



Introduction to sensors – Jeremy Watt

Purpose

This hands-on activity introduces students to both technological and biological *sensors*. It is designed to get them thinking about how they depend on sensors in their everyday lives, and how they might use them to build interesting things.

Overview

The idea of a sensor is introduced as a mechanism for measuring a physical thing, for a particular reason. A variety of examples are introduced and discussed to illustrate the concept of a sensor, with emphasis on communicating the reason sensors are deployed in biology and technology: in order to capture something useful and/or interesting about the world around us. Examples include

- a turnstile at an amusement park: a simple device for counting the number of people currently in the park, used so that park owners can anticipate how much maintenance the park needs
- a scale: measures weight, used so you know when to put down the chips
- the distance sensor on a smartphone: another simple machine used to turn off the phone screen when an object (like a face) gets too close to it, used so that the face does not press buttons etc. when one is talking on the phone
- a dog's nose: a sophisticated device, used for smelling food, territory, people, etc.

Students are then broken into small groups and asked to contribute examples of sensors: including what they sense, and why they are used. Groups then share these examples with the class.

We end the lesson with an exercise: students are asked to imagine and describe a machine that could do something useful for them (e.g. clean their room) that requires the use of 5 sensors. Students then share their ideas with the class and get feedback from peers and teachers.

Student Outcomes

Afterwards students will understand what a sensor is and how they are useful in their everyday lives. Moreover, they will understand sensors not only as a technological/biological devices, but also as tools for answering questions, solving problems, and bringing things to life.

Standards Addressed

MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.



Time

35 minutes

Level

Grade 7: Project C.A.R.E.

Materials and Tools

- A black/white board and markers
- A piece of technology (e.g. a smart phone) to illustrate examples of sensors in technology

Preparation

Brainstorming a list of sensors that are relevant to a particular class of students is a good idea. For example, have the students used some sort of technology in class this year that has some interesting sensor in it? What about their extracurricular interests? For example, have any students played a video game system with a motion sensor that maps their motions into the game universe?

Prerequisites

None

Background

Sensors are a part of our everyday lives: they are machines (they can be either simple or complex) that measure something in the world around us. Take the nose of a dog, what a wonderful sensor! A dog's nose is a sensor used for precisely the same reason we have a nose: to smell things. Dogs use their nose to smell the world around them (just like us), including the food they eat, the places they go, and the people they meet. As maybe you know, a dog's nose is a much more advanced sensor than the one we come equipped with, and can be thousands of times more sensitive. Imagine what they can smell!

But noses aren't the only kind of sensors around, even a simple turn-style at an amusement park is an example of a sensor (albeit a much simpler sensor). A turn-style is a simple device used to *count* the number of people entering and exiting the park. That count is useful to people who run the park because it informs their decision about when to perform maintenance on the park, lets them know if an advertisement, promotion, or new ride has brought more people into the park who stay longer, etc.

Whether its giving a dog the ability to learn about its surroundings via smell, or an amusement park owner better understanding of her customers, sensors are valuable tools that allow us to make use of the environment around us.

Teaching Notes

This lesson was a piece of a larger section on engineering design principles, elementary computer programming, and robotics. Although making connections to programming and robotics concepts

can be helpful, they are certainly not required. Beyond preparation (e.g. brainstorming examples of relevant sensors) one should also make sure

- in the small group brainstorming session that students understand correct and incorrect examples of sensors (e.g. a motor is not a sensor)
- in the individual exercise at the end of class that students go in thinking “problem first”, meaning that they think of interesting problems that they have (e.g. cleaning their rooms or getting over to a friends house after school) *before* thinking about the kinds of sensors that could be useful in solving the problem

Assessment

Students are evaluated both in terms of participation in the group brainstorming session, and in their final individual exercise. In the final exercise students must include

- a clear statement about the problem they wish to solve
- a clear statement about their solution including their 5 sensors, as well as what each type of sensor senses, and why they are useful in the solution