Sensor Starters

Grades: 4 & Up
Time: 15 Minutes -PDQ 1 & 2

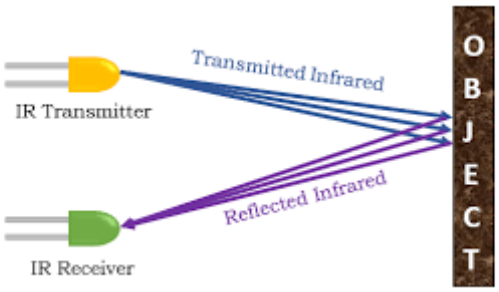
Subject: Physics, Technology, STEM
Topics: Proximity, Emitter, Detector

Meet the Proximity sensor

The **proximity sensor** is a non-contacting sensor that detects the presence of nearby objects without any physical contact. Phones, recycling factories, self-driving cars, anti-aircraft systems, and assembly lines all employ **proximity sensors**. They are also used in our daily life equipment like vacuum cleaners where an obstacle is detected while moving, smart lighting which switches on only when it detects the target, and mobile phones that turns off the touch screen during voice calls when your ear is close to the screen.

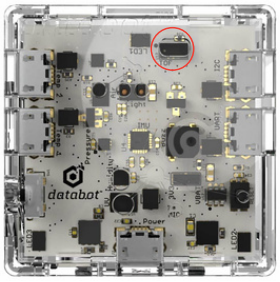
Background

The **proximity sensor** consists of a light **emitter** and a light **detector**. The light **emitter** is constantly on. Whenever the light hits a nearby object, some of the light is reflected back to the **detector**. The closer the object more light will be reflected. So, depending on the reflected light the sensor calculates how close the object is.



What You Will Need/Prep

- databot™ 2.0 & Vizeey™
- IOS/Android Smart Device
- Use Vizeey™ to scan the QR Code for Proximity.



The proximity is one sensor is labeled as TOF(Time of Flight). It is located above and to the right of the color/gesture/ambient light sensor of your databot™!

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Important Terms

Proximity sensor: A proximity sensor is a component that is designed to detect the absence or presence of an object without the need for physical contact.

Emitter: A emitter is a light source that constantly emits light.

Detector: A detector is a device that detects the reflected light.

What Does it Measure?

The **proximity sensor** measures the relative distance between the sensor and the target. The object detected by the sensor is referred to object. Without touching the object physically the distance of the object from the sensor can be measured using the **proximity sensor**.

What Are the Units for distance?

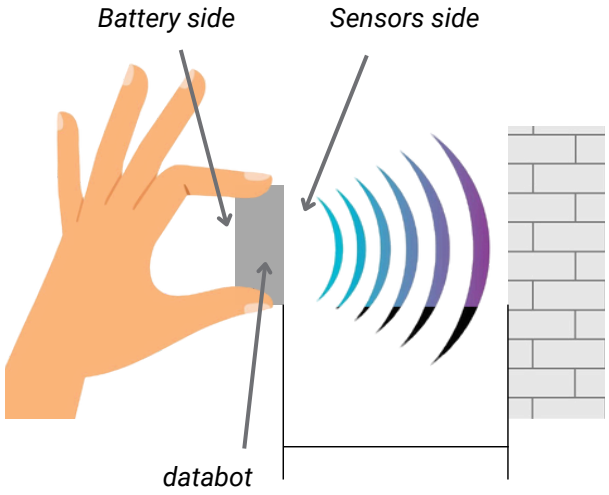
The distance between the object and the sensor is measured in millimeters (mm). There are one thousand millimeters in a meter.

1 m = 1000 mm

Exploration Preparation!

In the coming activities you will be exploring your local environment and exploring **proximity** using databot.

When the databot proximity sensor is activated it emits a beam of light that bounces off an object. By measuring how long it takes for the beam to return, the sensor calculates the distance. Use the diagram on the right to see how to position your databot correctly. Let's test it out!



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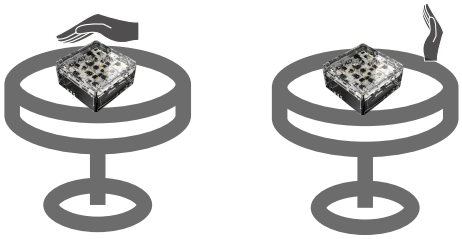
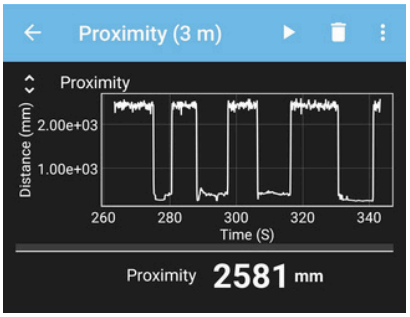
PDQ1 : Etch a sketch with Motion

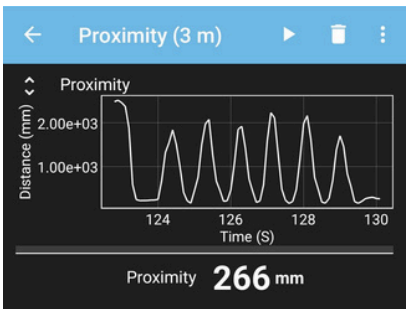
Prepare to experiment with your hand motion and watch the image that is generated by the graphic display. Can you draw shapes with the proximity sensor of your hand motion? Let's explore and find out!

