# Project Title: Vehicle Tracking & Maintenance System for Adom Logistics

# Introduction

Adom Logistics, a freight transport company in Tema, faces operational inefficiencies due to manual vehicle and delivery tracking. This project aimed to create a fully offline, console-based Fleet Management System to automate vehicle monitoring, driver assignments, maintenance scheduling, and delivery tracking using core data structures without external libraries or APIs.

# Data Structures and Algorithmic Justification

* + HashMap: Used for storing vehicle records for O(1) average-time retrieval.
  + Queue: Used for managing available drivers in FIFO fashion.
  + LinkedList: Used to track active deliveries and allow status updates and rerouting.
  + Min-Heap: Schedules maintenance by prioritizing vehicles based on mileage or last service.
  + Sorting Algorithms: Insertion, Merge, and Quick Sort implemented manually for organizing vehicles by mileage, driver name, and fuel usage respectively.
  + Binary Search: Used for efficient search of vehicles by registration number.
  + File I/O: Ensures data persistence using .txt files for offline operation.

# Time and Space Complexity Analysis

|  |  |  |
| --- | --- | --- |
| **Module** | **Structure/Algorithm** | **Time Complexit** |
| Vehicle DB | HashMap | O(1) |
| Driver Queue | Queue | O(1) |
| Deliveries | LinkedList | O(1) |
| Maintenance | Min-Heap | O(log n) |
| Sort Mileage | Insertion Sort | O(n^2) |
| Sort Name | Merge Sort | O(n log n) |
| Sort Fuel | Quick Sort | O(n log n) avg |
| Search Reg. No | Binary Search | O(log n) |

# Algorithmic Modeling of Dispatcher Decisions

The logic used mirrors how real-world dispatchers operate:

* + Drivers are queued and dequeued in the order of availability.
  + Deliveries can be updated or rerouted if conditions change.
  + Vehicles are maintained based on critical usage thresholds.
  + Decisions are modeled using algorithms rather than hardcoded sequences, reflecting how intelligent dispatch systems behave.

# Reflections and Challenges

The project challenged us to apply our knowledge of data structures in a realistic context. Avoiding external libraries pushed us to manually implement core algorithms. The biggest challenge was synchronizing file storage with live updates and ensuring consistent data between runs. We also gained insights into algorithm efficiency and real-world software design.

# Group Member Ratings

Each member was rated based on their contribution, attendance, coding participation, and teamwork.

|  |  |  |  |
| --- | --- | --- | --- |
| **NAME** | **ACTIVITIES** | **% CONTRIBUTION** | **ATTENDANCE** |
| **Nyamekye Korsah (11353306)** | Vehicle Module & File I/O | 92% | 5/5 |
| **Javis Frimpong (11285447)** | Delivery Module (LinkedList), Sorting Reports | 87% | 5/5 |
| **Bernard Mensah Afful (11253585)** | Driver Assignment (Queue), Binary Search | 78% | 4/5 |
| **Richmond Andoh (11254304)** | Project Coordination, CLI Menus, Maintenance Heap | 95% | 5/5 |
| **Steve Paa Kwesi Koompah (11276276)** | Fuel Reports, Manual Sorting Algorithms | 80% | 4/5 |
| **Fadhlu Abdul Jaleel (11352433)** | Testing, Debugging, Module Integration | 85% | 5/5 |
| **Desmond Owusu Ansah (11029640)** | README, Final Report, Presentation Slides | 88% | 5/5 |

# Conclusion

This project showcases the application of core data structures in solving real-world logistics problems. It emphasizes algorithmic thinking, problem-solving, and technical collaboration. We believe the system we built not only meets the functional requirements but also reflects a solid understanding of Data Structures and Algorithms II.