AME 547 Final Project

Automatic Product Placement Robot System (APPRS)

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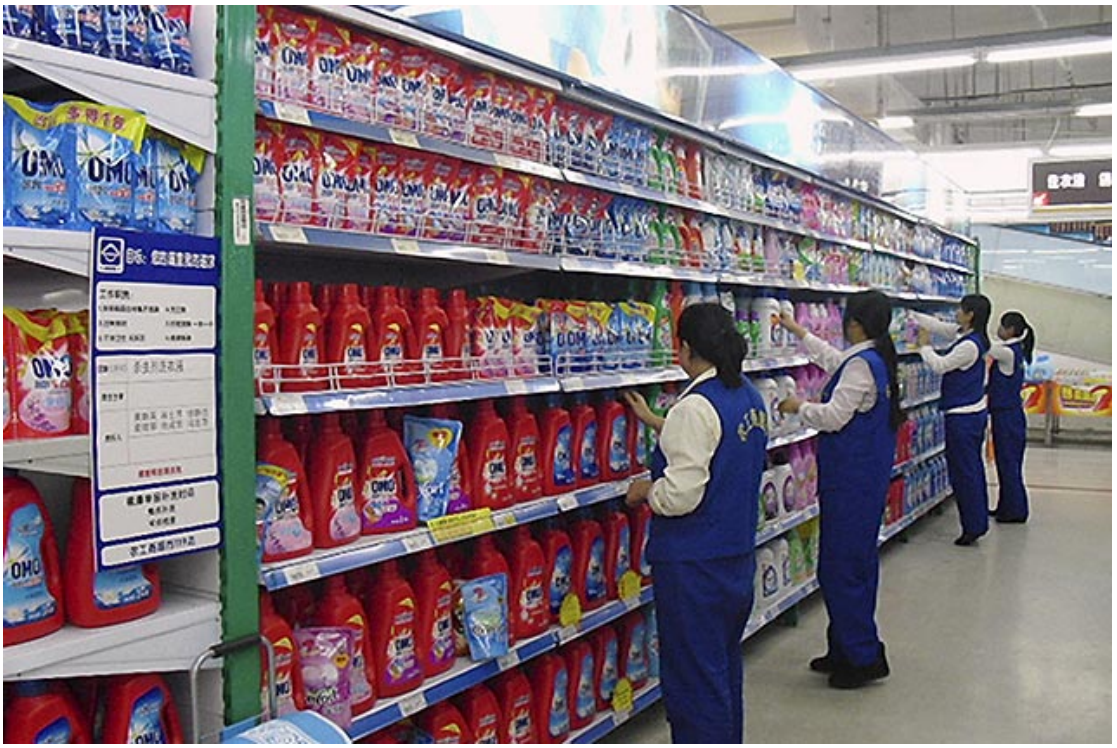
1. Motivation and Background



Nowadays, Supermarkets are everywhere in our lives. They ensure our daily supplies.

The human cost of a supermarket consists mainly of the cashier and the staff to tidy the product shelf.

Our team wants to design a robot which can replace those staff to tidy the product. In this way, the supermarket can save a lot of human cost.

