Classroom Activities for the Busy Teacher: VEX IQ with VEXCode Blocks

Table of Contents

Chapter 2: miniVEX Basics

Overview: Build a robot that is capable of driving around an obstacle course.

Project: THE SPACE AGENCY is in the market for a new planetary rover to explore the recently discover planet Zezuno. You are required to construct and test a robot that is capable of following a set of commands to explore the planet's surface. Before the robot is deployed, it must be extensively tested to ensure it will perform as expected. You can't fly a technician to Zezuno to reboot the robot!

Equipment required

- 1 VEX IQ robot kit per group
- 1 computer per group
- Masking tape and Tape measure

Teachers' Notes

This section will cover the following topics amongst others

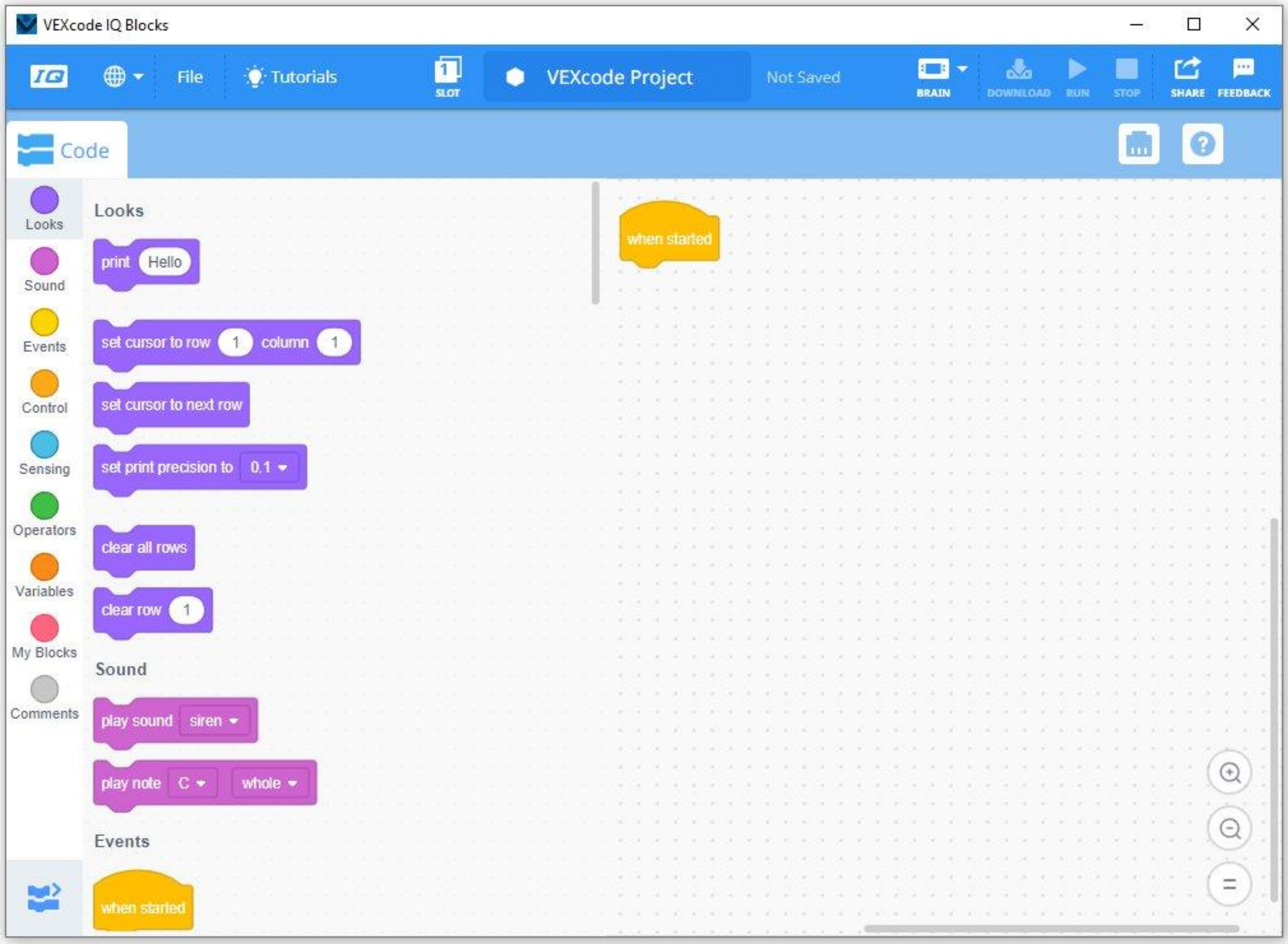
- Basic numeracy
- Decimal and fractional numbers
- Conversion between millimetres and inches

Get the students to build the miniVEX robot presented in Building Instructions.

