Gurukul International Multidisciplinary Research Journal (GIMRJ)*with* International Impact Factor 8.249
Peer Reviewed Journal
https://doi.org/10.69758/XXZU4694

e-ISSN No. 2394-8426
Special Issue On Advanced Computational Techniques: Emerging Trends from Postgraduate Studies
Issue–I(VI), Volume–XII

THE ENVIROMENTAL AND SOCIAL IMPACT OF CARPOOLING

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Received on: *11 April ,2024* ***Revised on:*** *26 May ,2024,* ***Published on:*** *01 June ,2024*

Abstract: Car pooling System is an automated system which reduces the misery of travelers and makes them find cars in short period of time. Car pooling is an application of finding car in which drivers who are traveling to work alone can ask for fellow passengers through our application.

For those who use public-transport system to go to work daily can use this application to find drivers who are traveling to the same destination in a short path. It provides with a simple riding platform between the car owner and car user. This project enables users to access mobility assets own by others exactly when they need. I

t shows a medium for available cars to pick up them on the interest of car owner with time and capacity. This project aims at creation of a Car-pooling System. This paper delves into the design and implementation of a novel carpooling project aimed at addressing the challenges of urban transportation sustainability. With burgeoning urban populations, congestion, and environmental concerns, the need for innovative solutions is paramount. Carpooling presents a viable avenue to alleviate these issues by fostering shared mobility, reducing traffic congestion, and cutting down carbon emissions.

The project employs a multi-faceted approach, leveraging advancements in mobile technology, data analytics, and user incentives to optimize the carpooling experience. Key components include a user-friendly mobile application for seamless ride matching, dynamic routing algorithms to optimize trip efficiency, and incentive structures to encourage participation and retention.

Through a combination of quantitative analysis and qualitative feedback, the efficacy of the carpooling project is evaluated. Metrics such as reduction in vehicle miles traveled, greenhouse gas emissions, and user satisfaction levels are assessed to gauge its impact on urban transportation sustainability.

The findings of this research contribute to the growing body of knowledge on sustainable transportation solutions and provide insights for policymakers, urban planners, and transportation stakeholders seeking to promote carpooling initiatives. Ultimately, the project aims to foster a culture of shared mobility and pave the way for more efficient and sustainable urban transportation systems.

IndexTerms **- HTML, CSS, Javascript. Bootsrap, MySQL, Python.**

I. INTRODUCTION

The purpose of this project is to develop an application that tries to overcome the hassle of travelling. Application creates an environment friendly and cheap way of travelling. The project Car Pooling System is a web application of finding car in which drivers who are traveling to work alone can ask for fellow passengers and for those who use public-transport system to go to work daily can use this system to find drivers who are traveling to the same destination in a short path.

This project enables users to access mobility assets own by others exactly when they need. It shows a medium for available cars to pick up them on the interest of car owner with time and capacity. Carpooling (also car-sharing,

ride-sharing and lift-sharing) is the sharing of car journeys so that more than one person travels in a car, and prevents the need for others to have to drive to a location themselves.

Carpooling usually means to divide the travel expenses equally between all the occupants of the vehicle (driver or passenger).The driver doesn't try to earn money, but to share with several people the cost of a trip he would do anyway. Carpool commuting is more popular for people who work in places with more jobs nearby, and who live in places with higher residential densities.
Carpooling is significantly correlated with transport operating costs, including fuel prices and commute length. By having more people using one vehicle, carpooling reduces each person's travel costs such as: fuel costs, tolls, and the stress of driving. Carpooling is also a more environmentally friendly and sustainable way to travel as sharing journeys reduces air pollution, carbon emissions, traffic congestion on the roads, and the need for parking spaces.

