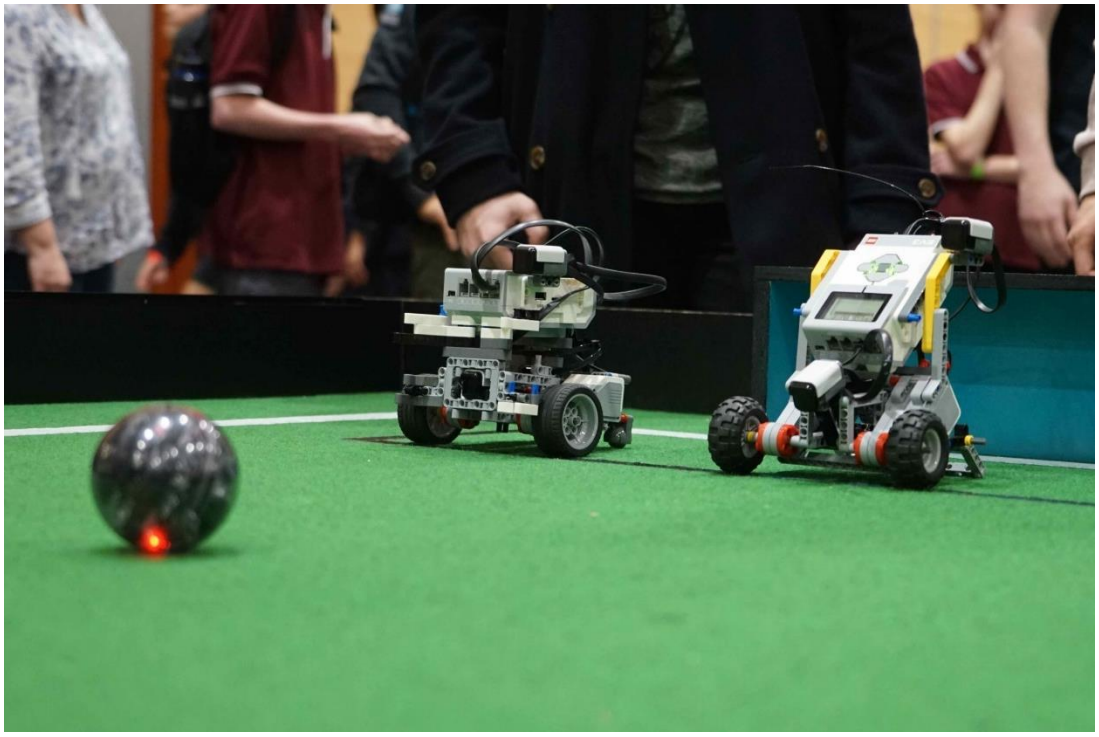
RoboCup Junior Australia

Introduction to RoboCup Soccer with LEGO® Mindstorms® EV3 Classroom

Steven Lau



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1. Overview

This is a very quick tutorial for students and mentors who are looking to get started with RoboCup soccer using the LEGO® Mindstorms® EV3 Classroom software.

This tutorial will cover:

- How to get values from a compass and infrared sensor
- How to make the robot drive towards the soccer ball using the infrared sensor
- How to make the robot face a particular direction using the compass sensor

It's then up to you to work out how to combine these skills into a soccer playing robot!

Be sure to check out more resources on the RoboCup Junior Australia website.

2. What You Need

Required knowledge:

- Basic understanding of how RoboCup soccer works (check out the RoboCup Australia website for details)
- Basic knowledge of EV3 Classroom programming environment or Scratch
- Basic knowledge of how to use a LEGO® EV3

Software

You can download the software from the following places:

- MINDSTORMS EV3 downloads – LEGO Education
- Microsoft Store for Windows (search for EV3 Classroom)

