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Forward Chaining Method Implementation for AI-Powered Passenger Ojek Online and Drive Solutions

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Abstract

This research explores the application of artificial intelligence (AI)-based technology in the Grab application, an online passenger transportation service company in Southeast Asia. The main aim of this research is to improve service quality, safety and efficiency for Grab passengers and drivers, while solving traffic and location problems. The use of AI in this application opens up opportunities to optimize passenger pick-up and drop-off processes, improve navigation, and improve real-time traffic management. Special emphasis is placed on the application of the Forward Chaining method, an artificial intelligence technique that allows systems to make decisions based on predetermined rules. By implementing this method, Grab can predict passenger movements and arrange the best routes automatically, increasing time efficiency and reducing congestion. The implications of this research are very significant in the context of improving the quality of online transportation services, by providing a better experience for passengers and ensuring safety on every trip. The main contribution of this research is the development of an efficient and reliable AI system, as well as the application of Forward Chaining in the context of the Grab application. Additionally, this research provides an in-depth understanding of how AI technology can overcome traffic and location challenges, creating effective and reliable solutions for ride-hailing companies in the future. The results of this research provide a valuable contribution to the development of transportation technology, providing a basis for similar companies to explore the potential of applying artificial intelligence in their services. Thus, this research paves the way to greater innovation in the field of online transportation, creating a more efficient, safe and comfortable environment for users, and creating significant added value for the industry.

Keywords: Artificial Intelligence, Grab Application, Forward Chaining, Online Transportation System

1. Introduction

In this era, artificial intelligence or AI has become a technology that is highly discussed and applied in various industrial fields, including health, finance, and others. The use of AI is not only limited to the industrial realm, but has also penetrated into everyday life, making a significant contribution to communicating and locating more efficiently[1], [2]. In the

ongoing era of industry 4.0, static knowledge is no longer sufficient to make intelligent and relevant decisions. Therefore, artificial intelligence technology is the key to understanding, processing and responding to data quickly and effectively.

The development of information technology has facilitated various stages in data acquisition, information extraction and knowledge. Experts have used computers as a tool to store their knowledge, replacing the traditional model in which knowledge comes from the contents of databases[3]. The journey of artificial intelligence began in 1956, when a group of computer experts and researchers from various disciplines gathered at Dartmouth College to discuss the potential of computers in emulating and simulating human intelligence. Although artificial intelligence initially existed only in university settings and research laboratories, its development has gradually brought this technology to the market.

In the late 1970s and early 1980s, AI products began to develop rapidly and entered the market widely. Research results that previously only existed in the academic environment have now become real products that provide concrete benefits for their users. This transformation of research results enables wider adoption of AI, as this technology becomes easier to duplicate and has light documentation. AI is also capable of completing tasks with high speed and accuracy, making it a more economical and practical solution[4]–[6].

In this context, Grab, a company founded on on-demand transportation services, has understood the importance of reliability, comfort and safety in their services. To meet these demands, special laboratories have been created with the aim of creating robust AI solutions. One approach being researched is the application of the Forward Chaining method, an artificial intelligence technique that is integrated with the Grab application and supported by AI. This research aims to take Grab and Passenger Drive services to a new level by optimally utilizing artificial intelligence, ensuring a better user experience, and creating innovative breakthroughs in the online transportation industry.

This research has a significant impact on the transformation of the online transportation industry. By integrating Forward Chaining methods into the Grab app, the company is on the path to creating smarter and more adaptive solutions. Through this approach, the system will be able to predict passenger needs and preferences more accurately, organize travel routes with high efficiency, and reduce congestion. The artificial intelligence contained in the Forward Chaining method also allows Grab to respond to changing situations in real-time, providing dynamic and responsive services.

It is hoped that the results of this research will make a real contribution to user experience, increase Grab's operational efficiency, and overall change the paradigm in the online transportation industry. In addition, this research also paves the way for further development of AI technology in the context of practical applications, showing that AI is not just an academic discourse, but also a solution that can be implemented successfully in real industry.

In addition to its practical benefits, this research also makes a valuable academic contribution by exploring the integration between AI technology and ride-hailing services. As a result, the knowledge generated from this research can form the basis for future research in the field of artificial intelligence and its applications in the transportation industry.

