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MINIMIZATION TRAFFIC CONGESTION WITH SMART TRAFFIC LIGHT BY USING FUZZY LOGIC

Nur Qurratu' Aini Jefrydin and Shahrifah Fhahriyah Syed Abas
College of Computing, Informatics and Mathematics,
Universiti Teknologi MARA, Perlis Branch
2020853614@uitm.edu.my and sfhahriyah@uitm.edu.my

ABSTRACT - Traffic congestion is a pervasive problem with significant negative social, economic and environmental impacts. This study aims to reduce traffic congestion on Raja Ashman Shah Road in Ipoh by implementing an intelligent fuzzy logic traffic light system. The system aims to reduce waiting times and improve traffic flow by automatically adjusting green light durations based on real-time traffic conditions. Data on the number of vehicles and queue lengths during peak hours were collected to compare congestion levels before and after the intervention. The results of this study demonstrate the effectiveness of deploying an intelligent traffic light system with fuzzy logic in minimizing traffic congestion and reducing waiting times. By dynamically adjusting green light duration based on real-time traffic conditions, the system optimized traffic flow and improved overall congestion. A comparison of congestion levels before and after the introduction showed a significant reduction in congestion and an improvement in traffic flow. The adaptability of the intelligent traffic light system makes better use of road capacity, reducing waiting times and minimizing congestion. As a result, we found a significant reduction in waiting time compared to the previous static system. The results highlight the effectiveness of intelligent traffic light systems based on fuzzy logic in minimizing congestion and optimizing traffic flow. This study will provide valuable information to improve the transportation system and improve the quality of life for road users in Ipoh.

Keywords: Fuzzy logic, Ipoh, traffic congestion, minimize, smart traffic light

1. INTRODUCTION

Traffic congestion has significant negative effects on society, the economy, and the environment. Hence, this study aims to minimize traffic congestion in Ipoh, Malaysia, specifically in Jalan Raja Ashman Shah, by implementing intelligent traffic light systems using fuzzy logic. The study's objectives are to develop an optimal traffic light control design and compare traffic congestion before and after implementing the study. The research location was chosen based on its proximity to Ipoh General Hospital, where congestion is worst during peak hours. The number of vehicles and queue length during peak hours, was collected through observations. The findings of this study have significant implications as they can help reduce queue times and minimize stress for Ipoh road users. The efficient management of traffic congestion would ensure timely arrival, particularly for working citizens, and enhance overall productivity. By addressing the issue of traffic congestion, this study contributes to improving the quality of life and transportation efficiency in Ipoh.

2. METHODOLOGY

Primary data was collected in this study, which are number of vehicle and length of queue from observations during the peak hours. Then, Fuzzy Logic method was used to solve this problem. MATLAB software was used to develop this study. There are 5 steps in this study. The first step is defining the linguistic variable for input and output. In this study linguistic variable from Hartanti et al. (2019) was used. Then, membership function and fuzzy rules based will be create. Next, fuzzy tools in MATLAB is implement to build the system. Lastly, compared the results with data from observations. In this study, the problem will define base from the variables to simulate a smart traffic light that can adapt base from situation.

3. RESULTS AND DISCUSSION

By analyzing the number of vehicles and the length of the queue, the system optimizes the green light duration to facilitate a smoother flow of traffic and reduce congestion. his adjustment allows more vehicles to cross the intersection in each cycle, clearing the queue faster and minimizing time spent in traffic. The use of fuzzy logic methodology further enhances the system's adaptability, as green light durations can now vary based on real-life

conditions, providing improved efficiency and reducing congestion during peak hours.

4. NOVELTY OF RESEARCH / PRODUCT

There were several studies that have been conducted on traffic congestion. One of the works presented by these researchers revolves on studying the exposure to traffic congestion during road trips by utilizing the Global Positioning System (GPS) trajectory of taxis and Point-of-Interest (POI) datasets based in Wuhan, China (Kan et al., 2022) . Next, the aim of Aid et al. (2019) in this study is to employ an Artificial Neural Networks (ANN) traffic congestion prediction mechanism which controls or minimizes congestion resulting in a smooth traffic flow. The aim of Hartanti et al.(2019) is to create a simulator that optimizes traffic time management by using Fuzzy Logic.

5. CONCLUSION

The study successfully achieved its objectives by implementing smart traffic lights at the Jalan Raja Ashman Shah intersection. This led to reduced traffic congestion and waiting times, improving vehicle flow. The system allowed more vehicles to pass through per cycle, effectively clearing queues faster and reducing traffic jams. The results demonstrate the potential benefits of adopting fuzzy logic-based smart traffic light systems to optimize green light duration and minimize traffic-related issues.

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