

Voyager & Ozobot: A STEM Team to Study Linear Motion

By Richard Born

Associate Professor Emeritus

Northern Illinois University

Ozobot “Evo” (ozobot.com) is a tiny one-inch diameter robot that can be quickly programmed using a Google Blockly dialect known as OzoBlockly (ozoblockly.com). This lesson combines the ability to program Ozobot to move freely in a straight line with Voyager’s ability to sense the resulting motion through its range finder. Students compute the slope of the resulting position versus time graph to determine Ozobot’s velocity.

Figure 1 shows a snapshot of a video that is included with this lesson. Voyager is mounted to the top of Ozobot with a piece of thick double-sided tape or with a small piece of clay. The sensor side (orange) of Voyager is facing the back side of Ozobot. This “STEM team” is then placed on a table about 5 cm from a wall and perpendicular to the wall. Voyager is set to a rate of 5 points per second. A portion of the resultant position vs. time graph is shown by the red line on the graph.

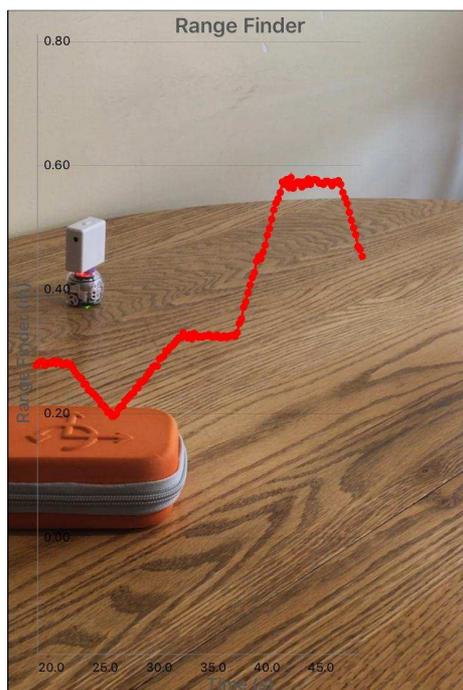


Figure 1

Figure 2 shows a simple OzoBlockly program that has been loaded into Ozobot to produce the motion. This motion makes use of Ozobot’s “free movement” capability, in which it can move freely *without* following a line. The program starts by setting Ozobot’s top light to the color red. Then there is a 10-second pause to give time for the student to properly place the “STEM team” on the table. Then there is a sequence of moves (yellow blocks) where Ozobot is told to move a certain distance at a specific speed.

Distances can be up to 127 mm, so larger distances than that require successive yellow blocks. Speeds can vary between 15 and 85 mm/s, and negative speeds will make Ozobot move backwards. Pauses (blue blocks) do just what you would expect—Ozobot remains at rest during the pauses. Students can program their own Ozobot movements by the use of move and pause blocks as desired. There are other blocks available that make Ozobot turn, but then the sensor will not be facing the wall perpendicularly. This experiment is intended only for studying rectilinear motion.

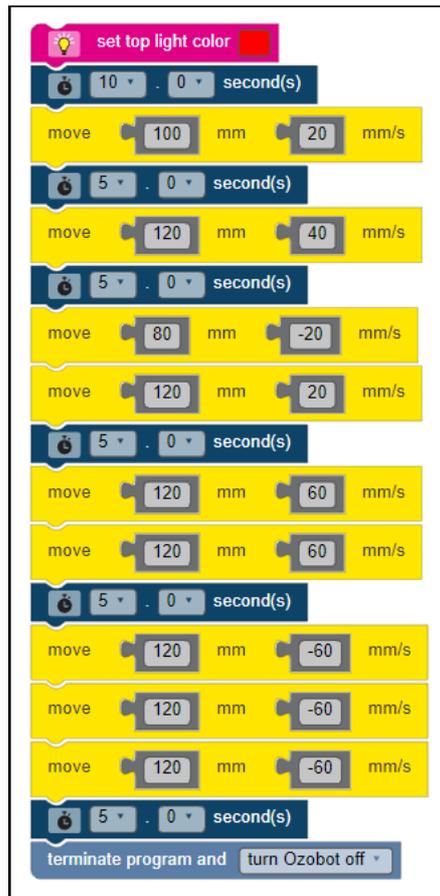


Figure 2

The csv file obtained from the PocketLab app can be imported into Excel or other data analysis programs such as Vernier Software & Technology’s Logger Pro™ ([vernier.com](http://www.vernier.com)). Analysis of slopes allows determining the velocity during various portions of the “trip”, as shown by the Excel graph shown in Figure 3.

This lesson can be used not only in the physical science and physics classrooms, but also in math classes for a practical application of the concept of slope. Positive slope means forward motion, negative slope means backward motion, and horizontal lines (zero slope) mean that the object is at rest. Students can also compare the velocities obtained from the slopes with those in the OzoBlockly program and hypothesize possible reasons for differences.

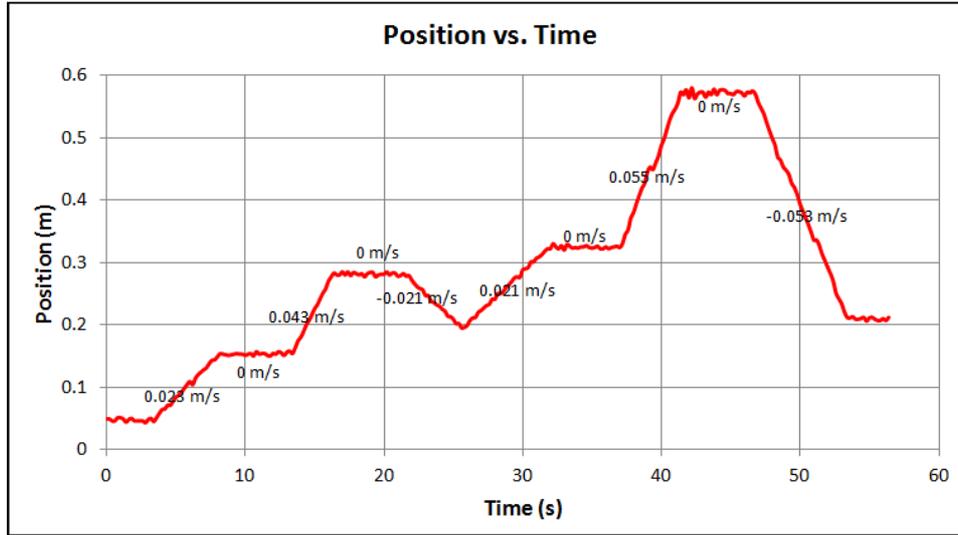


Figure 3