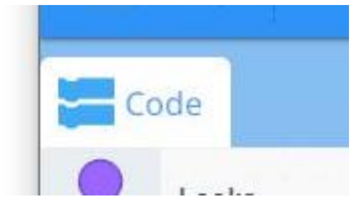
Photocopy and hand out Student Worksheet – miniVEX Basics. This worksheet gives the students a range of different activities to follow that progressively increase in difficulty. To make our robot move, we need to send instructions to the Smart Motors which in turn drive the wheels. The miniVEX design is often referred to as a wheelchair configuration, as it has a Left and Right Smart Motor that allows the robot to drive forwards, backwards and make turns.

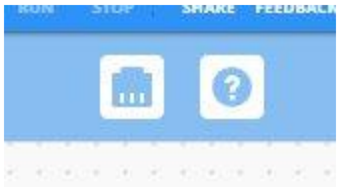
VEXcode IQ Blocks

This book focuses on the VEXcode IQ Blocks programming environment. If you have not already done so, you can download and install the software by following the official VEX instructions – www.vexrobotics.com/vexcode



There are two main sections to the VEXcode Programming Environment





Code: This holds the instructions that tell the robot what it needs to do.

Devices: This outlines the different parts of the robot, the Smart Sensor and Smart Motors being used and how they are all connected to the VEX IQ Robot Brain

A typical robot project will start within the Devices section, defining the parts of the robot, and then switch to the Code section to write the program. If the physical robot changes (new Smart Sensors, extra Smart Motors added etc), then we can switch back to the Devices section to make the appropriate changes.

Chapter 5: How Far?

Overview: Test the robot for distance characteristics

Project: In the initial construction of the robot the travelling characteristics are required. After characterising the properties, THE SPACE AGENCY have asked that you use your data to make predictions about the distance your robot will travel, given specific time constraints.

Equipment required

- 1 VEX IQ robot kit per group
- 1 computer per group
- Masking tape
- Tape measure
- Stopwatch

Teachers' Notes

Photocopy or print and hand out Student Worksheet – *How Far?*

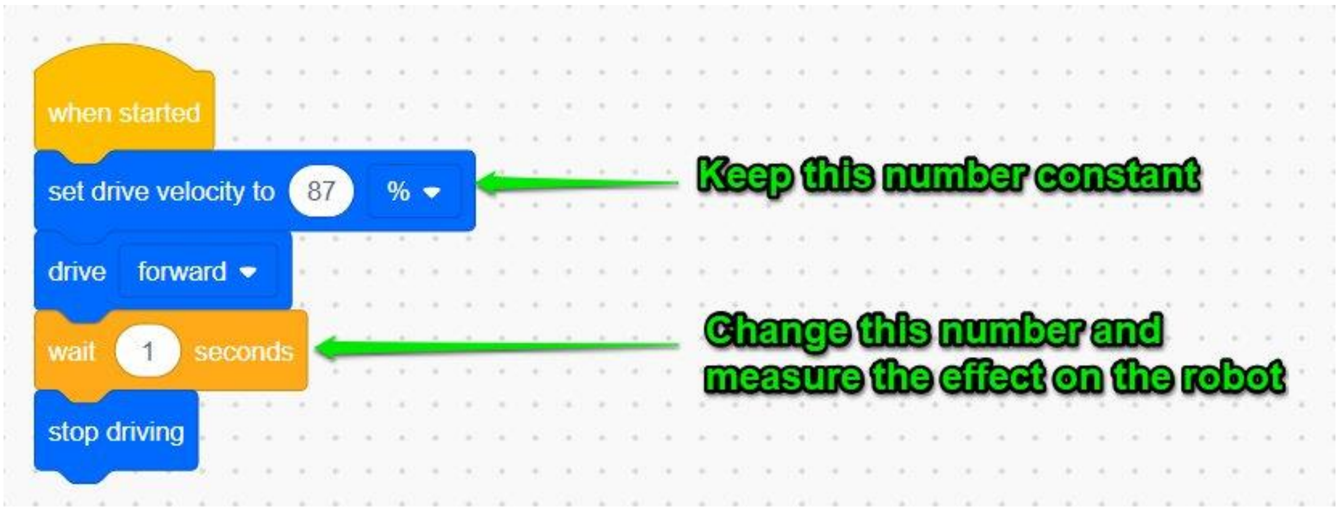
This section will cover the following topics

