Mobile Robot Project

Vision-Guided Obstacle Detection and Navigation for Autonomous Robots

Course Title: Engineering computer Applications (E1223)

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Section: 1

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Introduction:

This project focuses on detecting obstacles in an image, correlating them with sensor data, and planning a safe navigation path for a robot while avoiding these obstacles. The steps involve image processing, sensor data acquisition, data analysis, and path planning using the Rapidly-exploring Random Trees (RRT) algorithm.

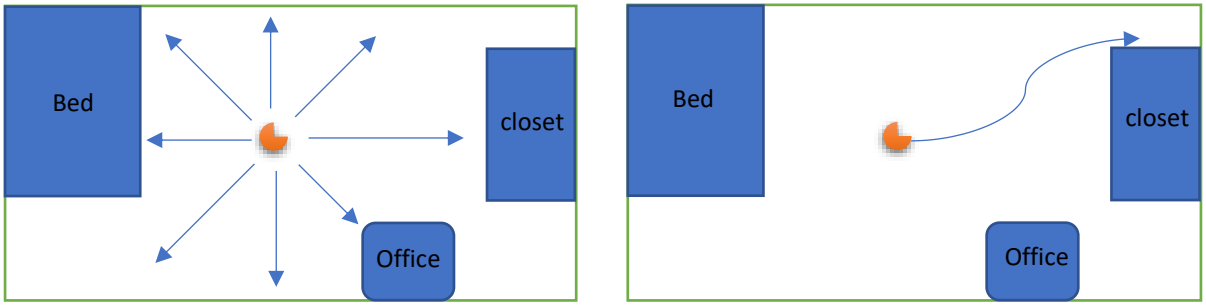
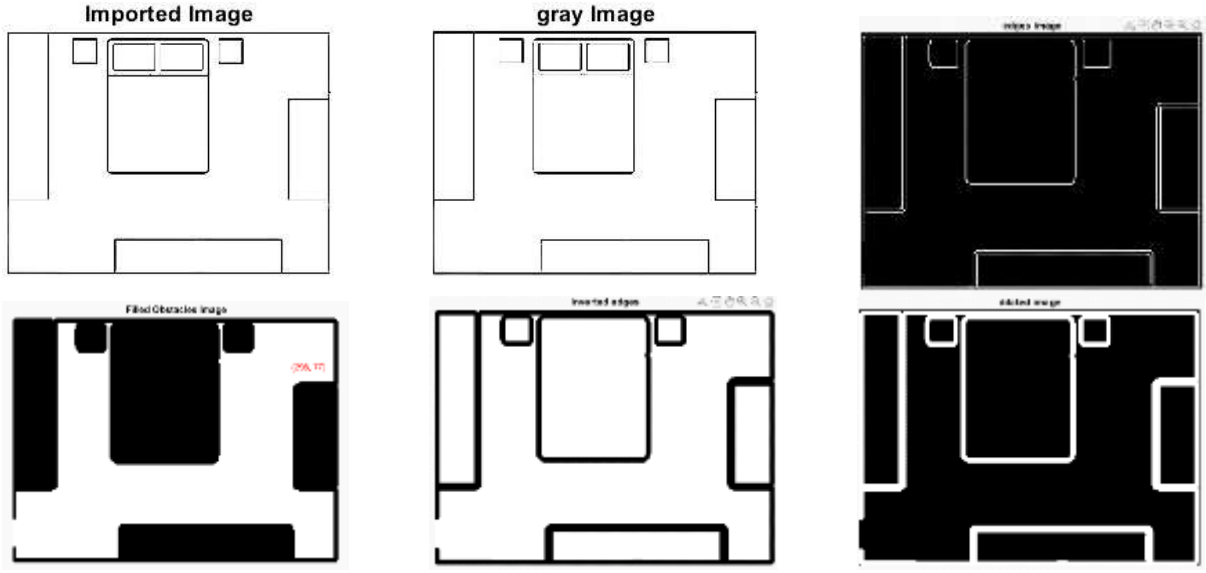


