

Introduction

A collaborative robot system is a collection of robots that work together to complete an unmanned mission. By eliminating the need for human controllers, error can be minimized, resulting in greater efficiency. CARE (Cooperative Autonomous Robot Exploration) aims to extend on existing robotic systems, such as NASA's Perseverance and Ingenuity Helicopter, with the goal to effectively explore uncharted areas in GPS denied environments. Our project aimes to demonstrate the capabilities and benefits of a collaborative robotic system using Ultra Wide Band Technology.

Ultra Mide Band

Ultra Wide Band (UWB) is a type of radio technology that can be used to accurately measure distance. Using the time of flight of the radio signal and the speed of light, the distance between to UWB modules can be measured. Using this basic principle, the location of the rover relative to the drone can be found.



Cooperative Autonomous Robot Exploration

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System Overview The rover contains four ultra wide band anchors. These

anchors will help determine the positions between the drone and rover. A Nvidia computer located on the rover is used to process data and send out commands. The three main devices the computer controls are the radio tranceiver, the rover, and the LIDAR sensor. Through the use of a radio transceiver, the drone's location data is transferred to the Nvidia computer. With this data, a control algorithm guides the rover towards the drone.



Rover

Onboard Computer Interfaced with UWB Tag and Radio Tranceive

Drone



While on mission, objects may obstruct the rover's path. In order to mitigate damages to the system, a basic obstacle avoidance algorithm was implemented. This algorithm utilizes a LIDAR sensor which detects obstacles near the rover. The rover will navigate around any obstacles in its path.



LIDAR Scanning Room Without Obstacles

CARE demonstrates the potential of a collaborative robotic system. With further development, autonomous exploration is a definite reality. Combining this technology with developing software such as machine learning and computer vision will enable a truly efficient autonomous system to be born.

Range: 30 m Cases Passed: 100% Accuracy: 40cm

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Obstacle Avoidance



LIDAR Scanning Room With Obstacles

Results

Rover reaching target

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