2. Project Description

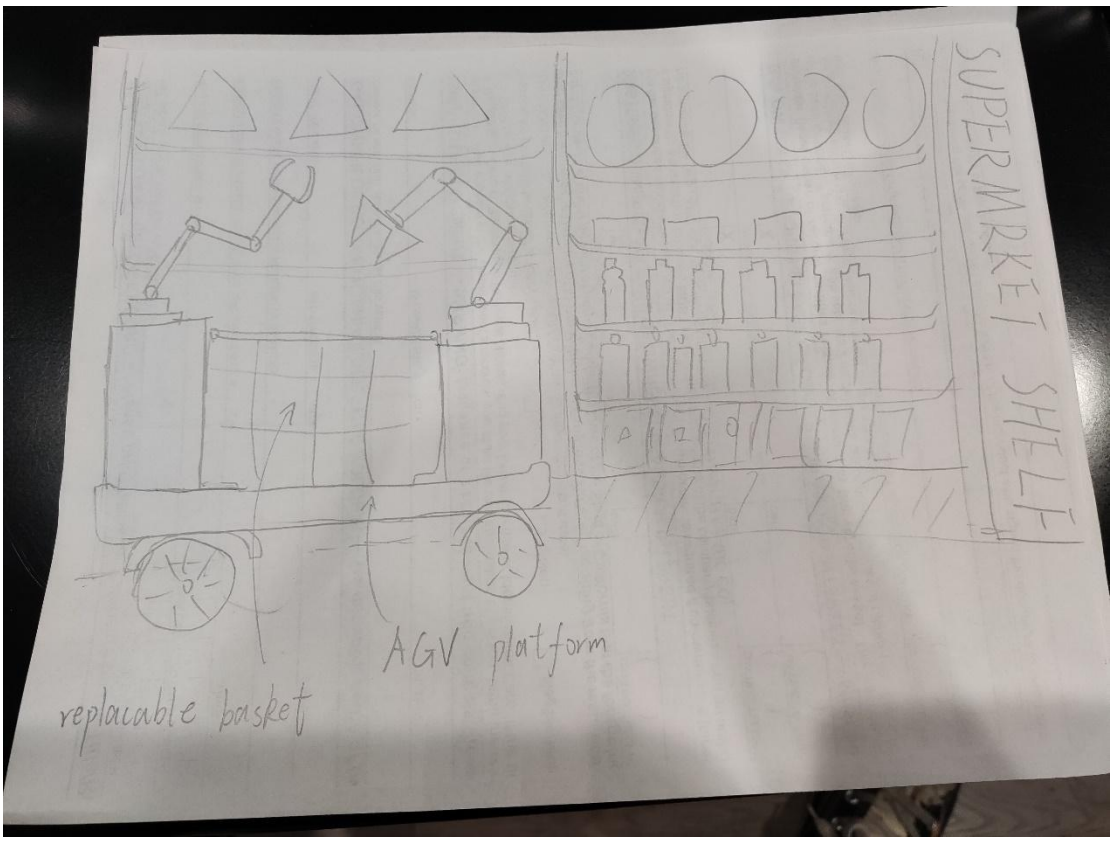


figure 1: Stech for our design

We want to design an AGV platform mounted with a replaceable basket and two 6-DOF robot arms. It aims to take the supermarket staff's work.

It can recognize the product in the basket accurately. Then catch the proper part of the product and put them to the right place of the shelf.

It can not only deal with small products like snacks or dairy supplies, but also some large products. In the second situation, two robot arms will operate collaboratively so that they can produce a huge force to lift up those heavy things.

Furthermore, big supermarkets always have many fresh-keeping cabinets with a door. Our robot can easily put products into those cabinets with two arms collaboration, one arm opening and holding the door and the other putting product into the cabinets

In a word, our robot can Completely replace human labor in arranging products. With our robot's help, supermarkets can save a lot of human resources.

3. Project Goal

A. Auto drive platform. The base unit of the whole system.
B. Organize the shelves
C. Place the goods onto the shelves depending on different shape or work type

1. **Type 1: Single arm**.Simple things like beverages, snacks, etc, which are light weight and small volume.

   Works could be done by only a single robot arm. Changing the grab method depending on its shape.

2. **Type 2: Double arm:** Large goods like a pack of bottle water, watermelon, a pack of roll paper.

   Because of the limitation of volume or weight, a single arm could not work very well. In this case we need two or more arms to cooperate together .

3. **Type 3: Double arm event system:** Goods like milk, juice, yogurt, ice-cream, etc, which are placed into the refrigerator or window.

   One of the robot arm is used to open the door and the other one could place the goods into their place

4. Project Key Point

(1) Collaboration of two robot arms.

(2) Path planning for the robot arm from grabbing the product to placing it into the right place.

(3) Decision making of choosing different work methods according to the situation.

5. Plan and Work Division

Step 1 Preparation (Goal A)

- Drawing models for auto drive platform and robot arm
- Establish the auto drive control algorithm

Step 2 Single arm (Goal C-1)

- Develop the inverse kinematic and dynamic method for single arm **(By 10/31/2022)**
- Establish trajectory planner for single arm**(By 11/07/2022)**

Step 3 Double arms (Goal C-2) (By 11/17/2022)

- Base on single arm, build double arms trajectory planner and its dynamics

Step 4 Event System (Goal C-3) (By 11/25/2022)

- Establish event planner