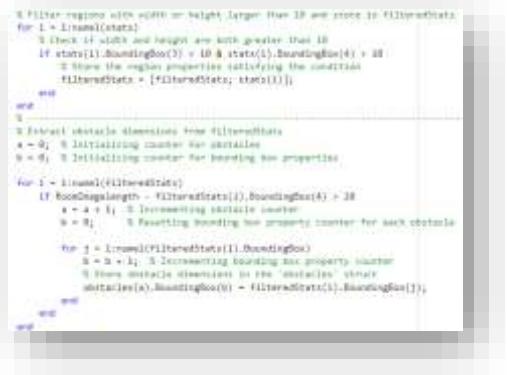
Image Processing:

The project starts by reading an image selected by the user. Various image processing techniques are applied to this image, including:

- Conversion to grayscale.
- Edge detection using the Canny algorithm.
- Dilation of edges to enhance detection and filling the obstacles.



Detection of Rectangles (Obstacles):



Region properties are utilized to identify closed rectangles within the image. These rectangles are considered potential obstacles.

Filtering is performed to remove rectangles that might not accurately represent obstacles based on size and other criteria.

All identified obstacles in the image are filled to properly represent them.

Scaling and Dimension Mapping:

Detected obstacles' dimensions in the image are scaled to represent their real-world dimensions using a known conversion factor.

Real dimensions of the detected obstacles in the image are recorded for further analysis.

Sensor Data Acquisition and Analysis:

Sensor data, likely obtained from an external device (Arduino or similar), is read and stored in an Excel file. MATLAB processes this data, including angles and distances measured by the sensors.

Data analysis includes statistical measures to identify and correct any anomalies or deviations in the readings.

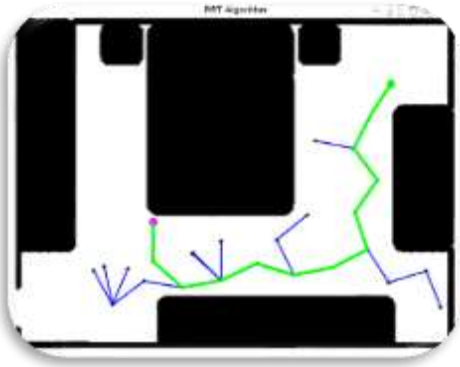
Sensor Data and Image-Detected Obstacles Comparison:

The project compares the dimensions obtained from sensors with the dimensions of obstacles detected in the image.

It identifies the closest matching sensor data to the image-detected obstacles.

Robot Navigation (RRT Algorithm):

The RRT algorithm is implemented for robot navigation, planning a collision-free path.

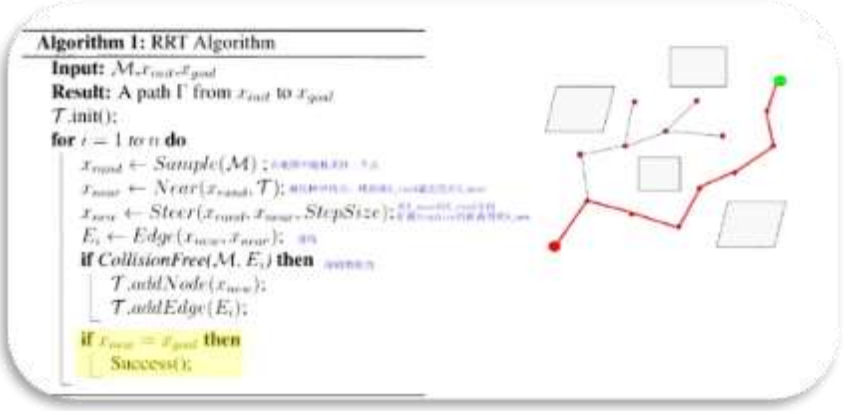


Starting and goal points for the robot's path planning are set based on the detected obstacles and sensor data.

The algorithm iterates through random points, building a tree structure to plan an obstacle-avoiding path.

Path Visualization:

The planned path from the starting point to the goal, avoiding obstacles detected in the image, is visualized.



Conclusion:

The project integrates image processing, sensor data analysis, and path planning algorithms to facilitate obstacle detection and robot navigation. By combining image-detected obstacles with sensor data, the robot navigates safely through an environment, avoiding obstacles based on the information gathered from both sources.

This multi-step process ensures comprehensive obstacle detection and safe path planning for efficient robot navigation in complex environments.