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## Introduction or Abstract

The idea is to use swarm robotics to simulate a warehouse model. Using Aruco markers to keep track of the bots and boxes, and obtain coordinates in the workspace. Camera suspended on top of the workspace is used to map and visualize it and determine the locations of the various components present. The next step is task planning, where a specific task of transporting a specific box is assigned to each bot. It is followed by path planning, where optimal non intersecting paths are determined for each bot so as to finish the task as quickly as possible without colliding in space and time frame. A feedback controller using PID is implemented on each bot so that it moves along its predefined path and achieve its task.

## Objectives

Explore the field of swarm robotics and implement a group bots that collectively undertake a task of transporting boxes from one place to another.



## Tools & Techniques Learned

### Tools Used:
- Soldering
- Laser Cutting
- Drilling
- Electronics - esp32

### Software Used:
- A* Algorithm
- Task Planning
- Communication using Server via requests
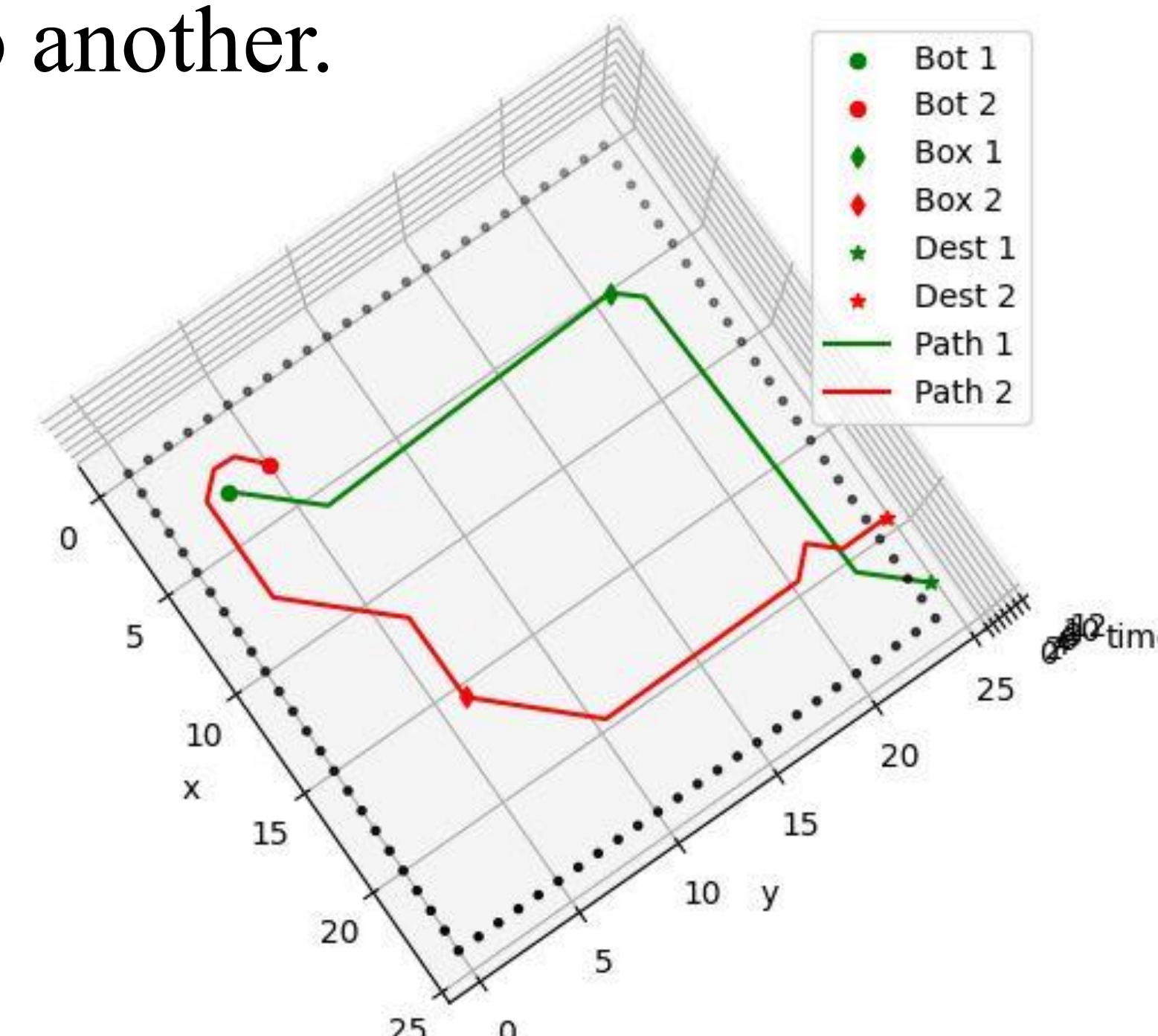- PID Control
- Aruco Marker Detection
- ThunderWorks

## Future Plan

- ❏ Increase the number and reduce the size of the bots.
- ❏ Implement better control methods.
- ❏ Research and implement more optimal and faster algorithms.
- ❏ Work on a better gripper mechanism to handle cargo more efficiently.
- ❏ Extend the capabilities of the swarm robots to operate in dynamic and changing warehouse environments.
- ❏ Explore the integration of advanced sensing technologies like LiDAR, computer vision

## Results

- ❏ Constructed 3 microcontroller bots with an electromagnetic picking mechanism.
- ❏ Implemented the path and task planning algorithms (*A* Algorithm*).
- ❏ Detected aruco markers using camera module and localized the bots and cargo.
- ❏ Achieved connection of all the bots over a common centralized WiFi.
- ❏ Fine-tuned the PID parameters to align the actual robotic path with the trajectories simulated in the theoretical model.

GITHUB LINK : For animations and code
https://github.com/vighnesh-nayak-203/ITSP-2023