COMPREHENSIVE LITERATURE AND PRELIMINARY OPTIMIZATION OF ADAPTIVE SIGNAL SYSTEM THROUGH AI BASED ON DIGITAL TWIN MODELLING.

Abstract

This research will focus on optimizing adaptive intersection signal systems in Nashville using artificial intelligence (AI) and digital twin modeling. Traffic congestion and inefficiencies at signalized intersections contribute to increased delays, safety concerns, and increased high level of air pollution which can have a negative impact on environment. To address these challenges, digital twin models will be developed and implemented by using the real-time traffic data, predictive models such as VISSIM, and AI algorithms. The digital twin allows for the simulation and analysis of traffic patterns under various scenarios and enabling dynamic signal optimization. Machine learning and reinforcement learning techniques will be used to predict traffic flow and adaptive signal timing in real-time, aiming to minimize delays and maximize intersection traffic flow. The data will be corrected by using sensors and all data integration and processing will be analyzed in an appropriate way to ensure data accuracy, reliability and maintain precision. In the final stage, the model will be tested to ensure it fits for expected objectives and demonstrates significant improvements in traffic efficiency and sustainability.

This research will provide great potential to make a significant impact on urban mobility, also provide a forward-looking framework and more adaptive traffic management systems. By reducing the congestion and delays at the roadways and creating more efficient urban transportation systems with effective maximum traffic flow.