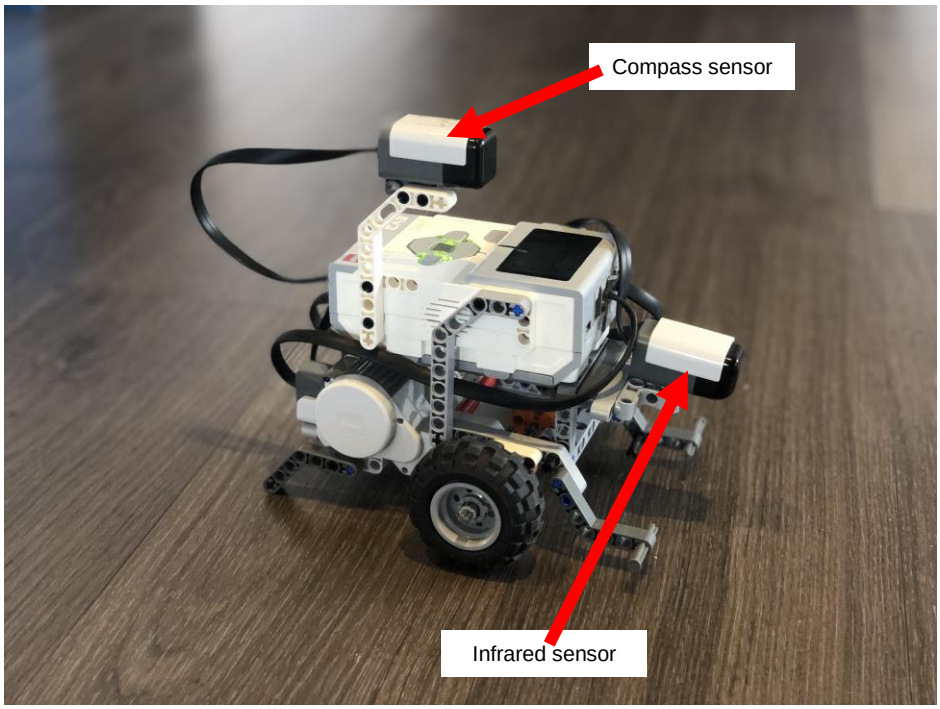
Hardware

Required parts:

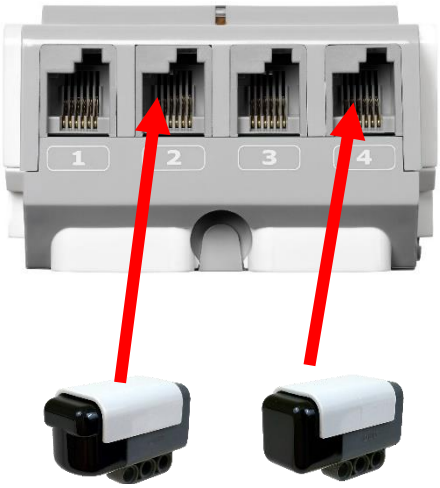
- EV3 robot drive base. Some suggested instructions:
  - ev3-rem-driving-base.pdf (lego.com)
  - RileyRover – EV3 Classroom robot design – Damien Kee
- Compass sensor
- IR sensor
- IR ball

The sensors and IR ball are available from Modern Teaching Aids.

You need to attach your sensors so robot should look something like this:

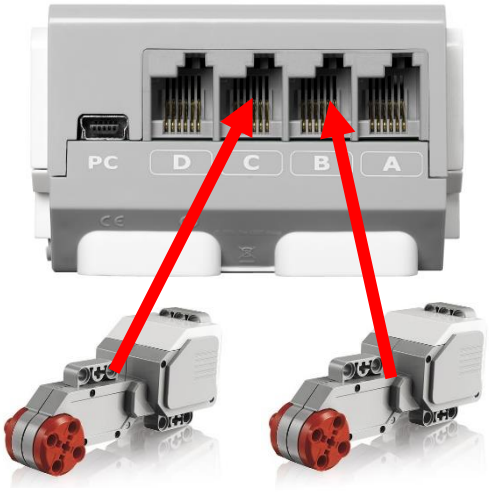


In this tutorial, the following ports will be used:



Infrared sensor

Compass sensor



Right motor

Left motor

Tip:
Make sure the compass sensor is mounted as far away from the EV3 brick and motors as possible. These can generate magnetic interference.

3. Reading Sensors

Using ‘Port View’

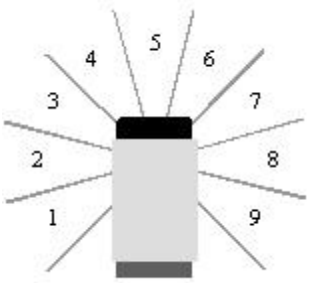
The simplest way to read the sensors is to navigate to the ‘Port View’ menu on the EV3 brick. You should be able to see the values from the infrared sensor in Port 2, and the compass sensor in Port 4.

The sensors may show up as ‘IIC-BYTE’. This is normal.

