SSUET CARPOOLING

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Certification

This is to certify that **Muhammad Areeb Kasmani (2020F-BCS-242), Fatima Sarwar (2020F-BCS-062), Aiman Nadeem (2020F-BCS-203), and Muhammad Hanzila (2020F-BCS-275)** have successfully completed the final project **SSUET CarPooling , at the Sir Syed University of Engineering & Technology,** to fulfill the partial requirement of the degree Bachelor's of Science in Computer Science.

External Examiner

Project Supervisor

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Project Title (mention project title here)

Sustainable Development Goals

(Please tick the relevant SDG(s) linked with FYDP)

SDG No	Description of SDG	SDG No	Description of SDG
SDG 1	No Poverty	SDG 9	Industry, Innovation, and Infrastructure
SDG 2	Zero Hunger	SDG 10	Reduced Inequalities
SDG 3	Good Health and Well Being	SDG 11 ✓	Sustainable Cities and Communities
SDG 4	Quality Education	SDG 12	Responsible Consumption and Production
SDG 5	Gender Equality	SDG 13	Climate Change
SDG 6	Clean Water and Sanitation	SDG 14	Life Below Water
SDG 7	Affordable and Clean Energy	SDG 15	Life on Land
SDG 8 ✓	Decent Work and Economic Growth	SDG 16	Peace, Justice and Strong Institutions
		SDG 17 ✓	Partnerships for the Goals

Range of Complex Problem Solving			
	Attribute	**Complex Problem**	
1	Range of conflicting requirements	Involve wide-ranging or conflicting technical, engineering and other issues.	
2	Depth of analysis required	Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models.	
3	Depth of knowledge required	Requires research-based knowledge much of which is at, or informed by, the forefront of the professional discipline and which allows a fundamentals-based, first principles analytical approach.	
4	Familiarity of issues	Involve infrequently encountered issues	✓
5	Extent of applicable codes	Are outside problems encompassed by standards and codes of practice for professional engineering.	
6	Extent of stakeholder involvement and level of conflicting requirements	Involve diverse groups of stakeholders with widely varying needs.	
7	Consequences	Have significant consequences in a range of contexts.	
8	Interdependence	Are high level problems including many component parts or sub-problems	
Range of Complex Problem Activities			
	Attribute	**Complex Activities**	
1	Range of resources	Involve the use of diverse resources (and for this purpose, resources include people, money, equipment, materials, information and technologies).	✓
2	Level of interaction	Require resolution of significant problems arising from interactions between wide ranging and conflicting technical, engineering or other issues.	
3	Innovation	Involve creative use of engineering principles and research-based knowledge in novel ways.	
4	Consequences to society and the environment	Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation.	✓
5	Familiarity	Can extend beyond previous experiences by applying principles-based approaches.	

Abstract

The project endeavors to innovate and improve existing commuting procedures within the university community through the development of a smart carpooling application. Employing advanced matching algorithms, flexible scheduling, and community-based connections, the application seeks to enhance transportation efficiency and sustainability. This departure from conventional individual commuting models promises to significantly reduce traffic congestion and environmental impact while fostering a more interconnected and sustainable campus community. The project represents a forward-looking initiative that aims to optimize commuting practices and contribute to a more efficient and eco-friendly university environment.

Undertaking

I certify that the project **SSUET Carpooling** is our own work. The work has not, in whole or in part, been presented elsewhere for assessment. Where material has been used from other sources it has been properly acknowledged/ referred.

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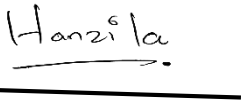

Muhammad Hanzila

2020FBCS275

Acknowledgement

I extend my sincere gratitude to all those who have contributed to the successful realization of this carpooling app project. Special thanks to my project committee for their guidance and support throughout the development process. I appreciate the invaluable insights and expertise provided by my peers and colleagues, which have significantly enriched the project. Additionally, I express my thanks to the university community for their cooperation and enthusiasm in embracing this innovative solution. This project stands as a collective achievement, made possible through the collaborative efforts and encouragement of all involved parties.