- Data gathering
- Graphing
- Interpolation / Extrapolation
- Decimal numbers and fractions
- Averaging of data
- Position and distance

Theory

This activity will look at the effect that changing the time of travel of the robot has on the distance it moves. It will become evident that the longer a robot travels the further it travels, but can the relationship between time and distance be predicted?

Students will program their robot to travel for 1 second at a specific power level. The same experiment is run again this time for 1.5 seconds at the same power level. Students should take as many measurements as time allows with a wide variety of run times. Encourage the students to take multiple runs and take the average of all their data to reduce the impact of experimental error. Keep increasing the length of time the robot is travelling and record the distance.



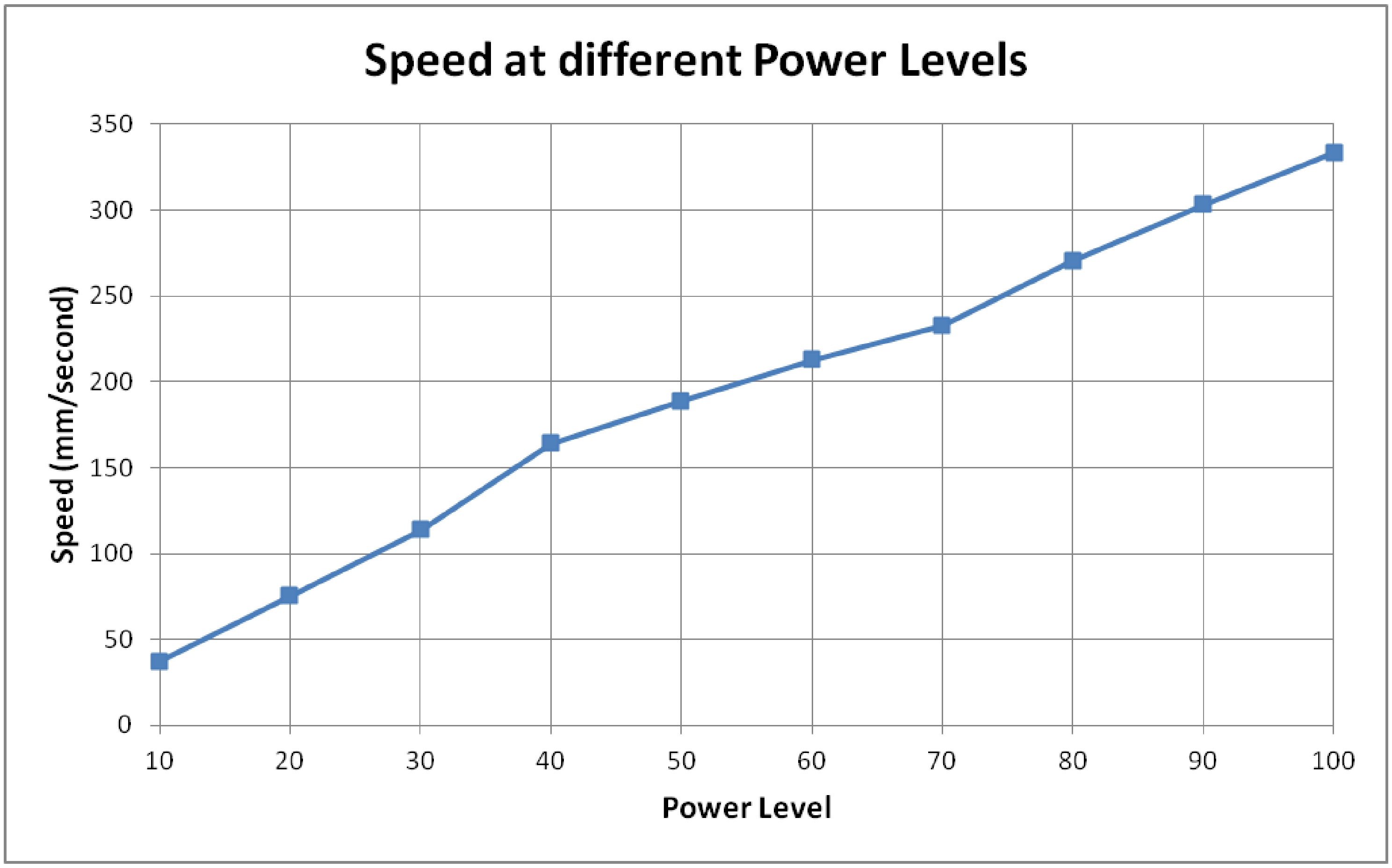
```
when started
set drive velocity to 87 %
drive forward
wait 1 seconds
stop driving
```

