Library Autonomous Robot Service (L.A.R.S.)

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Project Group 11

Problem Statement

Automating restocking of items in a grocery store takes a lot of effort. Checking for items whether they are present on the shelf or if they have expired. Disposing them or bringing them back from the inventory while finding the best paths in a dynamic environment. This requires a solution that is optimal to improve customer satisfaction and the store's revenue.

Changed to:
Automating the organization of books in a library takes a lot of effort. Checking for items whether they are present around to be organized can be a challenging task while finding the best paths in a dynamic environment. This requires a solution that is optimal to improve efficiency and makes a librarian's life easier.

Motivation

How many times did you go to a grocery store looking for an item to find out that it's out of stock and not on the shelf? Practically every person has gone through this. Grocery stores tend to take a long time from the time an item goes out of stock until the time it's restocked again. It involves a human being going to the shelves and check if an item is missing or not. Then go back to the warehouse, find that product and bring it back to the shelf. Using robots, we can automate the system to make the process less cumbersome.

Changed to:
Imagine you are a librarian and your job is to re-organize all the books people leave lying around randomly after they are done.You need to pickup the book and put it in its place. You also need to keep track of any new books being randomly left around. You need to also make sure you take the best path to place the book in its place. Using robots, we can automate the system to make the process less cumbersome.

Approach

Environment: Store, Customers (bots), shelves (removing and adding items), trucks (loading stock) and restocking bot.

Changed to:
Library with books lying around, bins(for placing books), random book spawner and book organizing bot (TurtleBot3 Waffle).

Algorithms: Determining the best path for the robot towards a book and then to the designated bins. An ideal path avoids any obstacles in the form of randomly spawned books and travels from the source to destination in the shortest time. In cases when there is no viable path, we introduce a wait state. Use Searching algorithms like (A*, BFS and others) and also develop heuristics to select the best path to the destination.

Metrics to check:

- Number of nodes expanded
- Time for which a shelf stays empty
- Time taken to travel from truck to shelf
- Compare different heuristics

Changed to:

- Books are picked and placed in an efficient order
- Time effective
- Places all books and avoid starvation
- Smartly calculates path

Task Assignment

1. Simulating efficient dynamic spawning of books (Arpith and Khalid)
2. Designing new services (Arpith and Manish)
3. Design a priority metric to pick and place books (Manish)
4. Create new .sdf files for books and .srv files for new services (Arpith and Manish)
5. Dynamic path recalculation for obstructed paths (Tanush)
6. Allow spawning of books only at integer points on the grid (Khalid)
7. Developing the path-finding algorithm (Tanush and Arpith)
8. Creating data structures to dynamically allocate object information efficiently (Khalid)