MTE 546 Project Proposal

Project Title: Evaluation of Object Detection, Distance Estimation, and Classification with an affordable sensor fusion setup consisting of an Xbox 360 Kinect Sensor and Camera

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Xbox 360 Kinect Sensor Background Information: The project will involve using an Xbox 360 camera to judge the relative distance and size of various testing objects at distances within its ideal and effective range. The Kinect sensor is equipped with an RGB camera capable of capturing 640x480 video at 30fps or 1280x960 at 15fps. The working range of the sensor is 1.2-3.5m with a horizontal and vertical field of view of 57 and 43 respectively. The Kinect is also equipped with a 640x480 infrared depth sensor capable of 30fps and a range of approximately 50cm-5m. The RGB and infrared camera will be used to detect and approximate the size and distance of various test objects of different colors and size within and at the edge of the operating range.

Main Objectives:

- Validate/invalidate the use of low-cost sensor fusion setups for object detection, distance and size estimation by creating sensor models.
- Test the accuracy/range of such device and model the capabilities of the sensor.
- Experiment with different arrangements and algorithms for object detection, distance estimation (such as POSIT and Camshift) and classification.
- Find out the limitations of the sensor setup.

Main Methods and Approaches:

- Estimation will be conducted by fusing information from both RGB and infrared cameras of the Kinect sensor, as well as the camera.
- An extended Kalman filter or other algorithms will be used for estimation.
- A model of the depth sensor will be built using a fixed-size whiteboard.
- Objects of different size, color, and shape will be identified and measured within the operating range of the sensor.
- We will use the OpenKinect library to get experimental data from the Kinect sensor.
- We will potentially use pretrained computer vision models for object classification.

Expected Outcomes:

- Provide insights into the effectiveness of low-cost sensor fusion setups for object detection and estimation.
- Determine the accuracy and limitations of the Xbox 360 Kinect sensor for distance and size estimation.
- Compare the performance of different algorithms for estimation.
- Potentially propose improvements or alternative setups based on the findings.