"**Rambul**: A Mobile Application Enhancing Motorcycle Transportation Services for Efficient Travel in Butuan City"

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1. **Related Works**

Motorcycle taxis are an affordable, flexible, and efficient transportation option, particularly in congested urban areas, offering quick navigation through traffic, reaching specific destinations, and being more cost-effective than traditional four-wheeled transportation choices, making them accessible to a wider range of commuters (Bausch and Mesarovic, 2018). To Asvial et.al (2018) to reach their destinations faster, many people in Jakarta prefer using motorcycles due to their affordability compared to cars and their ability to navigate through narrow streets, serving as shortcuts that cars cannot access and helping them avoid congestion on main roads. Hochmuth (2016) conducted a comprehensive analysis of the ride-hail app wars, emphasizing the importance of vehicle selection and its impact on customer satisfaction, while noting that ride-hailing platforms typically prioritize factors like distance, availability, and cost over individual preferences for specific features or amenities. Tilahun and Levinson, (2017) conducted a study exploring usage patterns, pricing mechanisms, and passenger preferences associated with Ride Hailing for motorcycle taxis in Addis Ababa's transportation system. Widjaja and Fanti's, (2020) research provides valuable insights into pricing and matching aspects of ride-hailing platforms, with potential applicability to enhance motorcycle taxi ride-hailing services through effective strategies. Lim et.al, (2018). This study enhances our understanding of the factors influencing user adoption of Ride-Hailing Apps, with perceived usefulness, subjective norms, risk, playfulness, and price level playing significant roles in adoption behavior. Ratha and Satapathy, (2020) focused on factors influencing users' intention to adopt and use ride-hailing services, including perceived usefulness, perceived ease of use, perceived risk, price sensitivity, and social influence. Zou et.al, (2021) highlighted convenience, cost-effectiveness, reliability, service quality, and trust as significant determinants for user adoption and continued usage of ride-hailing services. Han et.al, (2020) found that perceived usefulness, perceived ease of use, convenience, efficiency, perceived risk, price sensitivity, and social influence shape users' attitudes and intentions towards ride-hailing services. Cheng et.al, (2020) revealed that perceived convenience, cost-effectiveness, service quality, social influence, and trust significantly influence users' adoption of ride-hailing services. Additionally, Chen and Zhang (2021) emphasized users' high valuation of convenience, flexibility, pricing, and service quality, with the ability to rate drivers and provide feedback contributing to overall satisfaction and perceived value. Furthermore, different countries have implemented diverse regulatory approaches, driven by conventional transportation operators' calls for a fairer regulatory environment, including the expansion of traditional transportation regulations to encompass Ride-Hailing Apps and their driver and vehicle requirements; however, there is a lack of research on how the public sector integrates Ride-Hailing Apps into broader transportation plans to promote sustainability (Chalermpong et.al, 2023).

**Gaps**

The existing literature gaps, comprehensive analysis of the specific challenges posed by expensive and time-consuming travel with taxi, particularly during rush hours and in congested traffic conditions. Moreover, there is a research gap concerning the limitations of the current jeepney system, which follows fixed routes and may not provide direct access to passengers' desired destinations. Unfortunately, users do not have the option to choose their desired motorcycle. Further investigation is needed to explore the potential of motorcycle ride-hailing services in addressing these gaps by offering more affordable and efficient transportation options for urban mobility.

**II. Problem:**

The problem in urban areas, particularly in Butuan City, is the expensive and time-consuming travel with traditional taxis, especially during rush hours when traffic congestion is prevalent. Additionally, the existing jeepney system's limitations, with fixed routes that may not cater to passengers' specific destinations, hinder effective mobility within the city. Moreover, four-wheel vehicles face limitations in reaching passengers' exact locations, particularly when it comes to navigating small access roads.

**Specific Problem:**

Specifically, the lack of affordable and efficient transportation options for urban mobility in Butuan City contributes to slow travel times and inconvenience, particularly when using taxis. The rigid routes of the current jeepney system further restrict accessibility to specific locations, worsening the transportation challenges for residents and commuters.