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Chapter 1

1.1 Introduction

The evolution of modern transportation systems necessitates innovative solutions to address efficiency, sustainability, and community connectivity. This project undertakes the development of a smart carpooling application designed specifically for the university community. With the aim of optimizing commuting practices and reducing environmental impact, the research focuses on implementing advanced matching algorithms, flexible scheduling, and user-centric features. This introduction sets the stage for a comprehensive exploration of the project's objectives, methodology, and outcomes, emphasizing the significance of leveraging technology to revolutionize campus mobility and contribute to a more sustainable future.

1.2 Statement of the problem

The current mode of individual commuting within the university community leads to inefficiencies, traffic congestion, and environmental impact. Students, faculty, and staff often travel similar routes at similar times, yet opt for separate vehicles. This results in wasted resources and increased carbon emissions. Additionally, the lack of a dedicated carpooling platform within the university hinders opportunities for cost-effective and community-building transportation solutions.

1.3 Goals/Aims & Objectives

- To create a user-friendly mobile application for carpooling within the university community.
- To implement a Smart Matching Algorithm to efficiently pair drivers and passengers based on commute routes, timings, and preferences.
- To integrate Community-Based Matching to allow users to form or join communities based on shared affiliations like departments or residence halls.
- To provide features for flexible scheduling, in-app messaging, and driver/passenger profiles for a personalized carpooling experience.
- To ensure user safety with features like Live Location Sharing and AI Verification of Drivers.
- To facilitate multi-stop trips for users with various purposes, whether academic or personal.
- To implement a Payment Split feature based on the number of passengers to facilitate cost-sharing among users.
- To provide a web-based admin panel for managing driver data, verifications, and ride statistics.
- To generate detailed ride history and expense reports for user convenience and expense tracking.

1.4 Motivation

This project is motivated by the need to revolutionize university commuting. Conventional methods often lead to inefficiencies and environmental concerns. Leveraging technology, we aim to develop a smart carpooling app, fostering community connectivity, reducing environmental impact, and redefining how individuals navigate the campus. This project is fueled by the vision of creating a sustainable, efficient, and technology-driven transportation solution within the university.

1.5 Assumption and Dependencies

1. Assumption: User Adoption:
- The success of the project assumes that a significant portion of the university community will adopt and actively use the carpooling app.

2. Assumption: Reliable Internet Connectivity:
- The functionality of the app relies on the assumption that users will have consistent access to reliable internet connectivity for real-time updates, matching algorithms, and communication features.

3. Assumption: Willingness to Share Rides:
- The effectiveness of the carpooling model assumes a willingness among users to share rides, considering factors such as scheduling flexibility and destination compatibility.

4. Dependency: Integration with Mapping Services:
- The project is dependent on successful integration with mapping services to ensure accurate route planning, estimated time of arrival, and navigation for both drivers and passengers.

5. Dependency: Availability of Mobile Devices:
- The project assumes that a significant portion of the university community possesses smartphones or mobile devices capable of running the carpooling app.

6. Assumption: Support from University Administration:
- The success of the project assumes support and cooperation from the university administration for promoting and implementing the carpooling initiative within the campus.

1.6 Methods

1. Requirements Analysis:
- Conducted an in-depth analysis of user requirements through surveys, interviews, and feedback sessions to identify the key features and preferences essential for a user-friendly carpooling application within the university setting.

2. Literature Review:
- Conducted a comprehensive review of existing literature, focusing on carpooling app functionalities, smart matching algorithms, and safety features. This informed the project's design decisions and ensured alignment with industry best practices.

3. System Design:
- Developed a detailed system architecture, outlining the app's components, database schema, and integration points. Employed tools such as UML diagrams to visualize the relationships between different modules and ensure a coherent design.

4. Technology Stack Selection:
- Evaluated various mobile app development frameworks and backend technologies, considering factors such as scalability, security, and ease of integration. Chose technologies that align with the project's objectives and future scalability.

5. User Interface Prototyping:
- Created wireframes and interactive prototypes to visualize the user interface (UI) design. Gathered feedback from potential users to refine UI elements for optimal usability.

6. Algorithm Development:
- Implemented and fine-tuned smart matching algorithms based on user preferences, geographical proximity, and scheduling flexibility to ensure efficient and effective ride pairings.