Infrared Sensor Values

Turn on the infrared ball and move it around the sensor. The infrared sensor will show a value of between 1 to 9, depending on what angle the ball is located, relative to the sensor. A reading of 0 means that the sensor cannot see the ball.

I.e., a value of 5 means the ball is straight ahead. A value of 2 means the ball is to the left of the sensor.



Tip:
Keep the sensor away from sunlight. The sun emits infrared light, which can mess up your sensor readings! If you are getting odd readings, try closing curtains and doors if needed.

Tip:
Inside the infrared ball, there is a small switch. Make sure it is switched to 'Mode A'.

Tip:
Make sure the infrared sensor is attached to the robot horizontally.

Compass Sensor Values

Spin the robot around. The compass sensor outputs the direction it is facing in degrees (from 0° to 360°).

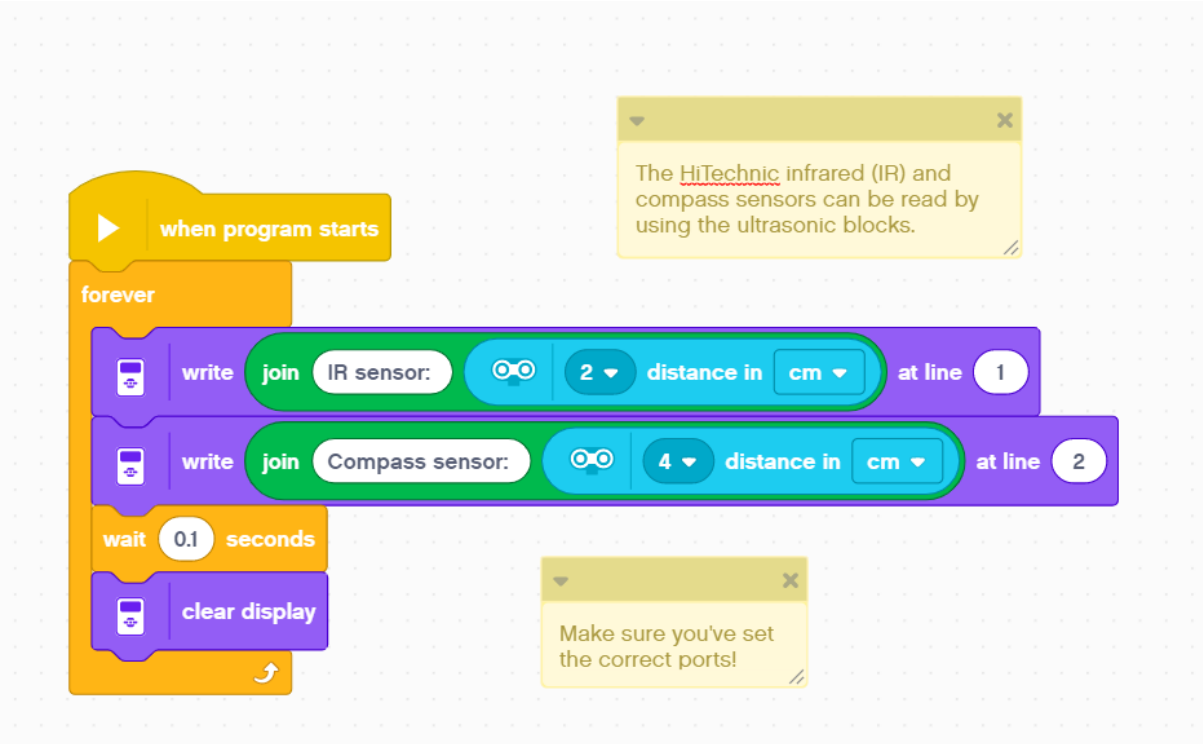
Tip:
Some older compass sensors can output a value between 0° to 180° instead. You should be able to determine this in 'Port View'. If this is the case, you will need to multiply the sensor value by 2. (180 × 2 = 360)

Tip:
Make sure the compass sensor is attached to the robot horizontally.

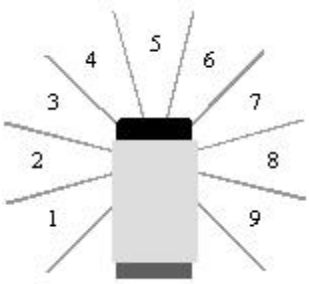
Displaying the Sensor Values on the EV3 screen

The first thing we want to do is read values from the robot's sensors, and then display them on the EV3 screen.