Keep this number constant
Change this number and measure the effect on the robot

By plotting the distance travelled (vertical axis) against the time taken (horizontal axis) students can build up a graph of their data. Students should find that there is a linear (straight line) relationship between the time programmed and the distance travelled. The slope of this line is the velocity of the robot (distance/time).

A random power level between 50% and 100% is assigned to each group, ensuring different results for each group. They cannot copy another group's data as it would be inaccurate for their robot.

With this data, students should now find a roughly straight line relationship between speed the robot travels and power level applied to the Smart Motors.



Look out for...

To set up, we will need a starting line a tape measure and a stopwatch. Encourage the students to work out what materials they will need and gently push them in the right direction if they miss out on anything.

When working with a fixed distance as in the case of the first section, we will be able to mark out a finish line as well as a start line. This is useful for students to visually see when the robot reaches 1 meter rather than stopping the timer when the robot stops.

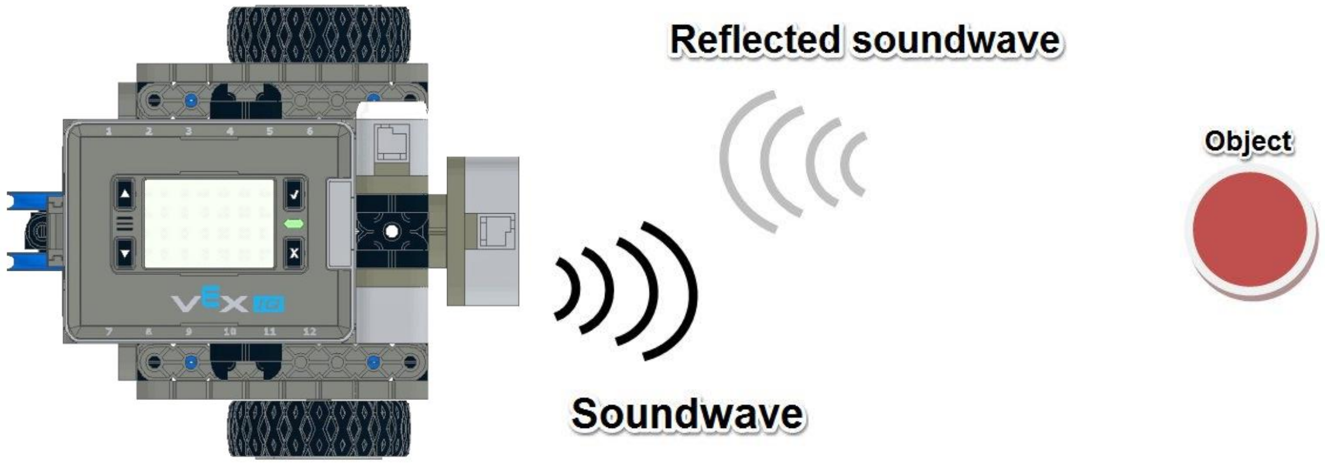
Smart students will program their robot to drive forward for 1 meter, wait a few seconds then reverse back to the start to save them from running after the robot each time.

Once they have calculated the speed for their robot, have them run a few tests on an untried power level and check that they do indeed travel at their desired speed. The robot may have a small margin of error

If this same experiment is run on carpet, students can expect to see a decrease in the speed of the robot due to the additional friction between the castor wheel and the carpet surface.