**III. Objective of the Study**

The objective of this study is to create a mobile application called Rambul to place motorcycle ride-hailing services in Butuan City to address the challenges of expensive and time-consuming travel with four-wheel vehicles and the limitations of the current jeepney system. The aim is to improve urban mobility by providing a more affordable, efficient, and flexible transportation option that caters to passengers' specific destinations within the city.

**Specific Objective**

1. To develop a mobile application, Rambul, that provides efficient motorcycle ride-hailing services in Butuan City, offering an affordable and time-saving alternative to conventional four-wheel vehicle transportation options.
2. To develop a mobile application, Rambul, that provides door-to-door motorcycle ride-hailing services in Butuan City, ensuring convenient and direct transportation for users to their specific destinations within the city.
3. To introduce Rambul, a motorcycle service ride-hailing platform, to our city, that will give convenience to the users even in the small area where 4 wheels cannot enter.
4. To develop a ride-hailing application that empowers users to select their desired motorcycle for their transportation needs.

**IV. Scope and Limitation**

The Scope of this study and application development project, Rambul, is the development of motorcycle ride-hailing services in the city of Butuan. The project's geographic scope includes Butuan City due to the city's unique urban transportation issues and characteristics. With a focus on door-to-door transportation, the project seeks to create a mobile application that enables users to call Riders, monitor the arrival of motorcyclists, Real Time Location of the rider and be driven from their pickup spot to their chosen destination. A user-friendly interface must be created, efficient ride-matching algorithms must be implemented, real-time tracking, and compliance with local laws and legal requirements governing motorcycle ride-hailing services must be ensured.

**Limitation**

The Rambul application has a limitation because it depends on the availability of motorcycles and the participation of riders. The effectiveness of the service relies on having enough active riders who use the application. However, there are additional constraints to consider when implementing this feature, especially the need for a strong and stable internet connection. This is essential for both users and riders to receive real-time location updates, which are necessary for smooth navigation towards the desired destination.In areas where the internet connectivity is limited or unreliable, both riders and users may encounter difficulties accessing the application, requesting rides, and receiving timely updates.

**V. Tech Stacks**

* **Unity Engine**: Unity is needed to create the user interface, handle graphics rendering, and manage the overall application logic. It provides a powerful development environment for creating interactive and visually appealing applications.
* **Node.js**: Node.js is a backend framework that enables server-side logic, handling data management, and facilitating real-time communication. It is useful for managing user requests, coordinating data exchanges, and ensuring a smooth experience for users and drivers.
* **Google Maps API**: The Google Maps API is crucial for integrating mapping and geolocation services into your application. It enables features such as real-time location tracking, route planning, and distance calculation, which are essential for providing accurate navigation and optimizing the ride-hailing experience.

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“Bronxder: Enhancing Order Management Efficiency and Customer Experience through a Tablet-Based Ordering System at Bronx Cafe"

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Several studies have examined the adoption and impact of tablet-based ordering systems in restaurants. Huang et.al (2019) found that customers' adoption of mobile self-ordering systems was influenced by factors such as perceived usefulness, ease of use, social influence, and perceived risk. Gao and Bai (2014) developed a tablet-based prototype system that improved the efficiency of the order-taking process. Raza et al. (2019) discussed the advantages and challenges of implementing mobile-based ordering systems, including improved order accuracy and customer experience. Xiao et.al (2018) highlighted that customers' intentions to use tablet menus were influenced by perceived usefulness, enjoyment, ease of use, and perceived risk. Ryu and Jang (2017) investigated how different aspects of tablet menu design affected customers' intentions and behaviors. Hasan et.al (2019) found that mobile-based food ordering apps positively impacted customer satisfaction. Tu and Chen (2019) integrated the unified theory of acceptance and use of technology to identify factors influencing consumers' intention to use tablet-based menu systems. Cho et.al (2016) explored the impact of tablet menus and self-ordering systems on various aspects of restaurant performance. Wang and Park (2019) studied the influence of tablet-based menu ordering systems on customer satisfaction and service quality. Go and Lee (2017) examined the effect of different tablet menu types on customers' behavioral intentions, considering variations across restaurant types.