You may have noticed that there is no specific block for the HiTechnic infrared sensor or HiTechnic compass sensor. We can use the ultrasonic blocks as a substitute instead!

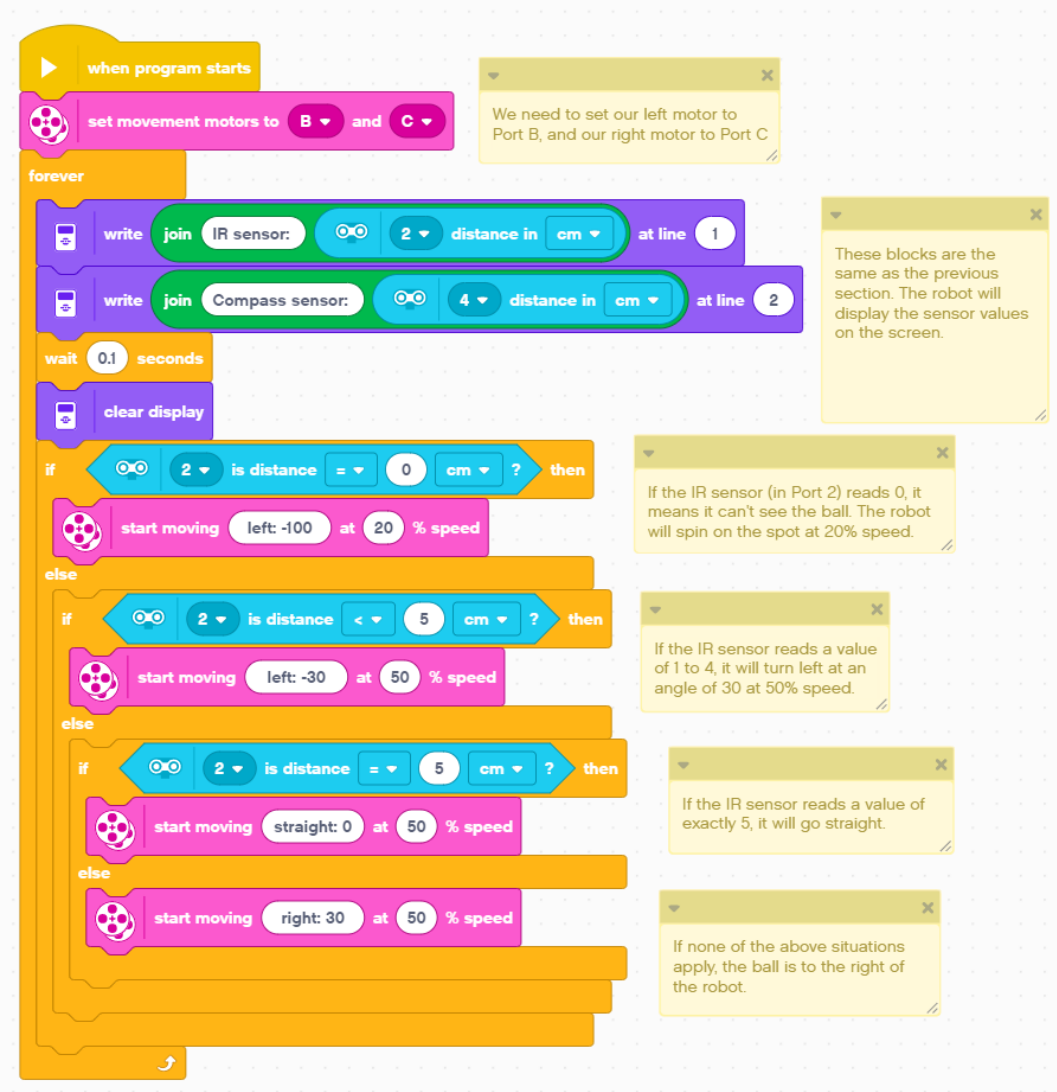


4. Following the Ball



We are now going to make the robot follow the infrared (IR) ball. Our robot is going to do four things:

1. If the IR sensor returns a value of 1 to 4, our robot will turn left
2. If the IR sensor returns a value of 5, our robot will go straight ahead
3. If the IR sensor returns a value of 6 to 9, our robot will turn right
4. If the IR sensor returns a value of 0, it means the robot cannot see the ball. We will make the robot spin on the spot until it can find the ball

