Simple Simon
GEN II Robot Soccer
EV3 -Tris 10
Training Curriculum

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You will find that GEN II Soccer is no harder than any other robot competitions. **It is actually easier for beginners to enter and compete successfully in Soccer!** They can then raise their expectations and skill levels as they compete. The use of IR Beacons is not a compulsory item for beginners to purchase or master, it just adds a further dimension of control for the robots and programmers when they get to that stage.

It is a common misconception that a lot of technical equipment is needed to compete in in GEN II. Teams starting out have the most fun if they build and program a Simple Simon Soccer Player or two and just compete!

Equipment needed for a Simple Simon Soccer Player Team:
2X LEGO Mindstorms EV3 45544Kits
2X Tris10 Infrared Seekers or Hitechnic IRV2
1X Hitechnic Pulsed Soccer Ball

Have a look at http://www.teaching.com.au/catalogue?catalogue=MTA&category=MTA-ROBOCUP-ROBOTICS-COMPETITIONS . There is a great deal where you can get started in Simple Simon for little more than the price of two NXT Kits! There are also great sensor deals for beginners if you look at the MTA catalogue.

The Simple Simon Approach
Build a Riley Rover robot from http://www.damienkee.com/home/2011/8/20/domabot-classroom-robot-design.html or a Tommabot from http://www.robocupjunior.org.au/tutorials

Add an infra red sensor and a bull bar and you are ready to go

Program a Simple Soccer Robot(or two) from the notes below. A Simple Soccer Player that can find the ball and kick it will be competitive in most GEN II League Tournaments. **It does not necessarily have to use a compass.**

Build a goalie using an EV3 or NXT light sensor. These sensors will pick up a pulsed ball from 40 cm if they are calibrated correctly. Change the Simple Soccer Player Program to just move forwards and back when it sees the ball. That way it will it will remain in front of the goals.

You do not need a GEN II field to practise on at this stage. Just mark out the field dimensions and goals on a mat, or the carpet of the classroom floor and develop your soccer team on this.

Simple Simon GEN II Soccer

Simple Simon is intended as an introductory level game of GEN II Soccer. It will give novice students a feel for the GEN II games and tournament conditions. State Committees will be running Simple Simon competitions if enough interest is shown. Simple Simon will not be offered at a national level.

Aims

To make GEN II Robot Soccer accessible to all students.

Limit the need to purchase specialised equipment in order to compete in GEN II

Maximise participation of students.

Minimise the infrastructure needed for GEN II Soccer games.

Rule Modifications

The following modifications can be made to the RCJA GEN II Rules.

1. Teams will have a maximum of two Hitechnic IRV2 sensors.
2. All other sensors must come from Mindstorms EV3 or NXT kits.
3. Only Mindstorms NXT-G or EV3 software can be used.
4. Games will be 5 minute halves with no half time break and 4 minutes break between games.
5. All programming should be done prior to the tournament.
6. If the ball hits the side wall, play will continue.
7. If "lack of progress" is called, the ball will be replaced to the nearest neutral spot.
8. "Damaged" robots can only be removed with the referee's permission.
9. If a robot is in a situation where it is about to kick an own goal, it should not be removed.
10. A damaged robot remains off the field for 30 seconds or until a goal is scored.
11. Any team that is not ready to start a game will lose a goal per minute for being late. The game clock will start at the scheduled time and the game will run according to the tournament schedule. Forfeits result in a 5-0 score line
12. Teams may not be given setup areas if accommodation is limited. They will use the area around the allocated field to program robots (if required)
13. Only one laptop and two robots will be brought to the field area. No spares or tools are to be used. One chair and one powerpoint will be made available to teams.
14. Robots and laptops are to remain in the field area once the tournament has begun.

Follow the training notes below and you will be playing GEN II in less than 2 hours.

These notes use the Tris10 Findball IR sensor as it is easier to show the programming features of EV3 with this. The Hitechnic IRV2 sensor can easily be substituted into these programs and by adding the 4 extra direction readings.

Any questions queries or comments, contact: b.thomas@ccg.vic.edu.au

Finding the Ball: The Mexican Wave

Overview

The first part of playing any ball game is to find and chase the ball. This unit allows your robot to chase the ball when it is in front of the robot.

If you get all of the robots in the class, you can create a Mexican wave of robots.

It is assumed that you have a minimal knowledge Mindstorms EV3 programming.

It is recommended that you go through this exercise as it ensures that all sensors and motors are plugged in their correct position and working.

