COMPA - COMPRA
Autonomous Shopping Cart

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Abstract

Compa-Compra is an autonomous shopping assistant that guides and assists the store user to complete their shopping easily and simply. The user communicates with ComCom through an application where products are specified. **Make your list and ComCom will guide you!**

1 Introduction

The act of shopping is a daily activity, but it is not always efficient. Whether due to the difficulty of finding products, congestion in the aisles, or the need to compare options, navigating the supermarket can become a tedious task. **Compa Compra** is an autonomous assistant designed to improve the shopping experience for any user, regardless of their profile, age, or specific needs.

Through a multimedia application, the customer enters their shopping list, and the ComCom robot processes the best route within the establishment using advanced localization and path planning techniques. Thanks to the **D* Lite** algorithm and the use of **Bluetooth** beacons, **Compa Compra** optimizes shopping time and facilitates efficient access to each product.

2 Theoretical Framework and Contextualization

The **CompaCompra** project is based on two key areas of robotics and autonomous navigation: **2D localization** using trilateration and route planning with **D* Lite**. These concepts allow the assistant to guide the user within the supermarket with precision and adaptability.

2.1 2D Localization

One of the main challenges of autonomous navigation is **indoor localization**. To determine **ComCom**'s position, 2D trilateration is used with four fixed Bluetooth beacons in the corners of the supermarket.

The method uses the measurement of the **Received Signal Strength Indicator (RSSI)** from each beacon to estimate the distance between the robot and the fixed references. However, the RSSI signal can be affected by interference, so **filtering and error correction** techniques, such as moving average and Kalman filter, are applied.

Once the estimated position (x, y) is obtained, it is adjusted to the nearest supermarket grid cell, defined as a mesh of **0.5m² per node**. This process allows for a discrete representation of the navigation space and facilitates route calculation.

For more information on trilateration, consult the documentation: Trilateration on Wikipedia

2.2 Path Finding Algorithm: D* Lite

The optimal movement of the robot is managed by **D* Lite**, an efficient route-finding algorithm in dynamic environments. Based on the user's position and the products on the shopping list, the system calculates the ideal trajectory on the node grid.

Each node in the supermarket can be classified as:

- **Free:** traversable areas without obstacles.
- **Occupied:** areas blocked by shelves, obstacles, or other customers' carts.

Initially, all known obstacles are considered, but the path is **dynamically recalculated** if **ComCom** detects new impediments during its journey. This allows the robot to adapt in real-time to changes in the environment.

For more information on **D* Lite**, consult the documentation: D* Lite on Wikipedia

3 Description of the CompaCompra System