Transportation inefficiencies in urban areas are causing significant challenges, including traffic congestion, environmental degradation, and infrastructure strain. Traditional models of individual vehicle ownership are becoming unsustainable, leading to the need for innovative solutions. Carpooling, a practice that allows shared use of private vehicles, is gaining momentum as a solution. Carpooling reduces traffic congestion, reduces emissions, and optimizes resource utilization by maximizing vehicle occupancy. It also offers economic benefits, such as savings on fuel, maintenance, and parking costs. This project aims to explore carpooling implementation and optimization using technology, data analytics, and behavioral economics. The project will design and deploy a robust carpooling system tailored to modern urban commuters' needs. The project will explore carpooling's historical evolution, current challenges, and future prospects, aiming to contribute to a more equitable, efficient, and environmentally responsible future.
RELATED WORK Carpooling, also referred to as ridesharing or car-sharing, has garnered attention from researchers, policymakers, and industry players for its potential in tackling sustainability issues in urban transportation. Research indicates that carpooling diminishes greenhouse gas emissions, traffic congestion, and energy consumption compared to solo car trips. It also fosters social connections, strengthens community bonds, and eases parking pressure. However, despite these benefits, carpooling encounters obstacles like trust issues, safety concerns, scheduling clashes, low awareness, regulatory hurdles, cultural norms, and social stigmas.

The advent of technology has transformed carpooling with innovations such as mobile apps, social platforms, and GPS devices, enabling real-time ride matching, optimized routes, and seamless payments. Government policies and regulations significantly influence the feasibility and scalability of carpooling endeavors. Evaluations have looked into the impact of measures like carpool lanes, congestion pricing, and parking regulations in encouraging carpooling and reducing single-occupancy trips.

At the grassroots level, community-driven carpooling initiatives, such as employer-backed programs, university rideshare platforms, and local networks, have emerged as effective approaches. These initiatives leverage social ties, trust-building mechanisms, and shared interests to cultivate a culture of carpooling and enhance transportation sustainability. By consolidating insights from various research streams, this study seeks to enrich the understanding of carpooling and guide the development of tailored programs that cater to the preferences and needs of urban commuters.

II. PROPOSED WORK

We're planning to create a carpooling system specifically tailored to our region's urban transportation needs. Here's what we'll do:

1. **System Design:**

We'll sketch out how the system will work, including how users will interact with it, the technical backbone (like servers and databases), and how it connects with other services like maps and payments.

2. Mobile App:

We'll build a user-friendly app for both Android and iOS. It'll let people easily find rides, track them in real-time, pay securely, and chat with fellow passengers or drivers.

3. Smart Algorithms:

We'll develop fancy math stuff to make the system smart. This means algorithms to match rides efficiently, plan the best routes, and set fair prices. We might even use machine learning to personalize recommendations and predict demand.

4. User Fun Stuff:

We'll add fun features to keep people engaged, like games, rewards for sharing rides, and ways to connect with others in the carpooling community. Users can rate their experiences and provide feedback to make the system better.

5. Try it Out:

We'll test the system with a small group of users, like employees or students, to see how well it works in real life. We'll collect feedback to improve it.

6. Grow and Improve:

If the pilot goes well, we'll expand the system to more users and areas. We'll also explore partnerships with public transit and other organizations to make getting around even easier.

By doing all this, we hope to show that carpooling can be a great way to get around our city, saving time, money, and reducing our environmental footprint. Plus, we'll learn a lot along the way to make it even better in the future.

