Autonomous Greeting and Guidance Robot

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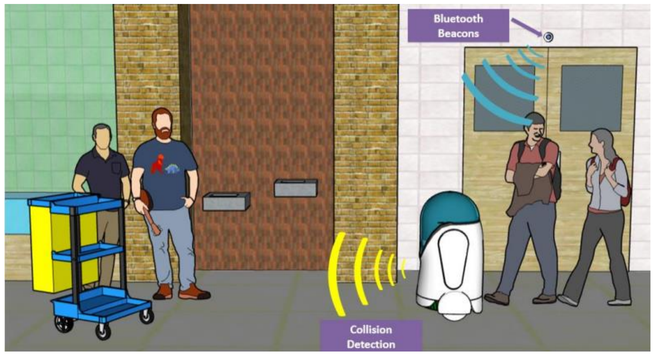
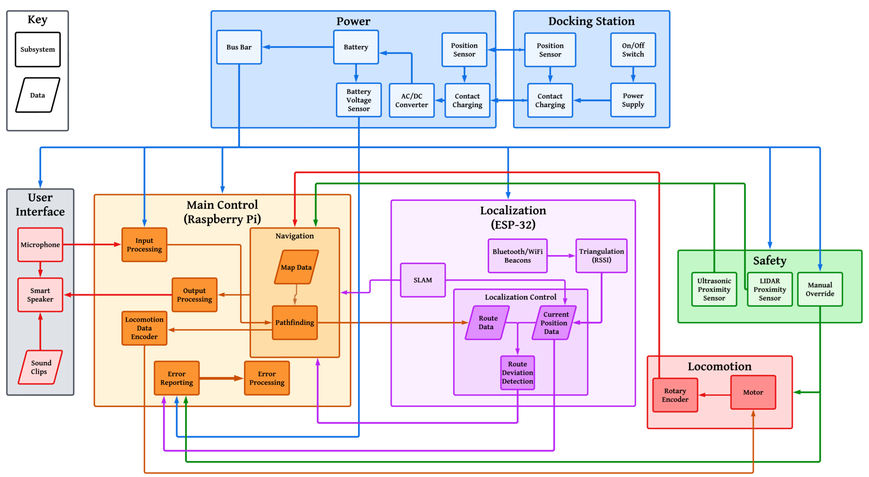
Abstract

The objective of this project is to design and develop a robot that can autonomously greet and guide people to their desired room within the new Ashraf Islam Engineering Building. The team's objective is to establish the basic functions of the robot. The basic functions include safety, power, human interaction, and navigation.



Design

- **User Interface** - This is composed of a voice command system.
- **Localization** -The localization system was designed to provide the location of the robot within the building by utilizing the wireless beacons alongside a LIDAR.
- **Main Control** - The brains of the robot which is the Raspberry Pi.
- **Locomotion** - Consists of a motor control system.
- **Safety** - Composed of the near-field proximity sensors, which will detect objects that come into range of the robot and alert the system to stop.
- **Power** - Uses contact charging to recharge the robot and provide sufficient power to the robot's systems

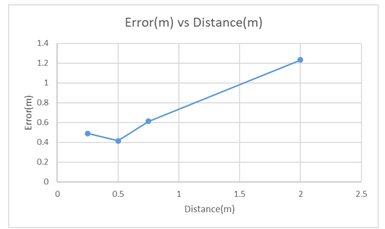


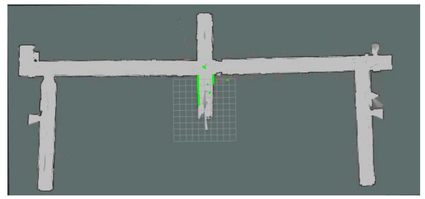
Experimentation & Results

We tested the robot's response to voice commands by providing spoken locations to the robot and observing that it moved to the desired locations.

In order to test navigation and safety functionality, we placed obstacles and people in the environment surrounding the robot and confirmed the robot was able to avoid collision while navigating its environment.

To test location accuracy, we tested the accuracy of Bluetooth beacon distancing instead of UWB and concluded that the error and variance of the measurements was too high to be a viable option for localization purposes.





LIDAR Map of the First Floor of Prescott Hall

Specifications

- Navigate from one position to another position independently
- Locate itself with a positional error less than 15 cm
- Be controlled using voice commands
- Prevent collisions with people or obstacles as much as possible
- Recharge itself without the need of human interaction

Highlights

The motors ended up having the largest impact on the design. We lacked a mechanical background, so we did not have much knowledge on how to go about picking a motor. We figured out a roadmap for upgrading the motors with the help of Mr. Tristan Hill and learning a lot of new information regarding DC motors overall.

Acknowledgements

The team would like to express thanks to Dr. Charles Van Neste for providing his guidance and knowledge through the course of the project. Additionally, thank you Dr. Andy Pardue for being the customer and providing the group another LIDAR sensor. Furthermore, special thanks to Tristan Hill and Dr. Stephan Canfield.

Future Work

Possible feature that can be included would be replacing the contact charging system with a wireless charging system. This would make it easier for the robot to charge itself without needing to be in an exact position and orientation. Another improvement would be the implementation of Ultra-wideband beacons to increase the accuracy of the robot's positional detection.