In the realm of robotics and autonomous vehicles, many applications, including object recognition, obstacle avoidance, localization, and navigation require range measurement. Methods for determining distance to an object can be classified as passive or active. Active methods determine distance by sending signals, such as laser, radar, or ultrasound, to the object, whereas passive systems simply receive information [1]. Stereoscopic imaging is a passive technique for measuring the distance between objects. It is based on the difference in the location of the same object in pictures taken by two different cameras. The cameras are separated by a small distance and horizontally aligned, and the pictures are taken at the same instant in time [2]. Using some simple image processing and basic geometry relationships, the distance from the cameras to the chosen object within the picture can be calculated.

This project explores the method of stereoscopic imaging in localization relative to fixed reference points of known positions. The finished project will consist of a “black box” that can determine its location in space based on its distance from known reference markers. At the heart of this black box will be a stereo camera device which uses the differences in the images to determine object distance. To determine the position of an object, the box will make measurements of the distance to the reference markers. Using triangularization, the relative position of the box will be determined.

These reference markers may be visual objects with a known distinctive shape or color. As part of the project, the scale of distance measurement will be chosen, whether inches, feet, tens of feet etc. This black box will have a user interface to help with the measurements. The box may ask for help from user to find the reference markers if it cannot find them autonomously. As part of the project, compensation for image distortion by the cameras will be determined. In addition, the distance errors computed by the black box will be determined.

References