Robot Setup

Build a Riley Rover add a bull bar and a Tris10 Findball infra red sensor.

All that you need is motors plugged into outputs B and C and the IR Sensor plugged into Sensor Port 1.

You operate the Tris10 sensor with the Ultrasonic (cm) tile.

Programming

In this program the IR Sensor is just waiting for a reading from the ball and then the robot will be told to move forward.

Create the following simple program that will allow you to check that everything is working OK.

Start with a loop. Leave it at the unlimited(loop for ever setting).
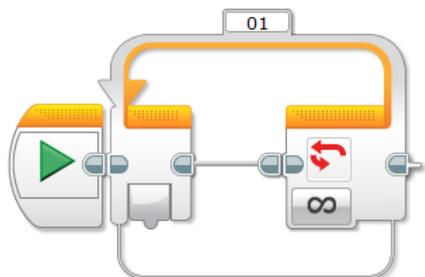
Add a switch to inside the loop
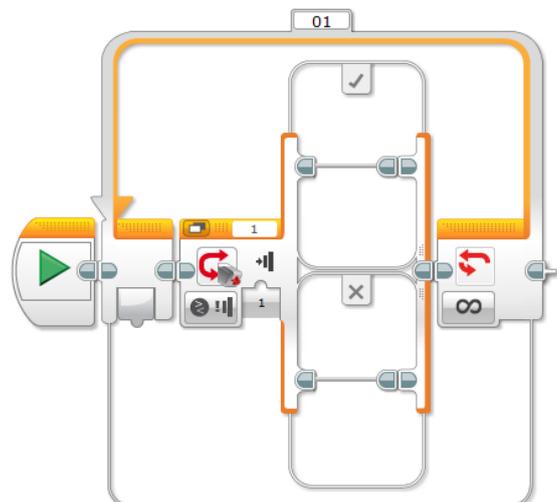
Programming(cont)

- Now change the switch from Touch Sensor to Untrasonic/Compare/Distance cm.
- Select the "= " sign
- Select 3 as you threshold Value
- Insert a Move Tank icon into the "True" branch of the switch.
- Select On for Seconds
- 100% Power Forward for both motors
- Set tiem for 1 Second
- Brake at End

Your programming area should look something like this
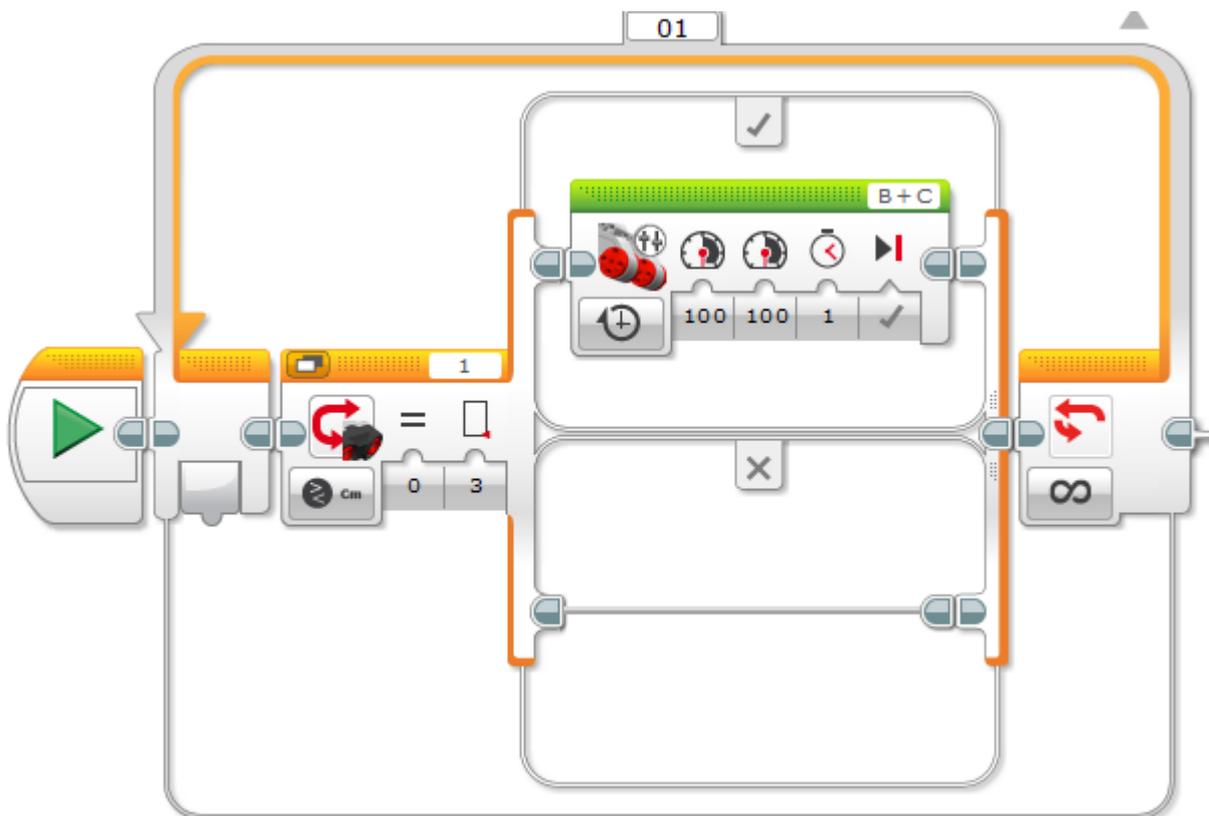
Save this program on your computer as MW.

