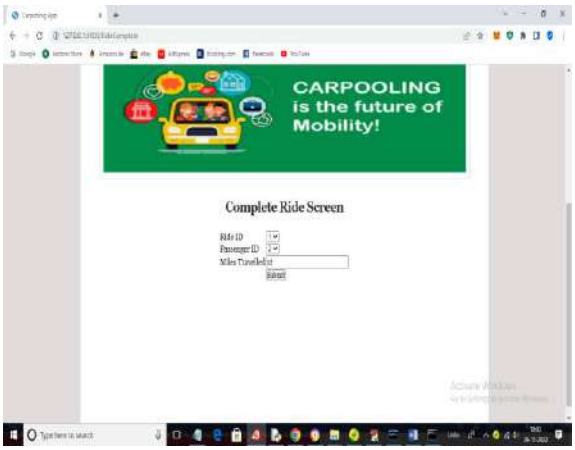
In above screen driver got request from Ben also and he will accept request and then click on 'Start Ride' link to start ride and get below page



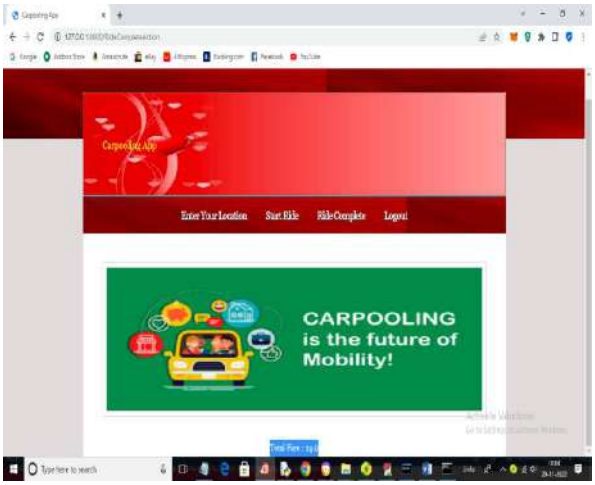
In above screen in blue colour text we can see 'Ride Started' and now driver can click on 'Ride Completed' link to get below page to collect fare



In above screen driver will select Ride Id and Passenger Id and then enter miles travelled and press button to get fare amount



In above screen I selected Ride ID as 1 and passenger ID as 2 and then miles travelled as 12 and then press button to get below Fare amount



in above screen in blue colour text we can see fare amount is 12 and now in user page click on 'Giving Rating' link to get below page

In above screen passenger will select Driver name and then select rating and then press button to get below output

In above screen we can see 'Rating Accepted'. Similarly by following above screens you can add multiple users and test the application

8- CONCLUSION

Car pooling is an effective way to reduce air pollution, parking problems, fuel consumption and commuting costs based on shared use of private cars or vehicles. In this paper, we study the car pooling problem and develop a prototype car pooling system to realize ridesharing based on smart phone platform and Google Map API. To study the car pooling problem, we formulate the problem to match passengers with drivers in this paper. As the car pooling problem formulated in this paper above is not a standard matching problem in computer science, existing algorithms for matching problems cannot be applied directly. Instead of applying existing algorithms for matching problems, we have proposed a heuristic method to solve the above mentioned problem. In our approach, we collect the requests of passengers and the trajectory data of drivers first. With the widespread deployment of applications and value-added services, smart phones become an important mobile computing platform today. Smart phones provide a cost effective way to acquire the trajectories of drivers. In this paper, we acquire the trajectory data of passengers with drivers based on smart phones. The problem is to match passengers' requests with drivers' trajectories. We propose a matching algorithm to assign passengers to drivers' cars based on their trajectories

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