AUTONOMOUS ROBOT DISCOVERY AND RETRIEVAL OF RESOURCE FOR NASA SWARMATHON 2018

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Project Summary

In the NASA Swarmathon competition, a group of robots, called Swarmies, searches for and collects April tagged cubes in a set space. The project started with NASA's base code to program the Swarmies and identified many methods that would allow them to gain an informational advantage. This project implemented the sharing of information so that data collected from other Swarmies can be utilized. The pickup rate of the April tag cubes was also improved by modifying the base code from the problems encountered by adding a pause clock cycle. Finally, a breadth-first search algorithm is used in order to advance through the arena so that any empty area would not be visited again.

Problem and Need

In the future exploration of Mars, the Moon, and other extraplanetary surfaces, the discovery and allocation of resources is crucial. One viable solution is using a swarm of robots to gather resources such as ice, minerals, and other materials. To make this solution a reality, algorithms must be developed for robots working as a swarm.

Significance

This project is significant for entities such as NASA that are looking for viable resource allocation schemes. This work is also useful for any companies that needs to search an area, such as for disaster relief, because the main component of this project is developing an algorithm that can efficiently search an area.

Goal

The goal of this project is to deliver an algorithm that will allow the swarm robots to use the full range of motion possible, utilizing their grippers to grab, carry and drop resources into the collection zone. The swarm robots will be able to use the search algorithm to detect the resources and collect them, with a goal to collect 90% of the resources that is laid within an area.Customer/User Analysis.

The end user for this project needs a minor background in programming, knowledge of ROS/C++/Python is a plus. The underlying algorithm for the search and pickup processes is completed, however the Swarmies need to be calibrated for each new environment. The types of people that can effectively use the Swarmies is anyone with a technical background, ranging from engineers to IT technicians.

Deliverables

In the Swarmathon competition, no hardware was modified, and all work was done on the software side. As such, this project's final deliverable is the search and pickup algorithm that was developed.

The algorithm is a search pattern that utilizes a swarm of identical robots to operate autonomously to search/map an area and recover specified resources in it. The objects that they recover can be modified, with additional programing, to fit a large range of situations.

Terminal Objective

By the end of this project, the object is to develop a comprehensive view of the Robotic Operating System (ROS) and a better understanding of the integration of the behavior of the Swarmies with the functionality associated with each module.

Overview Diagram

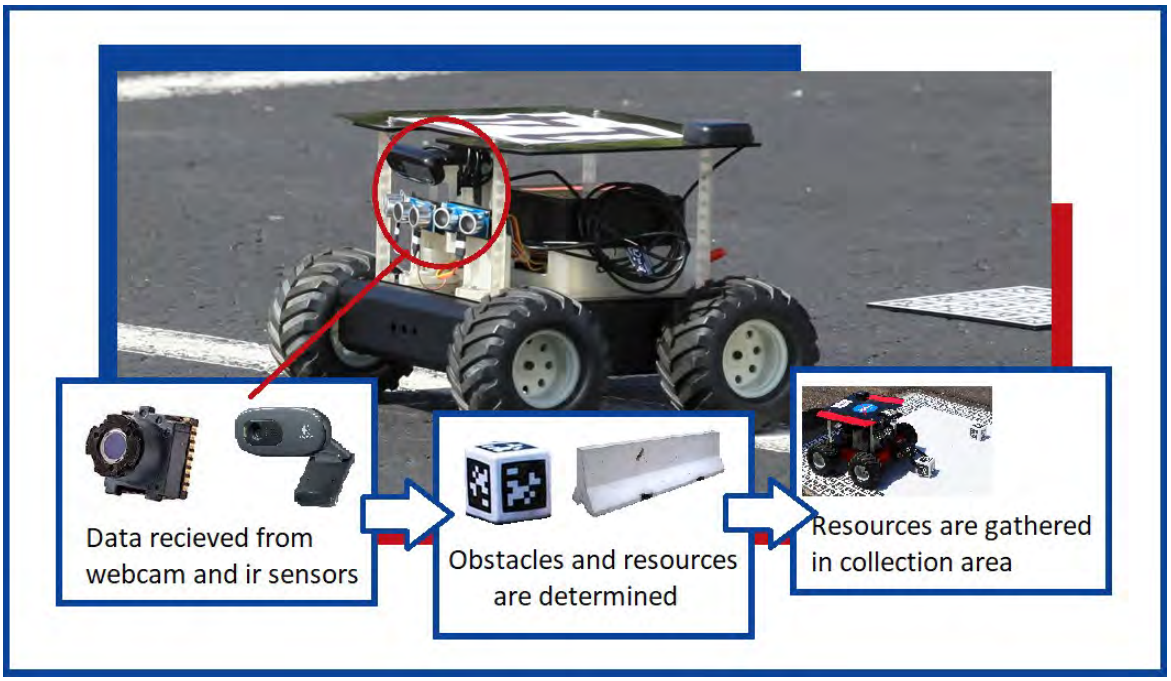

Fig. 1. Swarmie robot uses external signals such as camera and sonar to detect the environment. Internal signals such as GPS and odometer will use data to correlate what action to take whether it be search, pick up resources, etc.