2D Spatial Reconstruction Using a Rotating Time-of-Flight Sensor

Ozobot Editor Lesson—Teacher's Guide

Grades 9-12

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Lesson Summary

This lesson guides students in using Ozobot Ari to perform 2D spatial reconstruction using its built-in Time-of-Flight (ToF) sensor. By leveraging Ari's ability to rotate and measure distance via infrared light, students map physical objects within a confined space. The activity involves running a program where Ari rotates 360 degrees in small increments, recording the angle and distance data to the IO Console.

Students subsequently transfer this raw data into a provided Excel spreadsheet. The spreadsheet automates the necessary calculations, parsing the text strings and converting Polar coordinates into Cartesian coordinates. The final outcome is a scatter plot graph that visually reconstructs the 2D shape of the objects surrounding the robot. The lesson emphasizes using matte surfaces for sensor accuracy and suggests running the code in the Python Editor for faster execution, effectively combining robotics, physics principles, and data visualization skills.

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
- Extracting information from a string by parsing

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
- The use of SIN and COS functions to convert polar to Cartesian coordinates

Physics Principles

- The relationship between distance, velocity, and time as expressed by the well-known formula $d = vt$.

- Introduction to LIDAR—Light Detection and Ranging

Share Code – oizquz3

Applicable CSTA (Computer Science Teachers Association) Standards

2-CS-02	Design projects that combine hardware and software components to collect and exchange data.
3A-DA-11	Create interactive data visualizations using software tools to help others better understand real-world phenomena.
3B-CS-02	Illustrate ways computing systems implement logic, input, and output through hardware components.