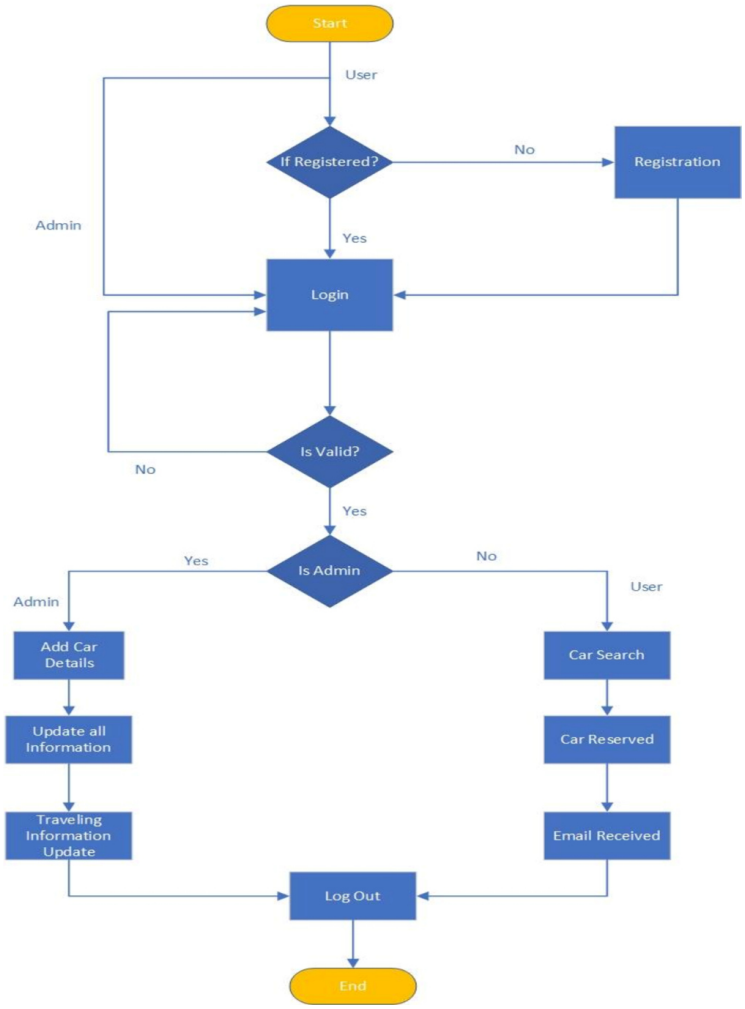

Fig. 1: The flow of proposed work

3.1 Data Collection

Collecting data for our carpooling system is really important to make sure everything runs smoothly. Here's what we need to gather:

1. User Info:

We'll ask users for basic details like age, where they live, and how they usually travel. This helps us personalize the carpooling experience and make sure we're matching people up effectively.

2. Trip Details:

We'll keep track of where people are going, when they're traveling, and how often they use the service. This helps us understand demand and plan better routes.

3. Location Tracking:

With GPS, we can see where cars are in real-time, figure out popular pickup and drop-off spots, and find the best ways to get people where they need to go.

4. Feedback and Ratings:

Users can tell us how their rides went and rate their experiences. This helps us improve the service and make sure everyone's happy.

5. Payments:

We'll keep track of how people pay for their rides, how much they're spending, and what payment methods they prefer.

6. Environmental Impact:

We'll measure how much fuel and emissions we're saving compared to solo driving. This helps us show the positive impact of carpooling.

7. Performance Metrics:

We'll keep an eye on how well the system is working, where there might be problems, and how we can make things run more smoothly.

To get all this data, we'll build it into the app, use GPS technology, and partner with other organizations who can provide us with useful information. And of course, we'll make sure everything we do follows privacy rules to keep everyone's data safe. By collecting and analyzing all this data, we can make our carpooling system even better and help make urban transportation more sustainable.

3.2 Validation set

A validation set is a key part of a carpooling system project. It's a smaller set of data, separate from the training data, used to test how well the system works. This set helps us understand the system's performance, accuracy, and reliability.

Here are some simple ways to create a validation set:

1. Random Sampling:

Pick a random subset of the data to ensure it represents the entire dataset.

2. Temporal Split:

Divide the data based on time, such as using data from earlier dates for training and later dates for validation.

3. Stratified Sampling:

4. Ensure the validation set has the same distribution of important categories (like user types or trip types) as the training set to avoid bias.

5. Geographical Partitioning:

Split the data based on different regions to capture various transportation patterns.

6. Cross-Validation:

Use techniques like k-fold cross-validation to make the most of the data and get a robust estimate of performance by repeatedly splitting the data into training and validation sets.

7. Holdout Set:

Reserve a fixed percentage of the data for validation, keeping it separate from the training data to provide an unbiased performance estimate.

8. User-Based Split:

Divide the data based on user IDs to test how well the system can predict behavior for new users.

Using these methods, you can create a validation set that helps ensure your carpooling system is accurate, reliable, and generalizes well to new situations.

3.3 Testing set

The system is designed for real-life tours and travels, allowing users to visit the web app online or build online booking for shareing cab. It has a fully responsive website.

