

## PROJECT SUMMARY

The management of oil waste is a critical concern in the energy sector, requiring efficient logistical solutions to minimize environmental impact and operational costs. Traditional methods of route planning for waste collection trucks often result in suboptimal paths, leading to increased fuel consumption and greenhouse gas emissions. To address these issues, advanced optimization algorithms are necessary to enhance the efficiency of waste collection routes.

This project presents a Hybrid Particle Swarm Optimization and Simulated Annealing (HPSOSA) algorithm designed to solve the Multiple Traveling Salesman Problem (MTSP) for oil waste management. The HPSOSA algorithm combines the global search capabilities of Particle Swarm Optimization (PSO) with the local search proficiency of Simulated Annealing (SA) to optimize the routes for multiple waste collection trucks. The objective function, focused on minimizing the summation of distances traveled by the fleet, was implemented and tested using a dataset of geographical coordinates. The algorithm was developed and executed in PyCharm, ensuring optimal performance and accuracy in solving the MTSP. The optimized routes were then exported dynamically to CSV files, each corresponding to a specific driver, and imported into a Flutter-based mobile application built in Android Studio for real-time route tracking.

The system was rigorously tested using various datasets from CVRPLIB to validate the efficiency and robustness of the HPSOSA algorithm. The mobile application effectively displayed the optimized routes on a map, assigning unique IDs to each driver for clarity. This comprehensive solution not only reduced the total distance traveled by the fleet but also contributed to significant fuel savings and lower emissions. The combination of PyCharm for algorithm development and Android Studio for mobile app deployment provided a seamless integration of optimization and real-time tracking, demonstrating the potential of HPSOSA in revolutionizing oil waste management logistics.