Programming Exercise:
***Voyager* Temperature Probe Controlled *Scratch* Pipe Freeze Warning**

Richard G. Born
Associate Professor Emeritus
Northern Illinois University

Introduction

Because of the fact that water expands when freezing, frozen water pipes can result in untold damage to a house. There are a variety of things that one can do to avoid this problem. One common thing is to let the cold water faucets drip, particularly those whose pipes are near or in the outside walls of the house. Southern climates are particularly prone to such issues, as pipes are more likely to be installed in outside walls and without adequate insulation for cold spells. Although water freezes at 32°F, research scientists have found that a temperature alert warning at 20°F can significantly reduce the number of frozen pipe incidents.

This is a great wintertime activity for students, especially on those cold winter days when it is too cold to spend much time outside. This lesson will challenge the student to use real-time data from Voyager's Temperature Probe and design a Scratch program that behaves as follows. Figure 1 shows the Scratch canvas. The faucet and current temperature should *always* be showing. The blue water drop, the red warning message, and the gray suggestion should appear *only when the temperature is below the 20° threshold*. In addition, the water drop should be in motion, dripping downward from the faucet, in the manner shown in the accompanying video. Also, the red warning message should flash on and often, as an attention getter. A *pdf* file with the faucet and water drop accompanies this lesson. The two images in this file can be captured as Scratch sprites for use in this lesson.

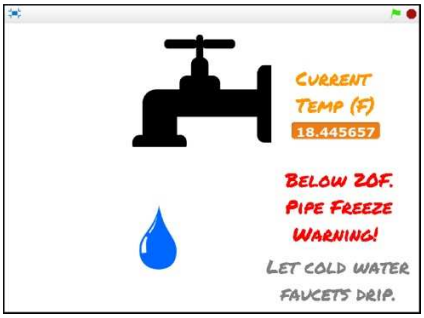

Figure 1

If you live in a climate where it doesn't often get below the 20° threshold, students can simply place Voyager and the connected temperature probe in the freezer compartment of a refrigerator. Although the author had no signal issue with his stainless steel fridge, the thermister can be put in the freezer with the wire and Voyager hanging outside of the freezer. As a final alternative in the event that a freezer is not available, students can test/debug their programs by "assigning" a temperature a few degrees above room temperature as the "threshold". With the thermister end of the Temperature Probe between the thumb and forefinger, the temperature will be above this defined threshold. When the thermister is released, the temperature will quickly drop below the defined threshold. Set Voyager units for temperature to °F or °C to agree with the commonly used temperature unit for your country.

The Author's Approach to this Scratch Program

Figure 2 provides a snapshot of the author's approach to the Scratch program of this lesson. The Scratch code for the "drip" sprite is shown to the right in this figure. The value of a variable called *currentTemp* is captured and processed within a *forever* loop. Within in this loop, the PocketLab *Get Temperature Probe Value* block continually updates the value of *currentTemp*. Depending on both the y-position of the drip sprite and the value of the current temperature, three *if* blocks either hide or show the sprite. The variable *currentTemp* is declared as available *for all sprites*, so this variable can be used in the simpler code for Sprite2 and Sprite3.

Figure 2