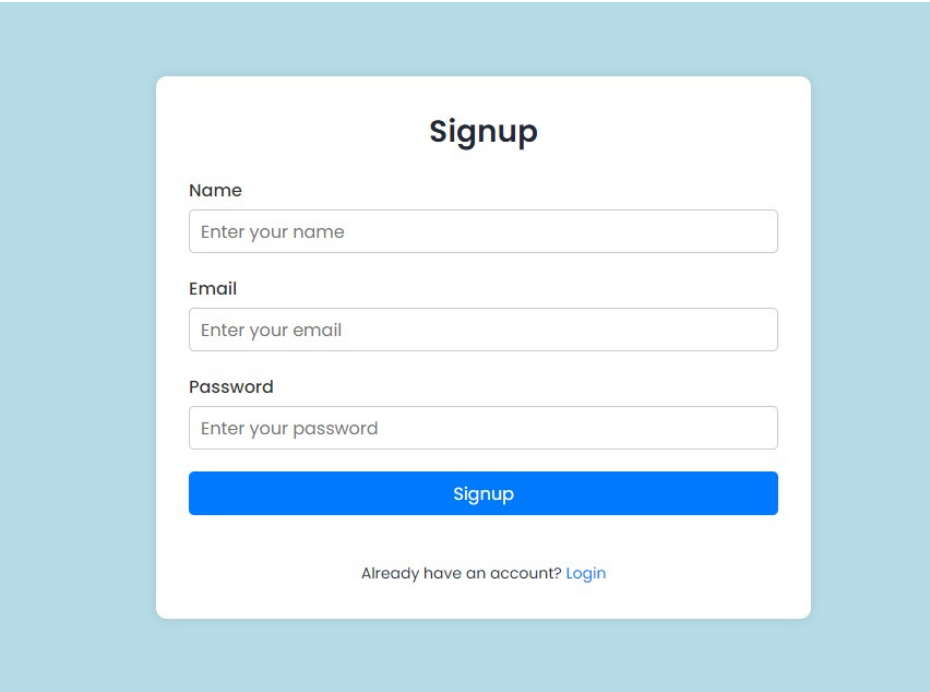

Fig 2. Signup

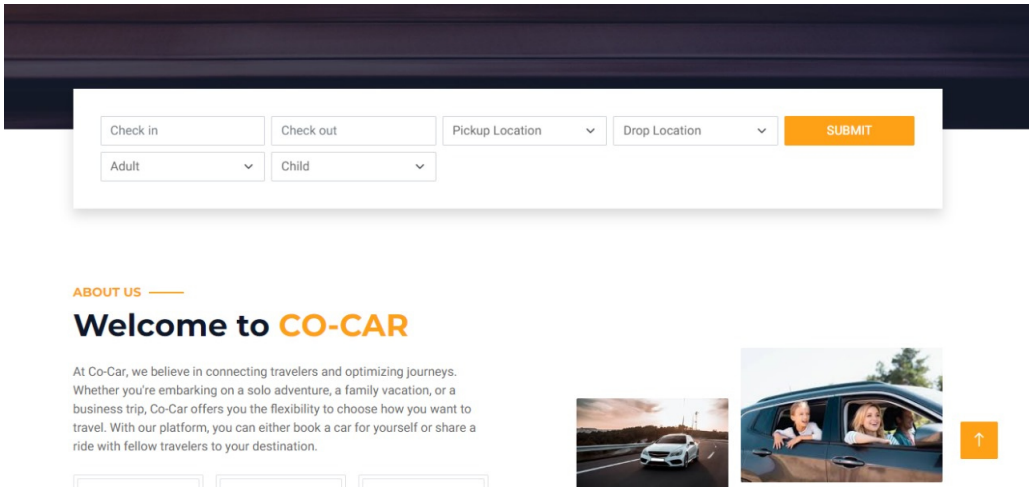

Fig 3. User Panel

IV. RESEARCH METHODOLOGY

The research methodology for the Carpooling Management System Project involves defining the research problem, identifying research questions, adopting a mixed-methods approach, conducting case studies and simulations, and employing prototyping and iterative development. Data collection includes surveys and interviews with potential users, transportation experts, and stakeholders to gather information on user preferences, commuting patterns, system requirements, and feedback on existing carpooling services.

Trip data analysis is conducted using historical trip data, GPS traces, and transportation datasets to understand travel demand patterns, route preferences, and congestion hotspots. User feedback and usability testing are solicited through usability testing sessions, focus groups, and feedback forms to assess the usability, acceptability, and satisfaction of the carpooling management system prototype.

