**Development of a Vision-Based Robot Localization System**

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## Abstract

The focus of this research was to further explore robotic localization and the capabilities of a cost-effective iRobot Create® robot system. The main goal was to utilize iRobot Create® robots with basic robotic vision in order to design a system that would be capable of defining the location of the robot within a predetermined, mapped area. The project strived to use an economic and effective method of vision based localization. Overall, this project will provide a base navigation system for future work and a demonstration for those wishing to see the capabilities of the iRobot Create® robots.

This paper explains, in detail, the framework for a multi-robot localization system and how a pair of Create robots could be used as a team in order localize within a space. This robot approach uses web cameras in order to identify fiducial markers as well as additional robots. A vision-equipped robot starts positioned nearby another similar robot and traverses the "unknown" field. Identifying wall-mounted markers and other robots motivates the navigation of the robot. Objects are identified by specific color, shape and pixel density. The robot identifies a wall marker, calculates the distance from that marker, identifies the other robot, and calculates the distance from the complementary robot. In this case, it is assumed that the complimentary robot has also been tracked to a marker. This provides enough information so that their location within a predetermined map is found by comparing the distance between the two wall markers.

This project investigates the differences of using a single camera system to determine distance from an object verses a dual camera system. The results form a system that is able to localize itself within the defined environment. They also allow for a marker-to-marker distance range to be defined. This outlined the limitations on marker placement for the system. The project serves as a scalable model. It is a basic solution to the "kidnapped robot" question. By continuing to build upon this basic solution, future alterations made to the situational environment can be overcome.