

INTISARI

Kawasan industri berperan penting dalam mendorong kontribusi sektor manufaktur terhadap Produk Domestik Bruto (PDB) nasional, khususnya dalam konteks pembangunan industri berbasis visi Indonesia 2045. Kawasan Industri PT XYZ merupakan kawasan industri dengan kontribusi signifikan terhadap pengolahan nikel nasional. Kawasan ini menampung lebih dari 80.000 tenaga kerja. Namun, implementasi sistem transportasi karyawan (*employee bus*) yang efektif masih menjadi tantangan dengan tingginya jumlah keterlambatan dan ketidakteraturan rute.

Penelitian ini bertujuan untuk merancang sistem rute bus karyawan berbasis kombinasi simulasi mikroskopik dengan menggunakan perangkat lunak **Simulation of Urban Mobility (SUMO)** dan metode heuristik *Greedy Algorithm*. Perancangan melibatkan lima skenario simulasi, yang mencakup variasi pola rute, penggabungan rute ganda dan individual, serta skema pengelompokan titik penjemputan dan pengantaran. Evaluasi dilakukan berdasarkan indikator jarak tempuh sertaketepatan waktu. Metode perbandingan digunakan untuk menentukan skenario terbaik berdasarkan jumlah keterlambatan dan waktu tempuh maksimum,.

Hasil penelitian menunjukkan bahwa skenario kelima yang mengimplementasikan penggabungan rute terpendek dan rute individual dengan pembatasan titik tujuan >1 km mampu menyelesaikan seluruh perjalanan secara tepat waktu. Selain itu, waktu tempuh rata-rata juga berhasil ditekan hingga 2391 detik. Perancangan ini memberikan kontribusi terhadap efisiensi sistem transportasi internal kawasan industri serta dapat diadopsi dalam pengembangan kebijakan transportasi berbasis data spasial dan simulasi realistis.

Kata Kunci : Kawasan Industri, *Employee Bus*, *Greedy Algorithm*, SUMO, Perancangan Rute, Simulasi Mikroskopik

ABSTRACT

Industrial zones play a crucial role in boosting the contribution of the manufacturing sector to the national Gross Domestic Product (GDP), particularly within the framework of Indonesia's 2045 industrial vision. PT Indonesia XYZ Industrial Park (PT XYZ) is one of the country's most significant industrial areas, contributing substantially to national nickel processing and employing over 80,000 workers. However, the implementation of an effective employee bus transportation system remains a challenge due to frequent delays and irregular route patterns.

This study aims to design an optimized employee bus routing system by combining microscopic traffic simulation using the Simulation of Urban Mobility (SUMO) software with a heuristic-based Greedy Algorithm. The route planning covers five simulation scenarios, incorporating variations in routing patterns, the integration of dual and individual routes, and grouping strategies for pick-up and drop-off points. Evaluation is conducted based on key performance indicators such as travel distance and timeliness. A comparative analysis approach is used to determine the best-performing scenario based on delay counts and maximum travel time.

The findings reveal that the fifth scenario, which integrates the shortest route combinations with individual routes while restricting destination points to >1 km, is able to complete all trips on time. Furthermore, the average travel time was successfully reduced to 2,391 seconds. This routing model contributes to improving the efficiency of internal transportation systems within industrial zones and offers a scalable solution for developing data-driven, spatially-aware transportation policies through realistic simulation.

Keywords: Industrial Zone, Employee Bus, Greedy Algorithm, SUMO, Route Design, Microscopic Simulation