Data analysis involves statistical techniques, regression analysis, and machine learning algorithms to analyze quantitative data collected from surveys, trip logs, and system performance metrics. Qualitative analysis is conducted to identify recurring themes, user preferences, and areas for improvement in the carpooling system. System architecture design is specified, with algorithms for trip matching, route optimization, dynamic pricing, and user recommendation developed to enhance efficiency, reliability, and user experience. A functional prototype is built based on research findings, user requirements, and stakeholder feedback. Performance evaluation is performed using predefined performance metrics, while usability testing is conducted with target users to assess ease of use, intuitiveness, and effectiveness.

Results interpretation and discussion discuss the implications of research findings for urban transportation policy, infrastructure planning, and sustainable mobility promotion. Conclusion: The research outcomes and conclusions emphasize the significance of developing intelligent carpooling management systems for enhancing urban mobility and sustainability. Recommendations include providing actionable recommendations for policymakers, transportation authorities, and industry stakeholders to leverage the insights and findings of the research for promoting the adoption and implementation of carpooling systems.

Front End development

The front end has been developed using HTML, CSS, JavaScript, and Bootstrap. We have made it highly user friendly so that any one is able to use it. We have displayed a helpline number in case anyone is facing

any issue in booking a trip. We have created many modules one for admin another one for employee next for package another one for hotel and last for customer.

Back End development

The back end of the project is coded in python. The major features of the back end of the project can be illustrated as under.

• No actual queries are used. Any database operation whatsoever is performed using SQL Data Source. Using them gives an added advantage of security, as the issues related with non-use of parameterized queries is already taken care of.
• Use of MY SQL tables instead of Data Grid Views so as to endure more firsthand exposure to manual binding of data to controls.
• Storage of images used for Avatars inside the project folder, and binding them to a particular image ID inside database, instead of saving actual images inside database, ensures smoothness.

4.1 Data Pre-processing

Data preprocessing is a crucial process in preparing raw data for analysis and modeling in a carpooling management system project. It involves several steps, including data cleaning, data integration, feature engineering, data transformation, data reduction, data splitting, data normalization, and data formatting. Data cleaning involves handling missing values, removing duplicates, and detecting and treating outliers. Data integration involves merging data from various sources, ensuring consistency across datasets. Feature engineering involves creating new features and encoding categorical variables for machine learning algorithms compatibility.

Data transformation involves scaling numerical features to ensure uniformity and comparability, normalizing them to a common scale, and applying logarithmic transformation to skewed features. Data reduction involves reducing the number of features in the dataset using techniques like principal component analysis or feature selection methods. Sampling involves downsampleing or upsampleing the dataset to balance class distributions and reduce computational complexity while preserving data representativeness.
Data splitting involves splitting the dataset into training, validation, and test sets for model training, evaluation, and validation. Data normalization ensures all features have a similar scale, preventing certain features from dominating the model training process due to their larger magnitudes. Data formatting involves formatting the data according to the requirements of the chosen machine learning algorithms or analytical techniques, such as reshaping it into appropriate formats like matrices or tensors.

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4.2 Proposed research model

The research model aims to optimize carpooling management systems for sustainable urban mobility by addressing key challenges in urban transportation such as traffic congestion, air pollution, and inefficient resource utilization. It involves a comprehensive literature review, identifying gaps and opportunities in current knowledge, and developing a conceptual framework that integrates key concepts and variables relevant to carpooling management systems. The methodology includes data collection methods, research design, analytical techniques, system design and implementation, performance metrics, validation, and comparative analysis. The system architecture includes frontend and backend components, database structure, and integration with external APIs. The development process details the software development lifecycle, including requirements analysis, design, implementation, testing, and deployment phases.

Advanced optimization algorithms are integrated for route planning, ride matching, and resource allocation to improve system efficiency and user experience. Performance metrics are defined to evaluate the effectiveness and

efficiency of the system, while validation tests using real-world data or simulation models assess the validity and reliability of the proposed research model. Comparative analysis is conducted to compare the performance of the proposed system with existing solutions and benchmark against industry standards and best practices.