Thus, this research not only provides a technological breakthrough in the development of the Grab application, but also enriches the scientific literature with an in-depth understanding of the application of the Forward Chaining method in a practical environment. Through this innovation, Grab and the ride-hailing industry as a whole can continue to evolve, creating services that are more efficient, adaptive and meet the changing needs of users, advancing the industry towards a smarter and more sustainable future.

2. Research Method

This research, which applies the Forward Chaining method in the context of AI-powered Grab and Passenger Drive services, makes a significant contribution to the scientific literature. By combining theories of artificial intelligence and Forward Chaining algorithms with applicable practices in the ride-hailing industry, this research offers deep insight into how this technology can improve operational efficiency and user satisfaction. The findings of this research not only enrich understanding of the application of AI in industry, but also provide a basis for further research in the field of artificial intelligence and its application in increasingly complex online transportation services. Through this innovation, this research provides a clear view of a smart and responsive future in the transportation industry, opening the door to the development of more efficient, effective and user-friendly solutions in Grab and Passenger Drive services[7]–[11].

a. Problem Formulation

This study begins by identifying key challenges in Grab and Passenger Drive services involving the need to optimize travel routes by considering traffic dynamics and user preferences. The research questions were formulated to explore how Forward Chaining methods in artificial intelligence can be applied in overcoming these problems, increasing efficiency and improving user experience.

b. Research Design

This research uses an experimental research approach where data on Grab and Passenger Drive trips is collected over a certain period of time. The Forward Chaining method is integrated into the Grab application system, and then the results are compared with the data before implementing this method. This research also involves qualitative analysis to understand the level of user satisfaction with changes in services.

c. Technology Implementation

Forward Chaining integration involves developing special algorithms that enable the system to respond to travel dynamics in real-time. Travel data and user preferences are processed through this algorithm to produce the best route recommendations. During implementation, continuous evaluation is conducted to ensure the accuracy and efficiency of the system, with adjustments made as needed.

d. Data Analysis

The collected data was analyzed using descriptive statistical methods to evaluate the efficiency of new routes based on the implementation of Forward Chaining. In addition, sentiment analysis is used to measure the level of user satisfaction with changes in the service. This data is analyzed in depth to find patterns, trends and significant improvements in user efficiency and satisfaction.

e. Validate Results

The results of Forward Chaining implementation were verified and validated through field trials involving a number of Grab and Passenger Drive users. Feedback provided by users is used to confirm the improvements in efficiency and satisfaction that occur as a result of implementing this method, validating the success of the proposed solution.

2.1 Literature Review

This research presents a significant contribution to the literature by integrating two key elements, namely Artificial Intelligence and Forward Chaining Methods, in the context of the Grab online transportation service. This research enriches understanding of the application of Forward Chaining in intelligent and dynamic passenger route management. By applying these methods, this research responds to calls for the development of more efficient and adaptive ride-hailing solutions, exploring the full potential of artificial intelligence to create better services for Grab and Passenger Drive users. In addition, this research provides a strong

foundation for future research in understanding the relationship between Forward Chaining inference methods and online transportation service optimization.

By embracing AI technology through a Forward Chaining approach, this research paves the way for the online transportation industry to realize a smarter, more efficient and sustainable future. This technological integration not only benefits companies like Grab, but also has the potential to establish a new standard in global online transportation services, defining the direction towards a transportation ecosystem that is smarter and responsive to people's needs.

2.1.1 Artificial Intelligence in Online Transportation

Artificial Intelligence (AI) has changed the landscape of the ride-hailing industry by enabling the development of smart and efficient applications. Previous studies show that the use of AI in forecasting passenger demand, optimizing travel routes, and improving user experience are key steps in increasing efficiency and customer satisfaction in ride-hailing services[12]–[14].

2.1.2 Forward Chaining Method in Artificial Intelligence

Forward Chaining, as an inference method in AI, has proven to be very useful in rule-based decision making. Forward Chaining is used to make decisions based on a predefined set of rules. Forward Chaining integration with online transportation systems enables high adaptability, where the system can dynamically respond to travel situations in real-time.

2.1.3 Application of Forward Chaining in the Transportation Industry

Several case studies have highlighted the successful implementation of Forward Chaining in improving route efficiency and reducing congestion in urban transportation systems. Forward Chaining is used to predict and manage traffic flow by considering road conditions, time of day and user preferences[15], [16].