- Open the Vizeey App on your smart device
- Turn on databot.
- Tap on **"Proximity (3m)"** in Vizeey™ to load the experiment.
- Place databot on the table
  - Ensure there is no object in front of databot.
- Use these icons ▶ ⏸ to start and pause the experiment.
- Begin your proximity sensor exploration:
  - Do some free-form motion trails by waving your hand in front of databot and see how motions affect the display.
  - Try different orientations with your device.
- Experiment 1: Control your hand motion and distance such that your data draws a triangular spike.
- Experiment 2: Holding the hand study for some time and taking it out draw a square wave.





Experiment 1



Experiment 2

Challenge: Now, with your newfound skill in drawing with a hand motion, create an original drawing recognizable by others. Good luck!

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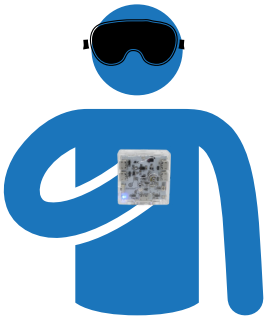
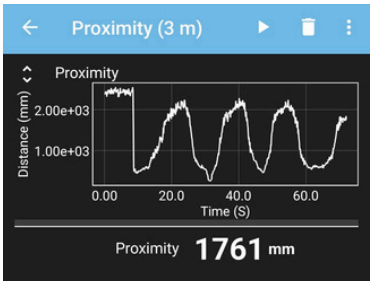
PDQ2 : Blindfolded Walk

Using the databot™ proximity sensor it is possible to find the distance of the object. Your mission is to walk into an empty room blindfolded with databot™ held in your hand. This mission should be done with your partner where one is blindfolded and walks into the empty room and the other guides them by watching the distance value.

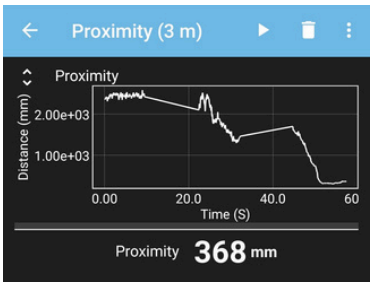
- Open the Vizeey™ App on your smart device.
- Turn on databot.
- Tap on **"Proximity (3m)"** in Vizeey™ to load the experiment.
- Start and pause your experiments using :
- Decide who is going to give instructions and who is going to follow the instructions blindly.
- Make your partner ready by blindfolding them, and make them hold the databot facing the room.
- Watch the distance value in the Vizeey™ and guide your partner to move, stop, and turn.
  - When the distance value is greater than 400mm your partner is free to step forward.
  - When the distance value is lesser than 400mm ask your partner to pause and turn, check the value, and then ask to proceed.
  - Important! Be sure to have your partner squat or rise up and down with the distance sensor as there may be a low object that would trip them!



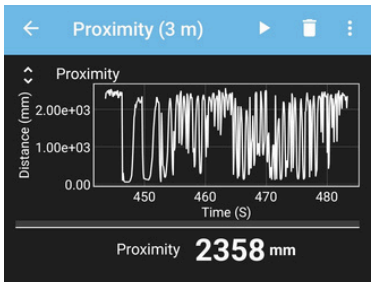
Blindfolded team member with databot in hand



Can move forward



Pause and turn



Can move forward

Check for Understanding

1. What is a proximity sensor, and what is its main function?
2. Can you name some common applications or devices where proximity sensors are used?
3. How does a typical proximity sensor work, and what are some of the physical principles behind its operation?

Standards & Alignment

NGSS Standards

- Waves and Their Applications in Technologies for Information Transfer (4-PS4-3) (MS-PS4-2)(HS-PS4-4)

Science and Engineering Practices

- 2nd Practice: Developing and Using Models
- 4th Practice: Analyzing and Interpreting Data
- 6th Practice: Constructing Explanations and Designing Solutions

Disciplinary Core Ideas

- Wave Properties (PS4.A)
- Electromagnetic Radiation (PS4.B)
- Defining and Delimiting Engineering Problems (ETS1.A)

Crosscutting Concepts

- Patterns
- Cause and Effect
- Systems and System Models

ISTE Standards

- 1.1 Empowered Learner (1a, 1d)
- 1.3 Knowledge Constructor (3a, 3b)
- 1.4 Innovative Designer (4a, 4c)
- 1.5 Computational Thinker (5a, 5b, 5c)

TEKS -Texas Essential Knowledge and Skills

- Science TEKS:

Grade 4 (112.15):
  - (b)(10)(A): Investigate how light reflects from objects to transfer information.

Grade 6 (112.18):
  - (b)(8)(A): Identify and analyze wave characteristics and their interactions with objects.

Grade 8 (112.20):
  - (b)(11)(C): Explore how technology can detect and measure properties of waves.

- Mathematics TEKS:

Grade 5 (111.17):
  - (b)(2)(C): Represent real-world problems using tables and graphs (e.g., distance values).

Grade 7 (111.19):
  - (b)(7)(A): Analyze and display data collected from the proximity sensor.

- Technology Applications TEKS:

Grades 6–8 (126.14–16):
  - (c)(2)(A): Collect and analyze real-world data using proximity sensors and represent findings.
  - (c)(3)(C): Create models and visual representations from sensor experiments.