Simulation-Based Analysis of the Impact of Novel Modes of Transportation at Non-signalized Intersection

Master‘s Thesis of Pavithra Sathya Kumar

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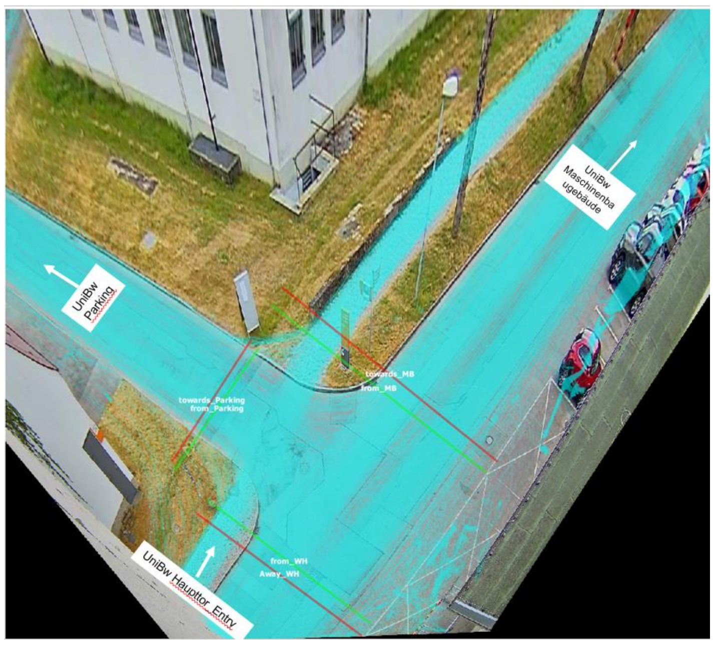

Figure:1 Detail View of Study Intersection at Universität Der Bundeswehr München Campus

The goal of this study is to assess the probable influence of upcoming traffic types at non-signalized crossings by utilizing actual trajectory data. The aim is to improve the precision of traffic simulations and safety evaluations by integrating comprehensive trajectory data into multi-modal simulation models. The study specifically strives to comprehend the intricate interplay of various transportation modes, including motorized cars, bicycles, and pedestrians, and enhance the accuracy of calibration in simulation models to correctly mirror real-life traffic behaviors. This all-encompassing strategy seeks to enhance the management of urban traffic and the investigation of safety at intersections without traffic signals. The main goal of this study is to examine the following research questions firstly, Analyze the dependability of aligning a multi-modal simulation with trajectory data from the actual world. Secondly, Examine the use of microscopic simulators in assessing safety in situations where several transportation modes coexist in mixed-traffic environments. The purpose of these issues is to determine a connection between theoretical simulation models and real-life urban transportation characteristics, with an emphasis on improving the reliability and usefulness of simulation tools by using a large amount of trajectory data.

The methodology involves a combination of literature review, trajectory data collection, and simulation. The study employs the FLOW program developed by DataFromSky for trajectory analysis and the Aimsun Next software for simulation. The calibration process adjusts the sensitivity factor and headway aggressiveness to accurately reflect actual traffic circumstances in the real world. A range of traffic scenarios were generated to simulate varying degrees of car and pedestrian interactions to analyze circumstances that pose a safety risk. The data collection occurred at the Universität der Bundeswehr München (UniBwM) campus. Simulations were calibrated using observed trajectory data to correctly represent real traffic behaviours. The simulation results suggest that the inclusion of trajectory data greatly enhances the precision of traffic safety evaluations at non-signalized crossings. The calibrated models accurately replicate real-world traffic patterns, hence improving the dependability of the simulations. The study also found that rear-end collisions are the most common sort of traffic event, based on both real-world data and simulations. The findings indicate that although the simulation models are efficient, there are still obstacles in precisely forecasting pedestrian and bicyclist behaviours due to their variability and the constraints of the simulated environment.

