Self-Locomotive Spherical Rolling Robot for Social Interaction

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Abstract

The spherical rolling robot propels itself through the rotation of its outer shell, and this rolling action is driven by the motion of internal omni-directional driving wheels. This layout allows the robot to have responsive movement and grant it the ability to make point-turns or turns where the robot can rotate while remaining in place. The robot's design is intended to also be semi-autonomous, allowing it to be capable of moving through a space on its own without the need for manual control by a human operator.

Introduction

The Senior Design Team has designed and built a moving mechanism housed in a spherical shape that enables the mechanism to move in a desired direction at a desired speed and with a desired degrees of maneuverability . The purpose of this design was to offer a form of interaction for individuals who are struggling adapting to the social isolation effects caused by the Covid-19 pandemic. The robot's design is intended to also be semi-autonomous, which means that it should be capable of moving through a space on its own without the need for manual control by a human operator. To facilitate this, the robot's outer shell is made of a clear plastic to allow internally mounted sensors to operate, granting the robot the ability to be aware of its own environment and perform simple obstacle avoidance. However, the robot remains capable of being guided manually by a human.

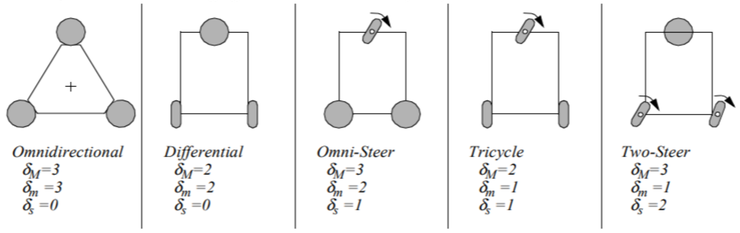

Figure 1: Degrees of maneuverability of three wheeled mobile robots

Methods and Materials

Vast amounts of components were required within this design to allow for successful communication amongst the microcontrollers, single board computer, and sensors shown below in figure 2.

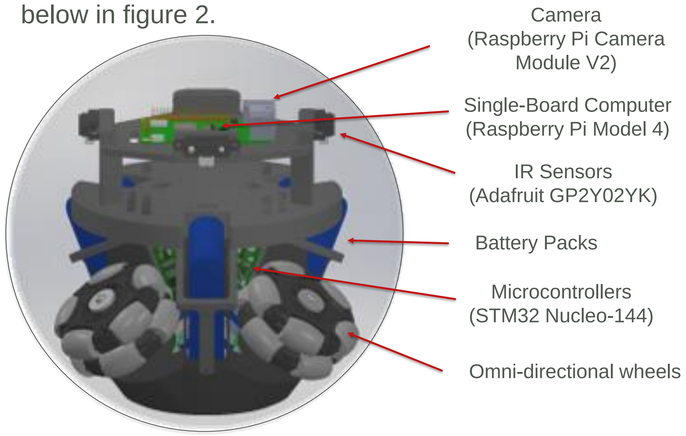

Figure 2: Fully Assembled Design

Many phases of programming were put into place to allow for successful communication amongst the microcontrollers, sensors, and single board computer. The process can be seen below

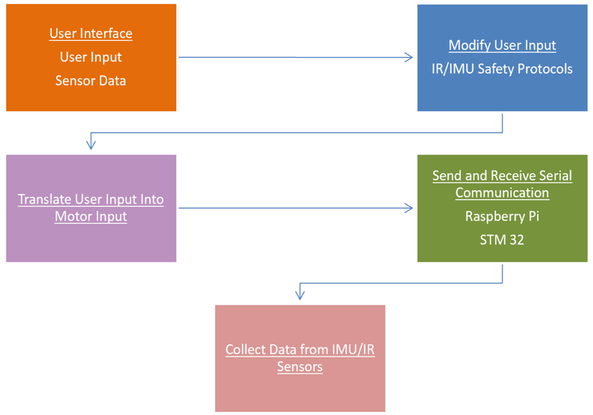

Figure 3: Programming Phase Diagram

Results and Discussion

The robot was able to spin its driving wheels utilizing simple test programming. Incorporating the microcontrollers and single-board computer became the main hurdle to overcome, exporting work from a computer program to inside the robot. The motion is still simple, but it is capable of the desired movement by the client.

Work was hampered by material acquisition issues throughout the semester, but the team was able to overcome it handily. Testing was conducted in the home of a group member on carpet and wood flooring, as this was gauged to be the average operating surface.

Conclusions

The spherical shaped rolling robot provides a form of interaction for individuals who are struggling adapting to the social isolation effects caused by the Covid-19 pandemic. Through the incorporation of various sensors and components, microcontrollers, and a single board computer, the ability to alleviate some mental health issues potentially caused from isolation by providing a form of interaction is now possible

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