

PROJECT ABSTRACT

Course Code:22AIE442

Course Title: Robotic Operating Systems & Robot Simulation

Project Title: Swarm Robotics for Logistical Transportation Hub

Team: 10

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Introduction

Logistics transportation is a critical aspect of modern supply chains, with the efficiency of moving goods directly affecting operational costs and delivery times. In tightly constrained environments, such as e-commerce fulfillment centers and grocery stores, the challenge intensifies as space limitations and traffic congestion slow down the flow of goods. As demand for faster, more efficient systems grows, traditional methods struggle to keep up with these logistical challenges. Two key areas that face these issues are large warehouses, like those of Amazon, and automated grocery stores, where goods need to be picked, sorted, and transported rapidly and efficiently.

Project Proposal

This project proposes a swarm robotics-based solution to improve the transportation of goods within space-constrained environments like Amazon warehouses and grocery stores. Swarm robotics, utilizing decentralized control and collaborative decision-making, can effectively navigate tight spaces, avoid traffic, and streamline the flow of goods between designated depots.

Objective of the Project

The objective is to develop a swarm robotics system capable of autonomously transporting goods efficiently in environments with limited space. This system will optimize the movement of goods, ensuring that robots can avoid congestion, replan

routes dynamically, and improve overall transportation efficiency in both warehouse and grocery store settings.

Application of Swarm Robots

In this system, robots will autonomously navigate the environment, picking up and delivering goods between pickup and drop-off depots. In a warehouse, robots will handle packages arriving at an entry point, sorting them for storage or shipment. In the grocery store scenario, robots will retrieve items from storage shelves and deliver them to checkout or customer pickup stations. Swarm robots will work collaboratively, adjusting their routes in real time to avoid collisions and congestion, making them adaptable to the dynamic and space-constrained nature of these environments.

Prototype Explanation

The prototype will feature a small-scale environment with three pickup depots and three drop-off depots, simulating both warehouse and grocery store layouts. Robots will navigate through narrow aisles, handling the efficient movement of goods while avoiding traffic. The prototype will be tested in a simulated environment to evaluate its performance, focusing on route optimization, traffic avoidance, and task allocation.

Scope of the Project

This project aims to demonstrate the effectiveness of swarm robotics in improving logistical operations in confined spaces, such as warehouses and grocery stores. The prototype will serve as a proof of concept, with potential applications extending to broader logistics, retail automation, and other industries where space constraints hinder efficiency.

