

Determining the *Length* of a *Moving* Object with Ari's ToF Sensor

Ozobot Editor Lesson—Teacher's Guide

Grades 9-12

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Lesson Summary

This experiment demonstrates how to measure the length of a moving object using Ozobot Ari's Time-of-Flight (ToF) sensor. While stationary objects are easily measured with a ruler, this lesson utilizes a stationary bot (Ari_1) to emit ToF signals against a background board while a second bot (Ari_2) carries the object past the sensor at a constant velocity of 20 mm/s.

The accompanying program captures timestamps and distance readings, outputting them to the IO Console. Students transfer this data to a provided Excel spreadsheet, which converts text strings into numerical values and generates a scatter plot of ToF readings versus time. By determining the time duration during which the object obstructed the sensor and multiplying it by the known velocity, the object's length is calculated. For the highest data sampling rate and accuracy, the lesson recommends running the program through the Python Editor rather than the standard Blockly interface.

If you haven't already done so, you should read the five-page student guide that accompanies this lesson. It provides all of the information needed by you and the student to thoroughly understand the lesson, including the Ozobot Editor block-based program and accompanying Excel spreadsheet.

Computer Science Programming Concepts in This Lesson

- The use of variables to hold the values of program constants
- The use of loops to handle tasks that must be repeated several times
- Using concurrency to accomplish tasks that are difficult without concurrency

Excel Spreadsheet Concepts

- The use of LEFT, RIGHT, and LEN functions to parse strings
- The use of the VALUE function to convert a string to a number

Physics Principles

- The relationship between distance, velocity, and time as expressed by the well-known formula $d = vt$.
- The use of a time-of-flight sensor for determining distance

Share Code – fgd4hw3

Applicable CSTA (Computer Science Teachers Association) Standards

- 2-CS-02 Design projects that combine hardware and software components to collect and exchange data.
- 2-AP-11 Create clearly named variables that represent different data types and perform operations on their values.
- 2-AP-12 Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals.
- 2-AP-19 Document programs in order to make them easier to follow, test, and debug.
- 3A-DA-11 Create interactive data visualizations using software tools to help others better understand real-world phenomena.
- 3A-AP-17 Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.

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