Theory

The Distance Sensor employs the use of ultrasonic range finding to determine the distance to an object. Distance Sensors, or SONAR (SOund Navigation And Ranging) sensors emit a very high frequency soundwave from one of the two openings in the sensor. This soundwave is typically 40KHz, far above what a human ear can detect. This soundwave travels through the air, and bounces off an object with the echo returning to the other opening on the sensor. By measuring how long it has taken for the sound to travel out to the object and return, the sensor can determine how far away the object is.



The robot is able to determine the distance to the object by timing how long it takes a reflected soundwave to return to the Smart Sensor.

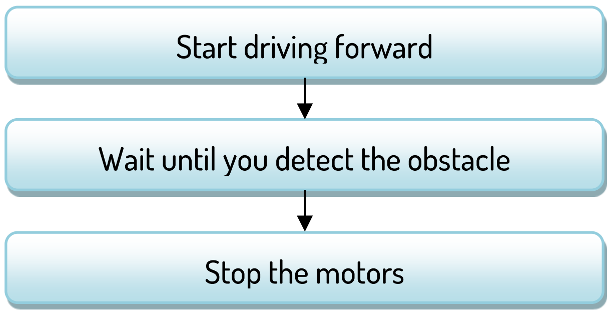
The reading that the Distance Sensor will display depends on the surface off which the ultrasonic waveform is reflected. Smooth, perpendicular surfaces give accurate readings, whereas irregular surfaces, (such as hands, other robots, angled walls etc) may give different results. The key here is to do plenty of testing.

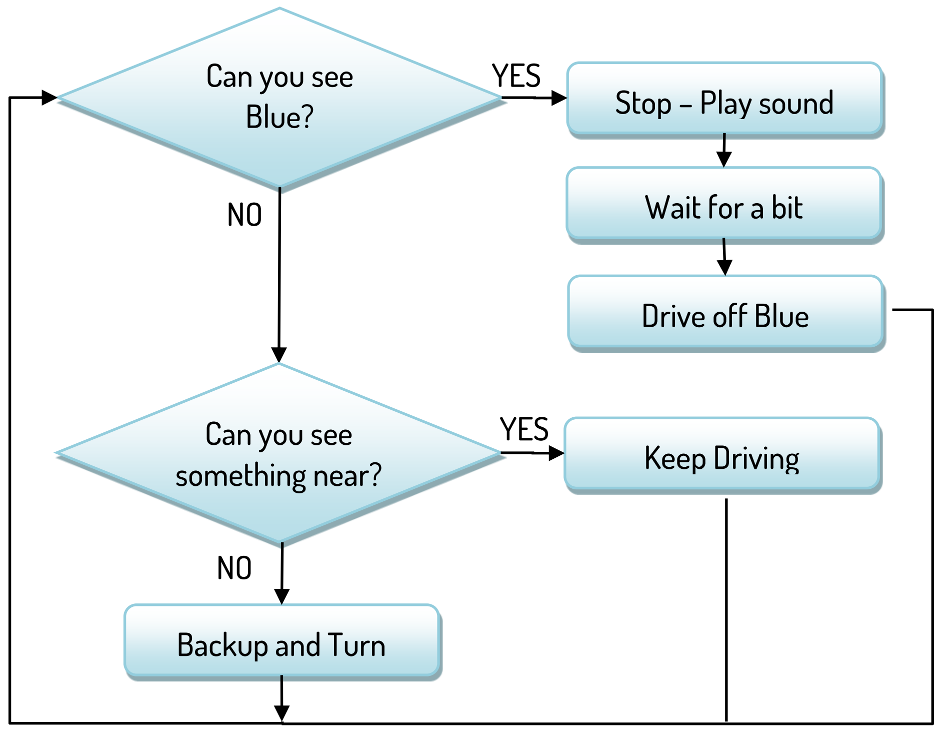
Teachers' Notes

Print and handout Student Worksheet – *Help, I'm Stuck*.

The first step of this challenge is to detect an obstacle and then stop. In this case, we do not want to tell the robot's wheels to move a set distance. Moving, for example, 1 meter forward will not help us if the obstacle is 5 meters away. It would be disastrous if the object was only 500mm away!