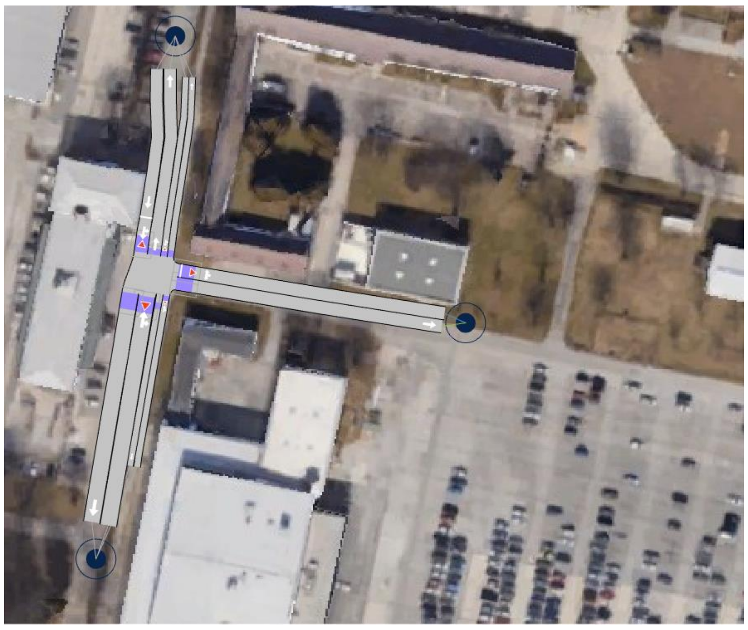

Figure:2 Model of the Study Intersection in Aimsun Software

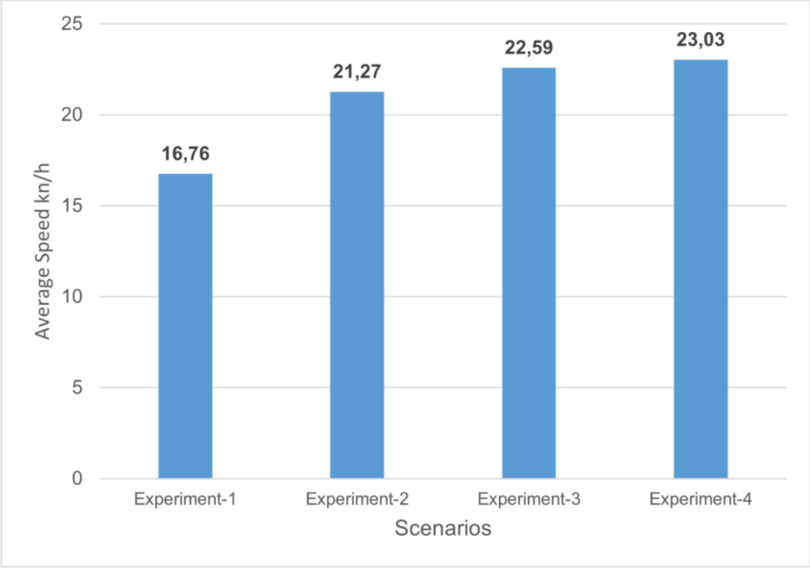

Figure:3 Scenarios Average Speed Analysis

The study is limited by simulation models' inability to predict pedestrian and cyclist behaviour. Fixed virtual gate settings and vehicle movement data noise were also challenging. Moreover, the calibration procedure employed in the study was predominantly concentrated on traffic patterns, lacking comprehensive validation of the model across a wide range of scenarios. This constraint suggests that bigger data sets and more specific micro-level variables could improve model accuracy. To effectively represent all road users, future studies should add demographic and perception data to simulation models. Adding more traffic circumstances to the calibration procedure and evaluating the models against larger data sets would also increase accuracy. Advanced data filtering and smoothing algorithms and better pedestrian and bicycling behaviour detection and prediction could improve simulation models for urban traffic management and safety assessments.