**Project Title : Autonomous Vehicle Navigation and Product Loading in a Warehouse**

Project Overview

This C++-based Autonomous Vehicle System will allow autonomous robots to navigate a warehouse, locate a specific product, and load it for transportation using file handling and pathfinding algorithms.

The system will:

* Store warehouse layout and product locations in a file
* Read orders and determine the shortest route to the product
* Guide an autonomous vehicle to the correct location
* Simulate product loading and movement to the delivery point

The project will improve warehouse efficiency, reduce human labour, and speed up order fulfilment.

**Problem Statement**

* Challenges in Warehouse Automation
* Modern warehouses face several challenges:
* Manual searching for products increases time and labor costs.
* Inefficient navigation leads to delays in product retrieval.
* Unoptimized route planning wastes energy and increases wear on robots.
* Errors in order fulfillment lead to customer dissatisfaction.

**Solution**

An autonomous vehicle navigation system that:

* Uses file-based warehouse mapping to find product locations.
* Applies pathfinding algorithms (A\*, Dijkstra) to determine optimal routes.
* Loads the requested product automatically and transports it efficiently.
* Reduces errors and increases efficiency in order fulfilment.

**Business Requirements-Objectives**

* Automate warehouse navigation for product retrieval.
* Minimize product retrieval time by using shortest path algorithms.
* Ensure accurate order fulfillment by reading order details from files.
* Reduce human labor costs by enabling autonomous product loading.

**System Requirements**

Warehouse Layout Storage – Warehouse grid with shelf locations stored in a CSV file.

Order Processing – Orders are read from a file, specifying the product and destination.

Autonomous Navigation – The vehicle calculates the optimal route to the product and loading area.

Product Loading – The vehicle loads the product onto itself and moves it to the delivery point.

Warehouse Data Storage (File Structure)

Warehouse Layout File (warehouse\_layout.csv)

Stores product locations within a grid-based warehouse system.

Orders File (orders.csv)

Stores customer orders for processing.

**Key Features & Functionalities**

**Core Features**

* Read warehouse layout from a file to get product locations.
* Read order details from a file and determine the product location.
* Implement shortest path navigation (A or Dijkstra’s Algorithm)\*.
* Simulate product loading once the vehicle reaches the location.
* Guide the vehicle to the destination point for order delivery.

**Advanced Features**

* Real-time tracking of vehicle position on a warehouse grid.
* Collision avoidance system to prevent accidents with other robots.
* Dynamic product location updates when new stock arrives.

**Expected Benefits**

* Reduces warehouse navigation time by 50% using optimized routes.
* Improves order fulfillment accuracy through automated product retrieval.
* Minimizes manual labor costs by using autonomous robots.
* Optimizes warehouse storage management with real-time updates.