ISE 589 Spring 2023

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HW1

Problem 1.

For task 1: Presence Detection, a proximity sensor could be used as a non-contact solution to detect the presence of a part. Some common types of proximity sensors include inductive sensors, capacitive sensors, and photoelectric sensors. Depending on the material of the parts, different sensors are preferable.

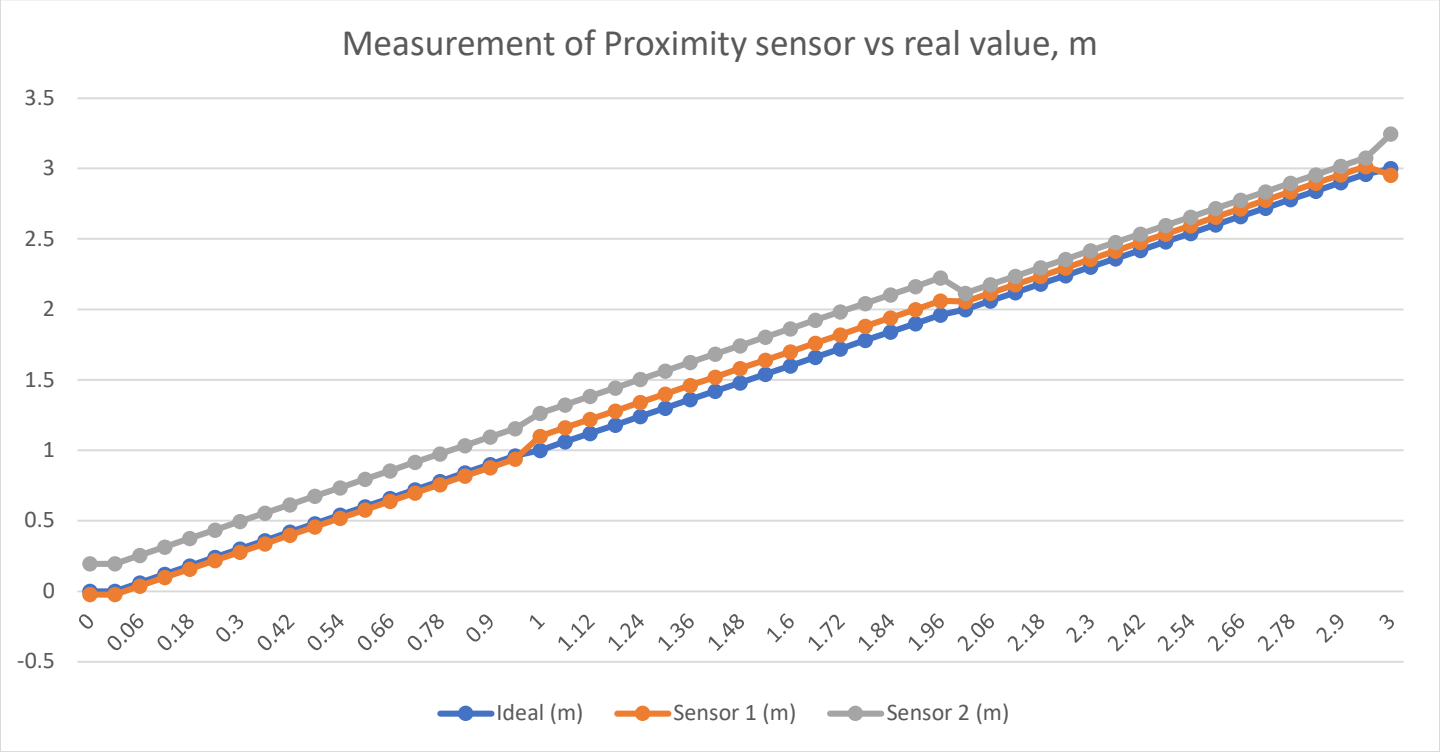
For task 2: Location and Orientation Detection, a combination of cameras and encoders could be used to determine the position and orientation of the part. Cameras provide visual information, while encoders provide positional information. Cameras with depth perception and correct algorithms could also give an orientation of the part.

For task 3: Velocity Detection, a combination of an optical encoder and a laser displacement sensor could be used to detect the velocity of the workspace. These sensors measure changes in position over time and can provide accurate velocity measurements.