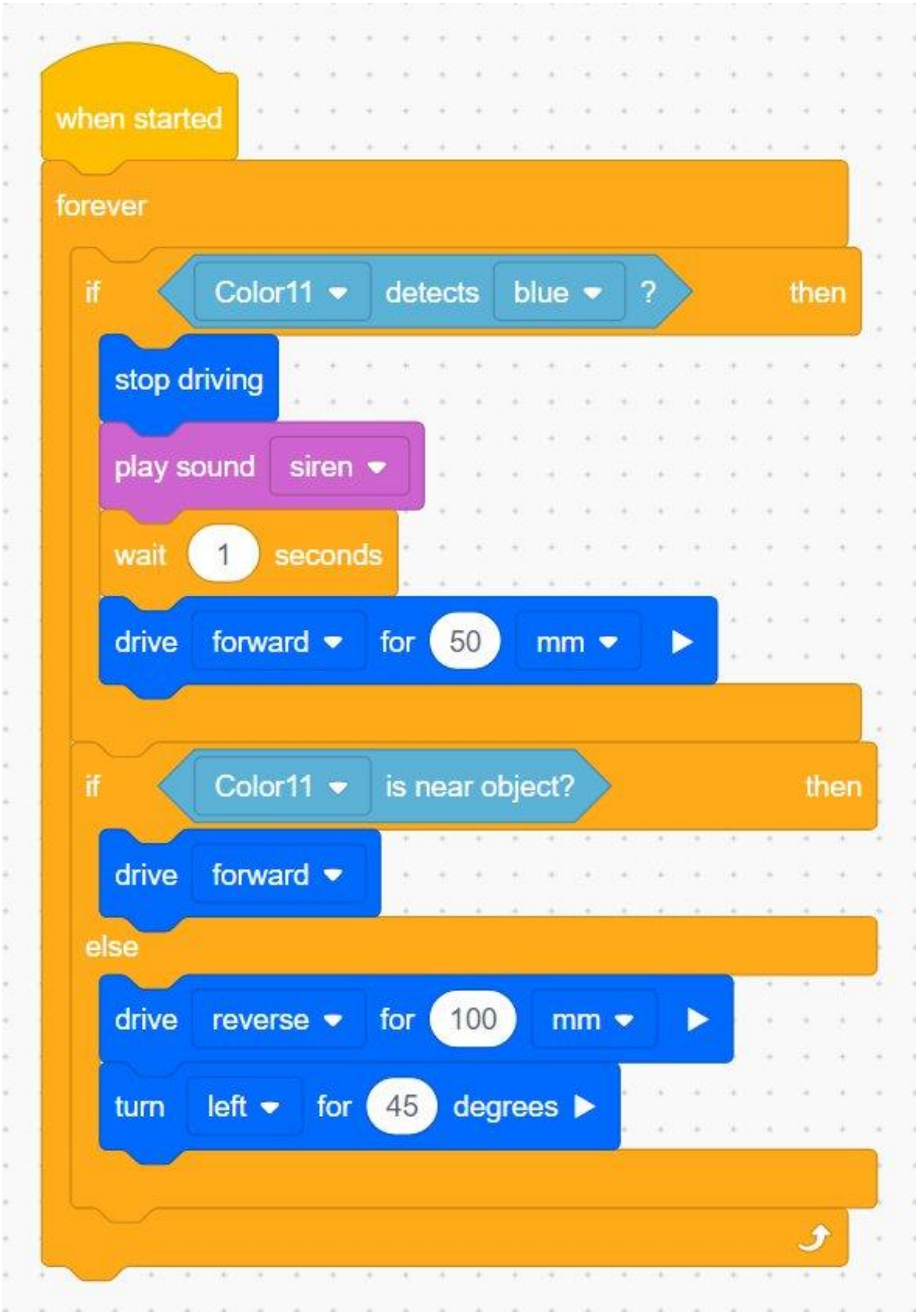
It helps to use a flowchart to plan what the robot will do.





```
IF the Colour Sensor sees BLUE
    Stop the Smart Motors
    Play a sound
    Wait for a bit
    Drive off the BLUE
IF the Colour Sensor detects something 'near' ie plateau,
    Drive Forward
ELSE
    Backup
    Turn slightly
```

Example Program



```
when started
forever
    if <Color11 detects blue ?> then
        stop driving
        play sound siren
        wait 1 seconds
        drive forward for 50 mm ▶
    if <Color11 is near object?> then
        drive forward
    else
        drive reverse for 100 mm ▶
        turn left for 45 degrees ▶
```