Earth Based Rover Testing Site

Overview:

NASA and the Jet Propulsion Laboratory (JPL) developed a Mars Rover. For the past seven years the two rovers have traversed areas of Mars doing the job of a geologist. Communication between NASA and the rovers on Mars is done through a narrow communication link. Due to the difficulty involved in sending instructions a number of rovers have been built along with simulated environment for scientists to test instructions and problem solve difficulties before communicating with the Mars rovers.

Part of the difficulty and joy of teaching robotics is suspending reality within your classroom and creating an environment where it is safer, cleaner and more exciting to use a robot than it is to just do it yourself. Sharon Campbell, an art teacher in Napa, California, is an excellent example of pulling out all of the stops to create an engaging and fantastic environment (http://www.edutopia.org/energy-efficient-art-classroom).

In this series of challenges that introduce Vernier Probes and Sensors we will create scenarios that put us in the place of Earth based scientists at JPL. We will be creating, testing and fine tuning programming that will be sent to the Mars rovers.

Teacher Preparation:

Sharon Campbell spends a considerable portion of her own time and finances to create her classroom, twice a year the Campbell family repaints her room. This amount of involvement is not required to create an engaging and believable robotics environment. You as the teacher have the choice to either create the environment yourself (the surprise of part of the room being transformed can assist with the "buy in" of the students) or you can have your students spend time creating the environment (the curriculum connections and possible collaboration with experts has greater educational value).

Temperature

Activity Summery and Scenario:

As mention in the article "Unexpected Discoveries" pg 3-4, the Mars Rover Spirit is stopped in its tracks and will unlikely move from the current positioning. Due to Spirit's inability to move, the sensors and probes on the device have been able to make more in-depth discoveries than otherwise possible. Because of the break, scientist will be able to collect a plethora of data from the stationary rover. This is a good place for us to begin with probes and building our classroom mind set and atmosphere.

The rover will take periodic temperature readings over the course of its remaining time. Spirit will send the readings back to Earth to be interpreted by scientists.

Teacher Preparation:

Creating the ideal atmosphere is important, especially when using scenarios within the classroom. In creating the atmosphere for this challenge you can build a Mars type landscape or create a scaled digital image of a Mars background. Leave the program running for the duration of the day and overnight while creating changes in the temperature. Set up a video feed that will record the rover-bot as it is taking readings that will later be viewed by those interpreting the data.

Why would the JPL team need to set this scenario up on Earth before sending these instructions to Mars?

Curriculum Connections:

- Students explain the possible causes of fluctuations in temperatures.
- What do the students expect the rover-bot to read over the next 2 years (on Mars)?
- Did the program record enough temperature readings? Could anything be improved? Why?

In the Classroom:

Creating scaled backdrop images helps students connect to the created environment. We have a street view picture of our Main St. created by Kathy Holberg that we film robot parades in front of.

UVB

Activity Summery and Scenario:

The Mars Rovers are looking for water, a key component in life, which has been found. Without water, the mission to Mars changes considerably. Although water has been found the levels of UVC and UVB rays are considerably higher than on Earth. **Why is shielding from UV Rays important for life and mechanical objects?**

We want to have the rover-bot discover where and when the lowest UV Rays exist. Is the lowest level of UV Rays at a certain location on Mars? Is it under the soil? Is it under a layer of ice?

Teacher Preparation:

Create a map or grid of ideal testing locations based on student predictions. The students will write a program that will traverse the grid or map recording readings at specific times or locations. We need to conserve energy due to the upcoming Martian winter, so this operation will need to be light activated and de-activated.

Curriculum Connections:

- What effects do UV Rays have on various forms of life?
- What are the various ways UV Rays are blocked? What qualities do those methods share?
- What are the ethical questions involved in cultivating life forms on Mars?

In the Classroom:

Tiled floor, corrugated cardboard, Laminated MDF board makes for great environment floors. Poster board can spin out under bots and shower curtains can bunch up.

Soil Moisture

* Inspired from "STEM with Vernier and LEGO Mindstorms NXT" #7

Activity Summery and Scenario:

As technology advances the imagination of engineers and scientists will turn towards the human habitation of other planets with our moon and Mars being likely candidates. Many habitats have been designed, from temporary to self-sustaining. The self-sustaining habitats all have an identical and necessary feature of plant life for both food and air purposes. If the government and private sector firms used massive amount of resources to create habitats on other celestial bodies they probably would not send a farmer to be the first inhabitant. An autonomous system is the ideal candidate to solve our gardening needs.

Teacher Preparation:

Select a variety of potted plants for the students to use and create an area near a classroom window or grow light. You will also need a 1 Liter bottle for each plant.

What other probes or sensors could be used to evaluate the success of the garden or further automate the garden?

Curriculum Connections:

- How wide of a variety of plants can be grown within the same area given separate watering systems?
- Would hydroponics provide a better growing method than traditional soil?
- What necessary nutrients are found in good growing soil? How could those nutrients be added to the soil in our habitat?

In the Classroom:

Incorporating, or encouraging students to seek out, experts is an important and often neglected piece of classroom teaching. With today's current technology face to face communication is easier than ever. For this activity I would have students video chat with AG students or specialists at local nurseries.