**Gaps**

Based on existing studies, the adoption of table-based ordering systems is already being implemented in some establishments within cities. However, a common practice is for waiters to carry the ordering device with them, requiring customers to call them in order to place their orders.

**Problem of the Study**

The current manual order management system at Bronx Cafe relies on pen-and-paper methods, leading to inefficiencies in the order-taking process. This traditional approach results in longer wait times, potential errors in order by the staff, and difficulty in tracking and prioritizing orders. Furthermore, the absence of a built-in digital solution poses challenges for the waiters who are required to carry the ordering device with them. This inconvenience often necessitates customers to call the waitstaff in order to place their orders, adding to the overall inefficiency of the system.

**Specific Problem**

Limited Order Visibility and Communication. Bronx Cafe lacks a digital ordering system, causing a lack of real-time order visibility and effective communication between different stakeholders. The absence of a tablet-based ordering system results in challenges such as delays in order transmission, potential mistakes in order fulfillment, and limited tracking of order status. This specific problem highlights the need for a solution that can streamline order management, enhance communication, and optimize the overall ordering process for improved customer satisfaction and operational effectiveness.

**III. Objective of the Study**

The objective is to develop and implement the Brxder tablet-based ordering system at Bronx Cafe. The system aims to automate the order management process, enhance communication, and improve the overall efficiency of the restaurant's operations. The goal is to provide a seamless and convenient ordering experience for customers while enabling effective order tracking and integration with the cashier system.

**Specific Objective:**

1. Develop the Brxder tablet-based ordering system: Create a user-friendly and intuitive tablet application that allows customers to browse the menu, select items, customize orders, and submit them digitally.
2. Improve operational efficiency: Increase the efficiency of the order management process, reducing wait times, minimizing errors, and optimizing resource allocation.
3. To propose the tablet-based ordering system to be built-in: To solve the problem of staff bringing the device that tends the customers to call them to make an order.

**IV. Scope and Limitation**

The scope of this project includes the development and implementation of the Brxder tablet-based ordering system at Bronx Cafe, focusing on streamlining the order management process and enhancing customer experience. The project encompasses the creation of a user-friendly tablet application that enables customers to browse the menu, customize their orders, and submit them digitally. It also involves the integration of the system with the existing cashier display system to relay order details and table numbers for efficient order processing. The scope further includes testing, training of staff members, and deployment of the system within the premises of Bronx Cafe.

**Limitation**

One limitation of this project is that is the need for stable network access is very important for the application to work. Additionally, the project does not cover advanced features such as inventory management, as it primarily focuses on optimizing the ordering process. Furthermore, the system's performance may be subject to limitations related to the hardware and software capabilities of the tablets used. Also, the device can only be used inside the store because of some modifications. Lastly, the project assumes that the provided cashier display system is capable of receiving and displaying the order information, and any necessary modifications or adjustments to the system are outside the project's scope.

**V. Tech Stack**

* **Unity with Firebase Realtime Database**: Unity with Firebase Realtime Database for real-time synchronization of orders between tablets, cashiers, and the kitchen.
* **Unity with RESTful API**: Unity with a RESTful API for communication between tablet orders, cashiers, and the kitchen.
* **Unity with WebSocket**: Unity with WebSocket for real-time order transfer and communication between tablets, cashiers, and the kitchen.

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**“Traffic Sign Quiz**: A Mobile Game Application with Image Recognition for TL Mabuhay Driving Lesson Academy Inc.”

