Thesis Project Summary

Topic: Multi-Agent Swarm Robot Simulation
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Status: On-going

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1. Introduction

Swarm robotics is a branch of multi-agent systems inspired by the collective behavior of natural swarms, such as ants, bees, and birds. It focuses on designing self-organizing robotic systems that achieve tasks through local interactions. In modern automation, swarm robotics is important in areas like disaster response, environmental monitoring, industrial processes, and military applications. This research is significant in improving the coordination of robotic swarms in dynamic environments. The objective of this study is to develop a multi-agent swarm system that enhances communication, task coordination, and autonomous decision-making, addressing key challenges in robotics and artificial intelligence.

2. Research Objectives

- To develop a multi-agent robotic system capable of cooperative formation.
- To implement swarm intelligence algorithms for control.
- To evaluate the system's performance in simulated and real-world scenarios.

3. Methodology

- Swarm Intelligence Algorithms: Flocking behavior
- Communication Strategies: Graph theory
- Control Mechanisms: Improved Advanced Potential Field
- Simulation & Hardware Implementation: Python

4. Expected Outcomes

- A working prototype demonstrating swarm behavior in a defined environment.
- Comparative analysis of formation efficiency.
- Contribution to industrial and research applications (e.g., search and rescue, surveillance, environmental monitoring).

Keywords: Multi-Agent Systems, Swarm Robotics