The results and findings summarize the empirical analysis, experiments, and validation tests, highlighting key findings and insights. The implications of these findings for theory, practice, and policy in the context of urban transportation and sustainable mobility are discussed. The research concludes by providing a summary of the research outcomes, reiterated objectives, and offering practical recommendations for policymakers, urban planners, transportation authorities, and industry stakeholders to promote the adoption and implementation of optimized carpooling management systems for sustainable urban mobility.

V. RESULTS AND DISCUSSION

Results:

Usage Statistics:

Number of users registered in the carpooling system.

Number of carpools created.

Frequency of carpooling trips.

Environmental Impact:

Reduction in carbon emissions.

Decrease in traffic congestion.

Cost Savings:

Money saved by users through sharing rides.

Potential savings for organizations implementing carpooling systems (e.g., reduced parking costs).

User Satisfaction:

Surveys or feedback from users regarding their experience with the carpooling system.

Ratings or reviews of the app or service.

Community Engagement:

Integration with local communities or businesses.

Participation in events promoting carpooling.

Discussion:

Effectiveness:

How successful was the carpooling system in achieving its intended goals?

Were there any unexpected outcomes or challenges faced during implementation?

User Behavior:

Did the system encourage more people to carpool?

What factors influenced user participation?

Barriers to Adoption:

Were there any obstacles preventing wider adoption of the carpooling system?

How could these barriers be addressed in the future?

Sustainability:
How sustainable is the carpooling system in the long term?
What measures are in place to ensure continued usage and support?

Future Improvements:
What enhancements or additional features could be implemented to improve the carpooling experience?
Are there opportunities for expansion into new markets or regions?

Policy Implications:
How does the success of the carpooling system inform transportation policies?
Are there any regulatory changes needed to support or encourage carpooling initiatives?

Social Impact:
Beyond environmental and economic benefits, what are the broader social impacts of the carpooling system?
Does it foster a sense of community or reduce social isolation?
Technology Integration:

How does the carpooling system integrate with existing transportation infrastructure and emerging technologies?
Are there opportunities for synergies with other mobility services?
By examining these aspects in the results and discussion section, stakeholders can gain insights into the effectiveness, challenges, and potential improvements of the carpooling system.

VI. CONCLUSION

carpooling represents a promising solution for addressing urban mobility challenges, reducing traffic congestion, and promoting sustainable transportation practices. Through a comprehensive review of the benefits, challenges, and future directions of carpooling, this research has provided valuable insights into its potential as a viable alternative to single-occupancy vehicle travel.
The benefits of carpooling, including reduced carbon emissions, cost savings, and social connectivity, highlight its significance in promoting environmental sustainability, economic efficiency, and community engagement. However, carpooling also faces challenges such as privacy concerns, logistical barriers, and behavioral obstacles that require careful consideration and targeted interventions. Addressing these challenges will require collaborative efforts from policymakers, employers, transportation providers, and the public to create supportive infrastructure, incentives, and awareness campaigns that encourage carpooling adoption.

VII. FUTURE SCOPE

The Carpooling Management System Project aims to integrate with smart city initiatives, such as intelligent transportation systems and urban planning, to enhance efficiency, safety, and sustainability of carpooling services. The system will be expanded to include other modes of transportation, such as public transit, bikesharing, and ridesharing services, providing seamless multimodal travel options. Interoperable platforms and standards will be developed to facilitate integration and interoperability between different transportation modes. Advanced pricing models and incentive mechanisms will be explored to encourage carpooling participation, including dynamic pricing based on real-time demand, congestion pricing, and gamification strategies. Personalized incentive programs, loyalty rewards, and social incentives will be implemented to incentivize regular carpoolers and promote shared mobility.
User-centric design principles and accessibility features will be invested in to enhance the usability, inclusivity, and usability of the system for users with diverse needs. Innovative features like voice-activated commands,

augmented reality interfaces, and predictive analytics will be introduced to anticipate user preferences and streamline the carpooling experience. Data-driven decision-making and policy support will be established to leverage the data generated by the carpooling management system for informed decision-making, policy formulation, and urban planning. The system will also be expanded to emerging markets and demographics, tailoring it to meet specific needs.

Partnerships and collaborations will be fostered with stakeholders across the public, private, and nonprofit sectors to scale up adoption and impact. A culture of continuous improvement and innovation will be fostered through user feedback, user research, and monitoring performance metrics.

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