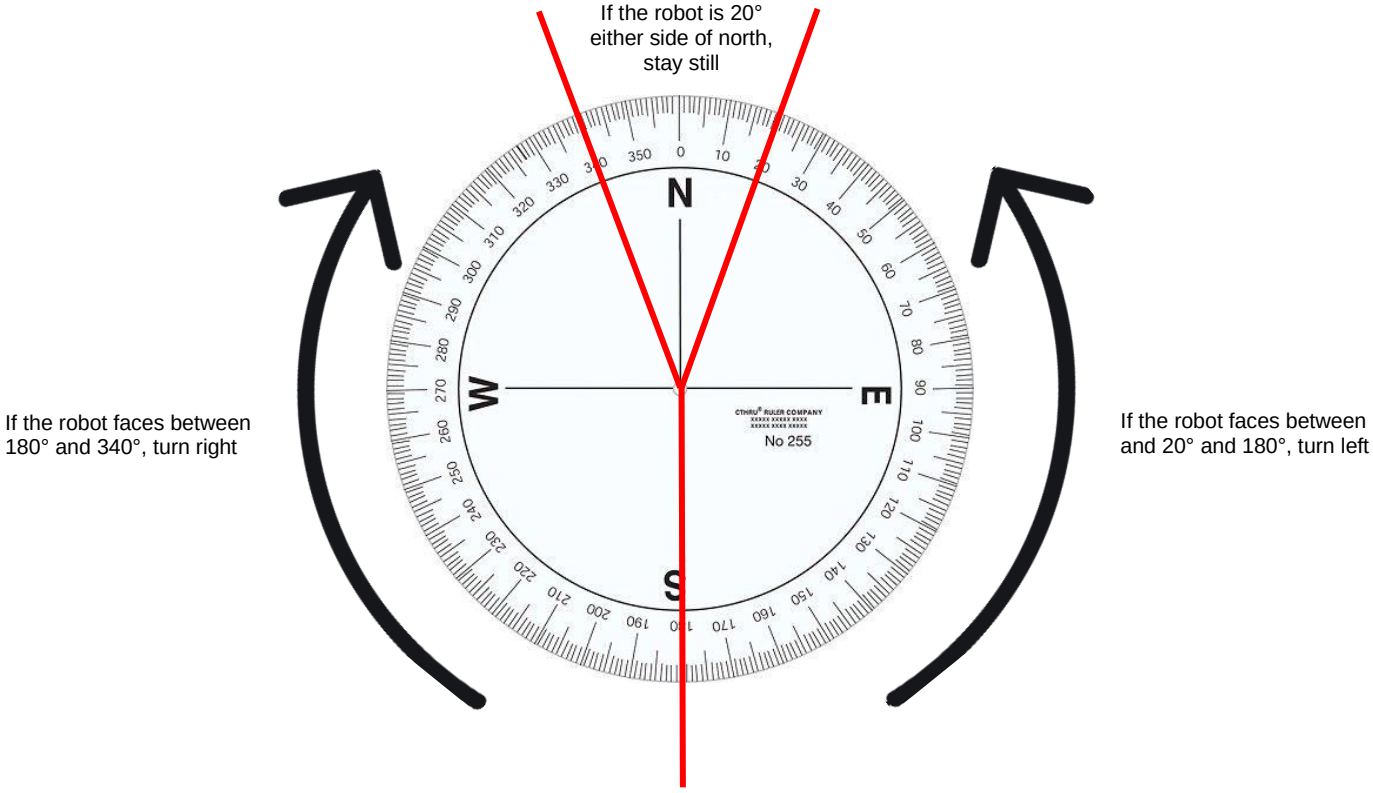


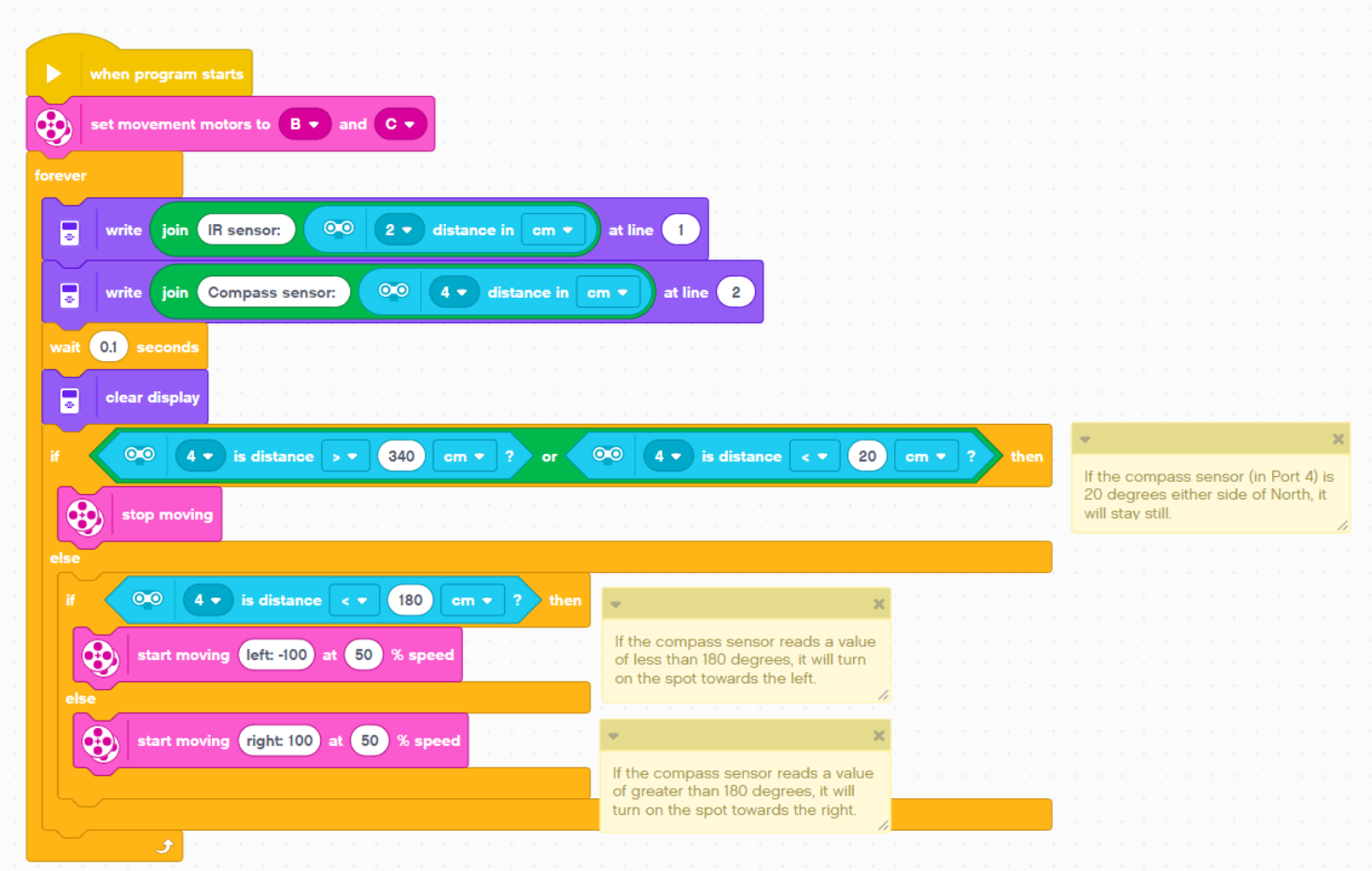
5. Facing the Right Way

We are now going to make the robot use the compass sensor to face north (0°).

Our robot is going to do four things:

1. If the compass sensor is between 0° and 20° OR between 340° and 360°, the robot will stay still. This is a 'buffer zone' so the robot is not too sensitive to changes in compass readings.
2. If the compass sensor returns less than 180°, our robot will turn left
3. If the compass sensor returns greater than 180°, our robot will turn right




when program starts
set movement motors to B and C
forever
write join IR sensor: 2 distance in cm at line 1
write join Compass sensor: 4 distance in cm at line 2
wait 0.1 seconds
clear display
if 4 is distance > 340 cm ? or 4 is distance < 20 cm ? then
stop moving
else
if 4 is distance < 180 cm ? then
start moving left: -100 at 50 % speed
else
start moving right: 100 at 50 % speed
If the compass sensor (in Port 4) is 20 degrees either side of North, it will stay still.
If the compass sensor reads a value of less than 180 degrees, it will turn on the spot towards the left.
If the compass sensor reads a value of greater than 180 degrees, it will turn on the spot towards the right.