Select download and Run ▶ in the right bottom corner of the programming page. This gets you to the correct section of the EV3. I always do this first time I run a program, but always hold onto your robot when you do this, it may get away from you.

The robot should do nothing at this stage

Place all of the class robots with their backs to the classroom wall

- The teacher will turn the ball on and roll the ball across the classroom.
- Did you get a Mexican Wave?
- Try rolling the ball further away from the robots. Which robot has the best range?

The pulsed ball has an incredible range and also can be sensed by reflection off walls. Experiment with the location of your IR V2 sensor and maybe shield it with black tape to reduce the influence of reflections and still maintain the excellent range.

To see what values your sensors are reading, simply plug the robot into your computer and select the
Port View icon.
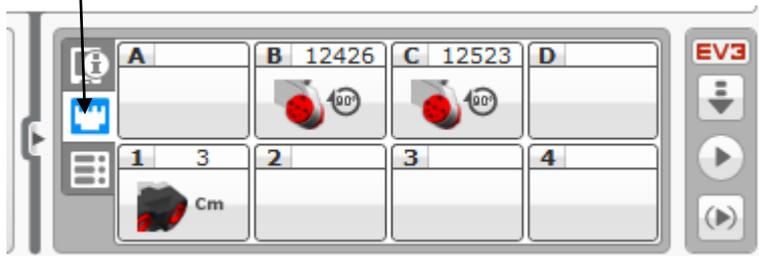
If you robot is ever mis behaving, this should be the first step of your trouble shooting.

You will find the Tris10 sensor gives the following readings.
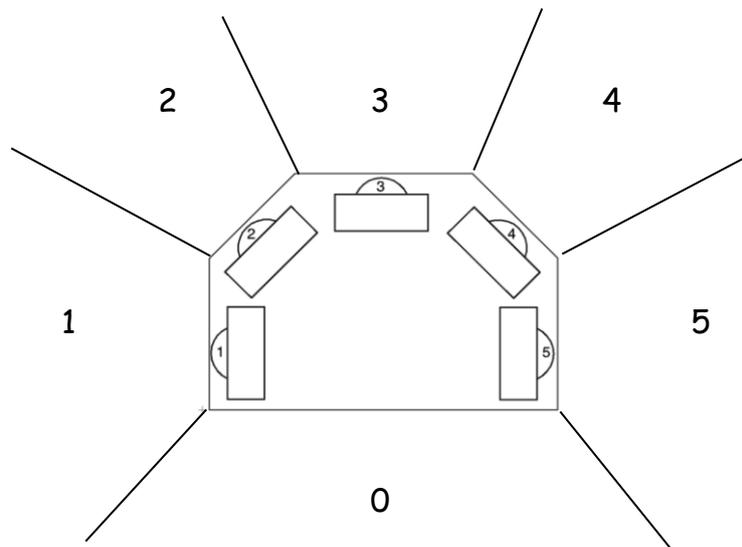
At this stage you can experiment with the placement of the LEGO pieces around the sensor to give you consistent readings. You will be amazed at the sensors ability to "see through" the LEGO. This should be repeated every time you add other attachments such as dribblers and kickers.

Simple Simon Soccer Player

Overview

You will now add another switch to the program from the previous unit. With this you can now scan for the ball and chase it, no matter where it is on the field.