7. Backend Development:
- Implemented the backend infrastructure, including user authentication, ride matching logic, and database management. Ensured robustness, security, and scalability to accommodate a growing user base.

8. Frontend Development:
- Developed the frontend of the mobile application, incorporating the finalized UI design and integrating with backend services. Employed a responsive design approach to ensure compatibility across various devices.

9. User Testing and Feedback Iteration:
- Conducted user testing sessions to gather feedback on the application's usability, performance, and overall user experience. Iteratively refined the app based on user input to enhance its effectiveness.

10. Deployment and Beta Testing:

- Deployed the app on a test environment for beta testing within the university community. Monitored system performance, identified and addressed any issues, and gathered additional user feedback.

11. Documentation:

- Prepared comprehensive technical documentation, including user manuals, API documentation, and system architecture diagrams, to facilitate future development, maintenance, and potential expansion.

1.7 Report Overview

This document serves as a comprehensive account of the development and implementation phases of a specialized carpooling application designed for the university community. The primary objectives revolve around the optimization of commuting practices, the mitigation of environmental impact, and the enhancement of community connectivity through the integration of advanced technological solutions. The report is meticulously structured to offer an in-depth understanding of critical elements, including the project's motivation, the applied methodology, system design particulars, the chosen technology stack, and the outcomes gleaned from rigorous user testing. Imbued with academic rigor and practical insights, this report endeavors to underscore the project's scholarly and practical significance in addressing contemporary transportation challenges within the university milieu.

Chapter 5

1. 6.1 Summary and Future work

SSUET-Carpooling is a cutting-edge mobile app designed to transform transportation within university. It seamlessly connects students, faculty, and staff for shared rides, reducing traffic congestion and environmental impact. The app employs advanced features like Smart Matching for efficient ride pairing and Community-Based Matching for community-building. With flexible scheduling, in-app messaging, and safety measures like AI Verification of Drivers, SSUET-Carpooling ensures a secure and convenient experience. Real-time traffic updates enhance trip planning, and multi-stop trips cater to diverse needs. Cost-sharing is simplified with the Payment Split feature, and detailed ride history and expense reports streamline tracking. The web-based admin panel facilitates efficient management of driver data. SSUET-Carpooling not only promotes sustainability but also fosters a stronger sense of community within the university, making it a game-changer for campus mobility.

Future Work:

- Explore opportunities to expand the app beyond the university to neighboring institutions or communities.
- Investigate the integration of eco-friendly transportation options, such as electric vehicles or incentives for environmentally conscious commuting.
- Further develop AI algorithms to continually refine smart matching, improving user experience and optimizing ride pairings.
- Seek partnerships with local businesses or public transportation systems to create a comprehensive and interconnected mobility ecosystem.
- Implement a system for collecting user feedback to continuously enhance features, address concerns, and adapt to evolving user needs. - Implement blockchain technology to enhance transparency and security in payment transactions, ensuring a seamless and trustworthy financial ecosystem within the app.

Chapter 6

7.1 Conclusion & Recommendation

In conclusion, this project embarked on the development of a smart carpooling application tailored for the university community. The research question focused on optimizing commuting practices and fostering sustainability through advanced matching algorithms and user-centric features. The project successfully addressed these objectives by implementing smart matching, flexible scheduling, and safety features, contributing to a more connected and eco-friendly campus environment.

The big accomplishments of this endeavor include the creation of a user-friendly application that promotes shared rides, reducing traffic congestion, and lowering environmental impact. The introduction of innovative features such as community-based connections, AI verification, and gamification for sustainability enhances the overall commuting experience. These achievements mark a significant step forward in addressing transportation inefficiencies within the university.

In the broader context, the project holds relevance beyond academia as it offers a scalable and adaptable solution for enhancing campus mobility, fostering community bonds, and contributing to a more sustainable urban environment. The question of how technology can revolutionize commuting practices remains open, urging further exploration and application in real-world contexts. As the project concludes, it leaves room for continued research and development to refine and expand the impact of smart carpooling solutions in addressing contemporary transportation challenges.

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