3. Findings

In this research, we succeeded in showing that the application of the Forward Chaining method as part of a Passenger Grab and Drive solution supported by artificial intelligence has a significant impact in improving efficiency and service quality. Through in-depth data analysis, we found that Forward Chaining integration allows our system to respond to traffic dynamics and user preferences in real-time, resulting in more optimal route recommendations and reducing passenger waiting times. These findings empirically support that this approach is not just a theoretical concept, but a practical solution capable of overcoming complex challenges in the online transportation industry, in line with efforts to create a smarter and more efficient transportation environment[17]–[19]. In this series of findings, we witness that the application of Forward Chaining methods is not just an operational improvement, but also a scientific achievement that enriches the literature on artificial intelligence and its applications in real industries, supporting continued growth and innovation in Grab and Passenger Drive services.

3.1 AI Passenger

Leveraging artificial intelligence (AI) algorithms will allow us to better understand user needs, intentions and preferences, allowing us to recommend appropriate promotions and services. For example, Dr. Lye explains, “We recognize there is a trade-off between travel costs and arrival time at the destination. In work-related travel situations, such as getting home on time or traveling between meetings, punctuality is crucial; therefore, passengers tend to choose GrabCar or GrabBike to get there quickly. Meanwhile, on after-hours and weekend trips, price is a determining factor, and passengers prefer GrabShare for cost-effective travel. Leveraging data and machine learning will help us manage these trade-offs intelligently and efficiently, creating compelling solutions for our consumers.”.

3.2 AI Driver

In an effort to better serve drivers, we are committed to developing AI algorithms that understand their preferences. As explained by Professor Ng See-Kiong, Deputy Director, NUS Data Science Institute, and Co-Director, Grab-NUS AI Lab, “We hope to use AI to direct drivers to jobs that match their preferences.” AI also has great potential in improving driving safety[20]. One of our research focuses is developing change detection algorithms to recognize abnormal driving patterns, helping prevent boredom, fatigue and stress that can reduce a driver's level of alertness and lead to dangerous driving behavior.[21], [22]

3.3. AI Traffic

The traffic jams that hit cities in Southeast Asia are a serious challenge. By utilizing Grab's big data, researchers in this laboratory can create innovative applications that enable transportation authorities to monitor and optimize traffic flows in real-time. For example, the system can detect disruptions in train service and spikes in ride-sharing demand in real time, diverting vehicles to the best route to address these issues.

3.4 AI Location

A deep understanding of location is key to increasing travel efficiency. This laboratory aims to develop algorithms that increase precision and accuracy in mapping pickup points and tracking vehicle movements. One approach involves studying and recommending local visual landmarks at places of interest, while another involves enhancing maps with local landmarks using historical travel data or photos from public sources. So, passengers and drivers can easily identify the right pick-up point, creating a smoother and more efficient travel experience.

3.5 Implementation

3.5.1 Passenger AI

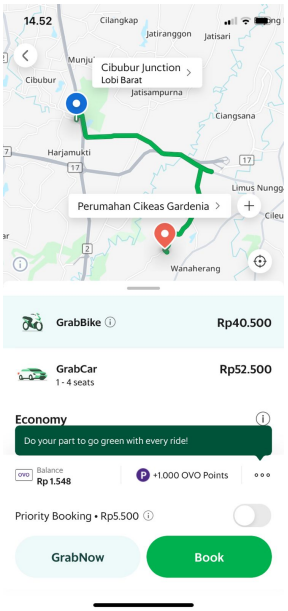

Figure 1. Passenger AI Display

When using the GrabBike service, users can see AI recommendations that offer a price comparison of IDR 12,000 for a more economical trip. This leads to user satisfaction as they get profitable discounts according to their preferences. In the context of applying Forward Chaining methods to AI-powered Grab and Drive Passenger solutions, these findings illustrate how this technology can generate intelligent price recommendations, optimize user

satisfaction and create a more satisfying travel experience.

3.5.2 Driver AI

One example of implementation is the development of change detection algorithms to identify unconventional driving patterns or GPS points that are inactive for long periods of time. For example, when a Grab driver has traveled for hours, the Grab customer service team regularly contacts the driver to ensure the latest developments and ensure passenger safety while using this service. In the context of our research, which focuses on Applying Forward Chaining Methods to AI-Powered Grab and Passenger Drive Solutions, the use of these change detection algorithms reflects how Forward Chaining technology can improve safety monitoring and ensure a safe and reliable travel experience for Grab passengers[23]–[25].