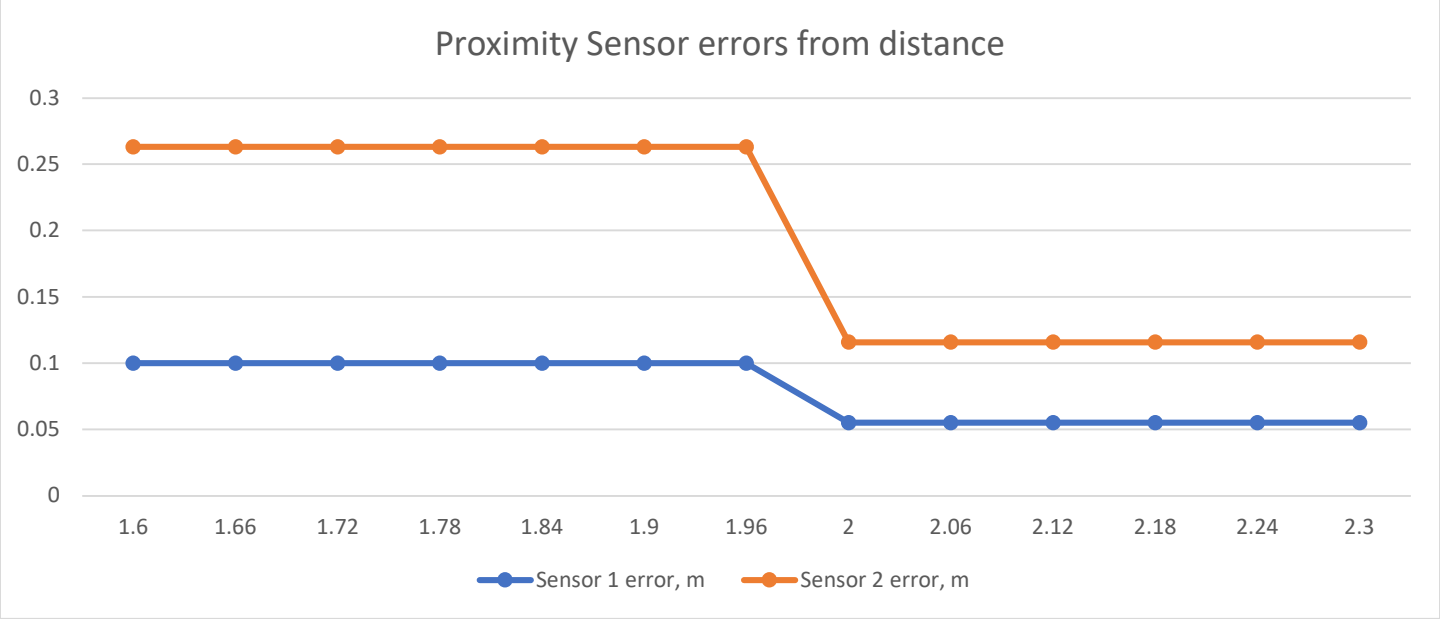
Ultrasound sensors can measure the distance between the sensor and the object, and by tracking changes in the distance over time, they can determine the velocity of an object. However, compared to optical encoders or laser displacement sensors, ultrasound sensors may have lower accuracy and performance in measuring velocity, especially in challenging environments with strong vibrations or changes in temperature.

Problem 2.

Sensor 2 has higher measurements relative to sensor one until a distance of 2.06 m (0.22m). After 2.06, the difference in errors between sensors is 0.06m.



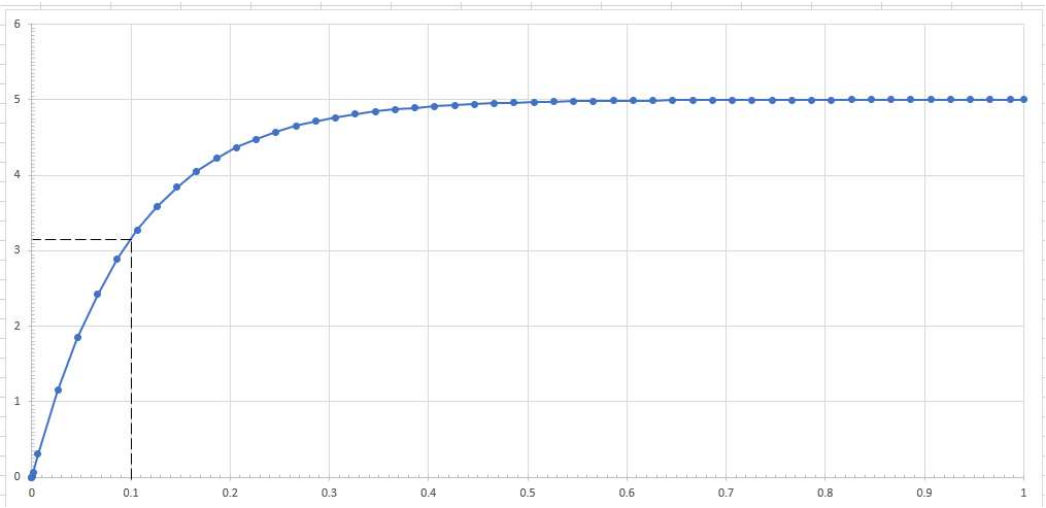
I would choose Sensor 1 because it has a lower error, and its non-linearity is lesser than sensor 2.



Sensor	Error at 2m	Mean Square Error
1	0.0551347	0.0073495
2	0.115798	0.047098

Problem 3.

The steady-state value is five, and so since 63.2% of 5 is 3.16. The corresponding time is 0.1 s.



$$G(s) = \frac{3.16}{0.1s + 1}$$

Problem 4.

The article "Bin Picking for Ship-Building Logistics Using Perception and Grasping Systems" by Cordeiro et al. (2023) describes the use of perception and grasping systems for bin picking in ship-building logistics. The authors used simulated data to train the model and real-life pictures with depth images to validate the model. They used the Mask R-CNN with ResNet-101 backbone was used as a deep Neural Network. Cordeiro et al. (2023) mention using a Photoneo PhoXi 3D scanner as one of the sensor technologies used in their perception system for bin picking in ship-building logistics.