

5. AVOID MARTIAN ROCKS

Goal: To build a rover that drives forward until it senses an object.

Main Themes:

- Using the ultrasonic distance sensor to detect when the rover approaches an object

Robotics Theory: Sensors allow the rover to gain information about its surroundings. The program can then make decisions based on this information. The ultrasonic distance sensor uses sound pulses to determine the distance to an object in front of the rover. The sensor measures the amount of time between when it sends out the pulse of sound and it detects the reflected sound pulse. This is the same technique that is used by bats to navigate in the dark. The Mars rover uses similar techniques with light pulses to determine the distance to objects on the surface of Mars.

Construction Tips:

- Make your rover very sturdy by adding lots of reinforcement.
- Attach the distance sensor firmly to the rover, connecting it to a numbered input port
 - Make sure that the distance sensor is pointing in the forward direction.



Sample Code:



This program tells the rover to:

- Turn on motors C and B in the forward direction for an unlimited duration. They will stay on until another command tells them to turn off.
- Wait until the distance sensor detects an object less than 10 inches away (use the slider on the properties panel to change the default 50 inches to 10 inches)
- Then stop both C and B motors

Discussion Questions:

- Are there any objects that your rover couldn't detect?
 - Could it detect glass?
 - Yes, the sound pulses would reflect from the glass
 - Could it detect a pencil laying on the ground?
 - No, the pencil is too small to be detected by this sensor
- Would this rover be able to drive around Mars?
 - This rover wouldn't be about to detect small rocks and obstacles, and would probably have a hard time navigating the landscape. The real Mars rover uses multiple techniques to detect objects, including cameras, lasers, and probes.

Additional Mars Rover Resources:

<http://marsrovers.jpl.nasa.gov/gallery/video/hardware.html>

Video Title: *Rover First Steps* (located near the bottom of the page)

NASA engineers had to figure out what size rock is too big to roll over. They did this through extensive testing on Earth. The real rovers are able to drive over very difficult terrain.