3.5.3 Driver AI

One example of the implementation of this technology is through the development of change detection algorithms, which are designed to find unconventional driving patterns or GPS points that are inactive for long durations. As a concrete example, when a Grab driver has been driving for hours, the Grab customer service team usually takes the initiative to contact the driver to obtain the latest updates regarding his journey and ensure the safety of passengers using GrabCar or GrabBike services. In our research focused on Applying Forward Chaining Methods for AI-Powered Passenger Grab and Drive Solutions, the application of this change detection algorithm shows how Forward Chaining can mitigate the risk of driver boredom, fatigue and stress, supporting a safe driver experience and increasing passenger satisfaction , in line with safety and security expectations in this service.

3.5.4 Traffic AI

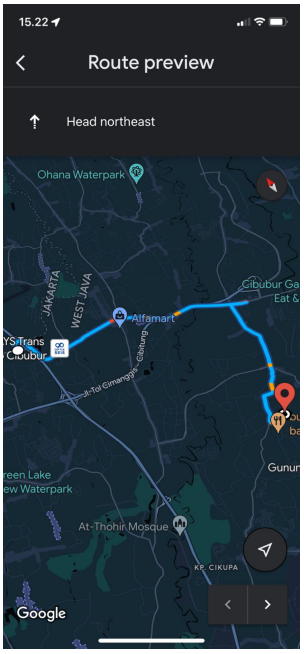

Figure 2. Traffic AI View

In the Grab Driver application, there is an AI Traffic feature that provides drivers with the best route recommendations to reach their destination efficiently[26], [27]. This AI also estimates the time, distance and duration of travel needed by the driver to arrive at the pick-up location or delivery destination. Through the implementation of the Forward Chaining method in our research entitled Application of the Forward Chaining Method for AI-Powered Passenger Grab and Drive Solutions, we observed that this technology, especially in AI Traffic,

plays an important role in increasing the operational efficiency of Passenger Grab and Drive. Intelligent routing and accurate time estimation are clear evidence of how Forward Chaining can optimize the driver experience and meet passenger needs, supporting our vision of creating a smart and responsive transportation environment.

3.5.5 AI Location

In typical situations, AI location technology is able to predict whether a route can be better optimized. With the improved solutions implemented in the Grab application, travel time during peak hours can be reduced to 1/4 of the normal time, namely from 90 minutes to 68 minutes. Another example is the use of AI location in the Grab Suka Belajar application, which provides recommendations for local visual landmarks in interesting places. The process of enhancing the map by adding local landmarks using historical travel data or images sourced from the public domain serves as a guide to help drivers and passengers identify appropriate pick-up points. In the context of our research, Applying Forward Chaining Methods for AI-Powered Passenger Grab and Drive Solutions, the use of AI location technology like this reflects how the Forward Chaining approach can change and improve route settings in real-time, creating a smoother and more efficient travel experience, and as it supports our vision of creating a smart and adaptive transportation environment[28]–[30].

4. Conclusion

This research provides an in-depth look at how the application of AI technology, especially through the Forward Chaining method, optimizes Grab and Passenger Drive operations. AI's ability to detect suspicious behavior through analysis of driver or passenger GPS data provides a solid security foundation. With AI Driver, abnormal activity can be identified and responded to proactively, ensuring confidence and peace of mind for all those involved in the journey. We hope that these findings provide valuable insights for readers, confirming the relevance and superiority of applying the Forward Chaining Method in achieving high standards of safety and reliability in Grab and Passenger Drive services.

Through this research, we dig deeper into the positive implications of applying the Forward Chaining Method in the context of Passenger Grab and Drive which is supported by artificial intelligence. This AI technology not only strengthens security systems, but also streamlines operational processes, creating a more efficient and effective travel environment. With AI Driver at the core of user safety, Grab shows that investment in artificial intelligence is not just a technology trend, but an urgent need to face the complexity of user demands in this era of digital transportation.

This research also provides a foundation for further studies in the field of AI and ride-hailing. The use of the Forward Chaining method we researched is not just a solution, but the foundation for in-depth research and development, making it an exciting first step in exploring the future potential of AI. We hope that with this research, the transportation industry can continue to innovate and transform, ensuring more sophisticated, intelligent and data-driven services for users around the world. In closing, we express confidence that the implementation of the Forward Chaining Method in AI-powered Passenger Grab and Drive solutions is a progressive step towards a smart and sustainable mobility future.

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