

## Suggested Internet Resources

Periodically, Internet Resources are updated on our Web site at [www.LibraryVideo.com](http://www.LibraryVideo.com)

- [www.howstuffworks.com](http://www.howstuffworks.com)  
Students can use the topical index on this site to find many answers to their questions about different sensors, like metal detectors, automatic doors, and smoke alarms and how they work.
- [www.usfa.fema.gov/kids/](http://www.usfa.fema.gov/kids/)  
The United States Fire Administration kids pages elaborate on the importance of smoke detectors and give other fire safety tips.
- [whyfiles.org/032air\\_bag/how\\_work.html](http://whyfiles.org/032air_bag/how_work.html)  
This page from the Why Files explains how sensors are used in automobile airbags.

## Suggested Print Resources

- Brain, Marshall. *How Stuff Works*. John Wiley & Sons, Hoboken, NJ; 2001.
- Macaulay, David. *The New Way Things Work*. Houghton Mifflin, New York, NY; 1998.



## Sensors

### Grades 3-6

Journey to Mammoth Island, a whimsical place where investigating scientific principles is always an adventure. Olive, a young girl, assisted by the Island's mammoth population and a visiting inventor helps the locals discover why and how machines work. Science facts are clearly demonstrated, giving kids an opportunity to see how important everyday machines are linked together by the science that drives them. Students come to see that science is a way of organizing information about the world, explaining why things work the way they do and allowing us to predict what might happen in new situations.

This guide provides a brief synopsis of the program, background on the science concepts presented, discussion topics, additional activities, vocabulary and suggested print and Internet resources.

### TEACHER'S GUIDE

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Teacher's Guides Included  
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## Program Summary

In *Sensors*, Olive and her cousin Troy are helping their family remodel the quaint, old Mammoth Inn in the snowcapped mountains of Mammoth Island. They decide that the old building could use some modernization and set out to think of ways to upgrade the security system and the entrance.

A visiting inventor soon arrives for a ski vacation and after tripping over the sleeping mammoth ‘burglar alarm,’ he sets to work helping them with their upgrade. The inventor explains the principles behind some of the sensors that would help modernize the old hotel. Sensors are devices that respond to heat, light, sound, pressure, magnetism, or motion. There are all kinds of sensors that can detect the presence of something.

A burglar alarm works by sending out invisible rays called microwaves that bounce off every object in a room and back to the detector. If all the objects in the room are still, the microwaves stay the same, but if the microwaves strike a moving object, their invisible pattern, or frequency, changes and the detector sets off an alarm! This same principle can be applied to automatically open the front door of the inn for arriving guests.

Smoke detectors are sensors that can sense tiny particles of smoke and raise an alarm before a fire gets too large. There are two types of smoke alarms. One type uses a special beam of light and a sensor that reacts to anything that disturbs the light, such as smoke. The other type is called an ionizing detector. This type can detect extremely small particles that disturb the electrical circuit within the device. A microchip in the detector can sense the change in electrical current and triggers the alarm.

Metal detectors are another type of sensor that operates by making a series of rapid magnetic pulses. These pulses cause any nearby metal object to produce its own magnetic field, which is then detected by a receiver coil inside the metal detector, and an alarm signal is triggered. The gateways of metal detectors in airports have receiver coils that detect any changes in the magnetic field caused by metal objects on anyone passing through the gateway. The exterior is shielded, so no one passing by will set off the alarm.

After many technological upgrades, a customer appears and offers to buy the big old hotel. His plan is to restore it to its old fashioned splendor!

## Glossary

The following words are included for teacher reference and for use with students to extend the subject matter in the show.

**burglar alarm** — A sensor used to detect intruders.

**effort** — The force applied to get work done.

**energy** — The ability to do work.

**force** — A push or a pull on an object that causes a change in motion.

**metal detector** — A sensor that uses rapid magnetic pulses to detect objects that are made of metal.

**infrared motion detectors** — Small electronic sensors that detect infrared waves — heat waves that radiate from moving objects. When the detector senses an object moving across its field of view, especially warmer objects such as people, animals and cars, it electronically turns a switch.

**power** — A measure of how quickly work is done.

**sensor** — A device that responds to a physical stimulus (such as heat, light, sound, pressure, magnetism, or a particular motion).

**smoke alarm** — A detector used to warn occupants of a building of the presence of a fire. Some smoke alarms use a constant beam of light; when particles of smoke interrupt the ray of light, they break an electrical circuit and set off an alarm. Ionization detectors are another type of smoke alarm that use a tiny amount of radioactive material to charge (ionize) the air, causing a small electrical current. When smoke particles disrupt this current, the alarm is triggered.

**work** — To move or change something. Doing work takes energy. When you use force to make something move, you are doing work.

## Pre-viewing Discussion

- How do automatic doors work?
- What are sensors? What types of sensors do humans have?
- Ask students to list all the sensors they come in contact with on a weekly basis.

## Follow-up Questions & Activities

- Have students design and create a burglar alarm for their rooms. There are inexpensive electronic kits available that let kids build their own motion detectors and burglar alarms while learning about basic electronics, infrared sensors, and motion detector technology.
- Have students help their parents check their household smoke detectors and make sure there is at least one detector for each floor of their home. Most local fire departments provide free smoke detectors as well as replacement batteries for those who cannot purchase them.
- Encourage students to research how ‘truth detectors’ like voice stress analyzers and polygraph tests work.
- Ask each student to write a story in which a sensor plays a part. Students can read their stories aloud to the rest of the class.
- Almost every industry students can think of now contains some sort of automated system that uses sensors to make work easier. Have students choose one to research (i.e., supermarkets, automobile industry, banking, space exploration, transportation, communication) and have them report back to the class on how sensors are used in the industry they chose.

*(Continued)*