

INTRODUCTION

Another part of our study is **tackling** the “lake” monitoring. While we **surveying** the planet, we observe a lot of “lakes” (**lakes, craters which contain liquids**) on the surface, so we want to find out if the liquids hold in these craters are hazardous chemicals. That’s why, we construct a robot to analyze the lake in order to check if they are harmful to humans. Our robot is a sensor-controlled robot programmed to determine the acidity of a liquid. It is mobile, so that “hazardous” chemicals can be kept away from human operators. We use a Vernier pH Sensor and a Vernier NXT Sensor Adapter connected to our NXT, to test the acidity of several solutions (**found on the planet**). We know that acidic solutions have pH values less than 7, basic solutions have pH values greater than 7, and neutral solutions have pH equal to 7.

What is a Hazardous chemical?

A hazardous chemical is a substance that could cause a negative health effect, such as cancer, lung damage, skin irritation, or even death. If a mixture contains at least 1% of a known hazardous chemical, it is classified as a hazardous material. Consequently, many common household solutions, such as paints, cleaners, inks, and dyes can be considered hazardous. An acid is sometimes considered a hazardous chemical, because it can cause severe burns if it gets in your eyes, nose, or skin. Not all acids are hazardous, however. Some acids, such as vinegar and lemon juice, are used in cooking to give foods their distinctive flavor.

OBJECTIVES

In this project, we will:

- Build a robot to find the “lake” (a cup) and lower a probe.
- Use the NXT to determine the pH value of a liquid.
- Play a sound based on sensor data.

MATERIALS

- computer
- LEGO NXT Intelligent Brick
- MINDSTORMS Edu NXT v2.0 software
- LEGO MINDSTORMS NXT Educational Set
- Vernier NXT Sensor Adapter
- Vernier pH Sensor
- 2 glass cups
- acid, basic and neutral solutions
- goggles

CONSTRUCTION

Our idea to construct the robot is to move the robot toward a cup of liquid, stop when a LEGO Touch Sensor contacts the cup, and then lower the pH Sensor into the cup. Once the pH of the liquid is determined, the robot should raise the pH Sensor from the cup and back away.



Figure 1 The robot controlling the “lakes” from the planet

So, the robot should approach the cup, stop when the touch sensor comes in contact with the cup, and then lower the pH Sensor. After a few seconds the robot should raise the pH Sensor, play a sound, and then back away from the cup. The program compares the pH value of the solution with a pre-defined limit. If the pH is below 7 (the acid), the solution is considered hazardous and the robot will shout. If the pH is above 7, the solution is considered safe and the robot will say “Good.” The robot then raises the pH Sensor and backs away from the “lake” (the cup).

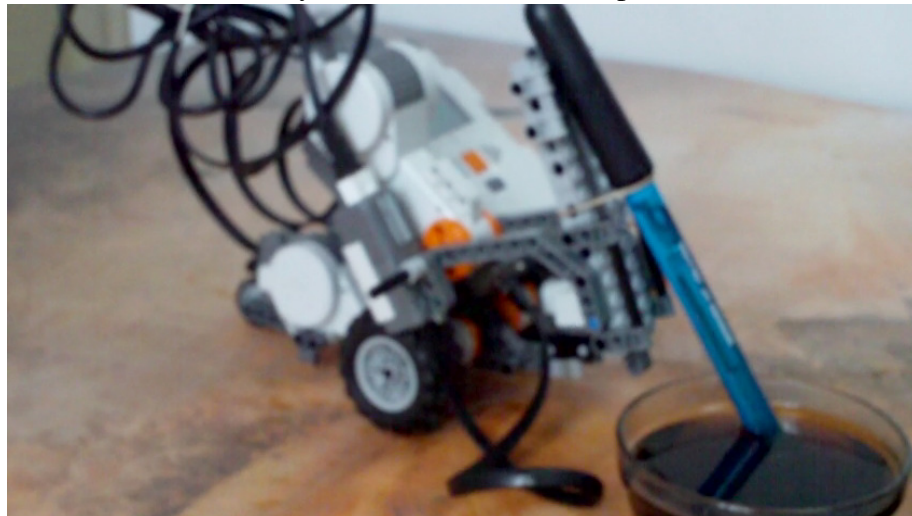


Figure 2 The ph determination