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According to Nagar (2022), proper knowledge and adherence to traffic signs and regulations are crucial for all individuals, particularly those obtaining a driving license, as it significantly reduces the likelihood of accidents occurring. Furthermore, Hussain and Shi (2019) highlight that the lack of professional driver training in Pakistan, with drivers relying on non-professional instruction, increases the likelihood of road traffic accidents (RTAs), motivating the need for professional training. The study by Purnamasari (2019) reveals that, on average, 77.11% of drivers understood 32 traffic signs correctly, with variations between male and female respondents, but violations were observed despite good understanding. Additionally, an analysis by Hassan et.al (2022) demonstrates that road users exhibit a relatively low level of awareness (43%) of traffic signs, with age, education, and years of driving experience influencing comprehension. Borrego-Jaraba et al. (2020) emphasize the significance of road sign recognition skills and propose a gamified approach, while Tran and Tran (2020) propose a mobile-based system combining deep learning algorithms and game-based learning principles for traffic sign recognition. Barmpounakis et.al (2019) implement a mobile-based serious game utilizing CNN models for real-time traffic sign recognition, enhancing learning and understanding. Similarly, Li et.al (2017) integrate traffic sign recognition technology into a game-based application for interactive and engaging learning. Lastly, Ertan (2020) trains a CNN model with annotated data for real-time traffic sign recognition on a mobile device.

**Gaps**

Existing studies have already delved into and suggested a gamified approach to underscore the importance of traffic signs. However, there remains a pressing need to enhance knowledge and training concerning traffic signs and regulations among individuals. To address this gap, the inclusion of pre-assessments can have a significant impact on improving users' understanding and retention of traffic sign-related knowledge.

**II. Problem of the Study**

Traditional methods of studying traffic signs, such as reading manuals or attending classroom sessions, may not be engaging or effective for everyone. It is important to bridge this knowledge gap and provide an accessible, enjoyable, and interactive learning experience that caters to individuals with varying learning styles.

Traffic signs play a crucial role in ensuring road safety. However, many individuals face challenges in obtaining their driver's license due to a lack of knowledge about various traffic signs. Without proper understanding and recognition of these signs, individuals may fail their exams and be unable to acquire their license, which can limit their mobility and access to opportunities.

**Specific Problem**

The specific problem addressed is the lack of knowledge and understanding of traffic signs among individuals, leading to difficulties in passing the LTO licensing exam and potential risks to road safety. Traditional learning methods are not engaging or effective for everyone, highlighting the need for an interactive tool to help individuals memorize and comprehend traffic signs, improving their exam success and promoting road safety. Furthermore, there is a growing need for tools that can assess and enhance the teaching process on an individual level.

**III. Objective of the Study**

The main objective of this thesis is to develop an image recognition game, "Traffic Sign Quiz," designed to assist individuals with limited knowledge of traffic signs in improving their understanding and recognition of these signs. By creating an enjoyable and interactive learning experience, the game aims to enhance the traditional method of teaching that will help users memorize traffic signs and prepare them for the Land Transportation Office (LTO) licensing exam.

**Specific Objective**

1. Create a mobile game application called "Traffic Sign Quiz" that tests players' knowledge of traffic signs.
2. Create a mobile game application with an image recognition feature that can enhance their knowledge of traffic signs.
3. To evaluate the effectiveness of the application by conducting a pretest before using the application and conducting a post-test after using the application.

**IV. Scope and Limitation**

This study focuses on developing and evaluating the effectiveness of the "Traffic Sign Quiz" game as a tool for improving users' recognition and understanding of traffic signs. The scope includes designing an interactive game using image recognition technology to detect and identify traffic signs in real-life scenarios. The study will assess users' performance and gather feedback to evaluate the game's impact on users' knowledge and preparedness for the LTO licensing exam.

**Limitation**

The limitation of the "Traffic Sign Quiz" game is its reliance on image recognition technology, which may be affected by variations in lighting conditions, image quality, and occlusions. This can result in challenges and potential inaccuracies in correctly identifying and recognizing traffic signs, leading to misleading learning experiences for users.

**V. Tech Stacks**

* **Unity with OpenCV**: OpenCV integration in Unity for powerful image processing capabilities.
* **Unity with Firebase ML Kit**: Firebase ML Kit integration in Unity for ready-to-use image recognition features. Unity with Custom.
* **Machine Learning Models**: Create and integrate custom machine learning models in Unity for tailored image recognition functionality.

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