Robot Setup

All that you need is motors plugged into outputs B and C and the Tris 10 Sensor plugged into Sensor Port 1.

Programming

Place an ultrasonic switch in the "True" branch of the switch in the Mexican Wave program

- Set the first switch to greater than 2
- Set the second switch to greater than 3

The means that for the lower branch the, sensor readings will be 0,1or 2 meaning that the ball is to the left of the robot.

The middle branch is for sensor reading 3 meaning the ball is straight ahead.

The top branch is for readings 4 and 5, meaning the ball is to the right of the robot.
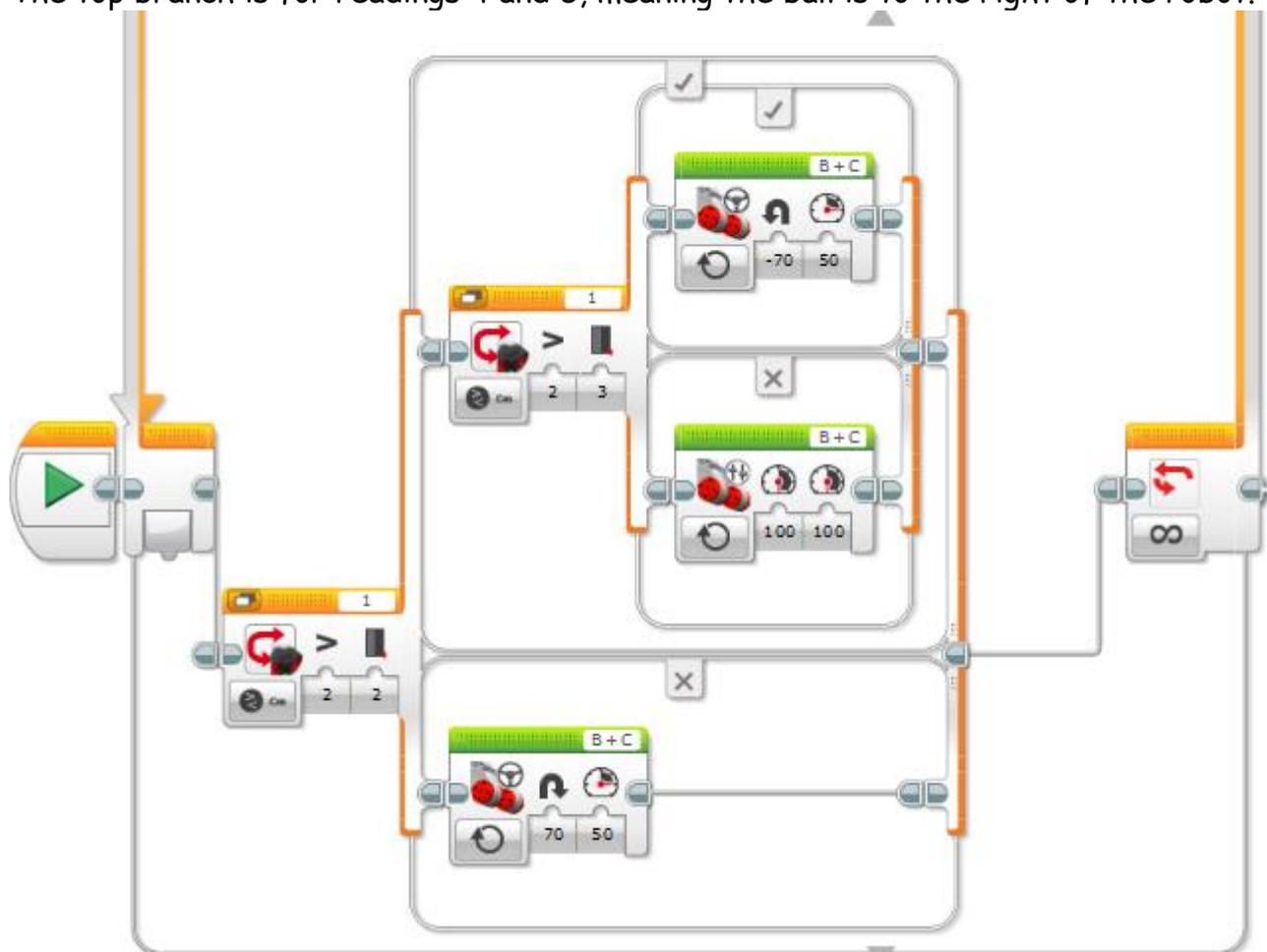
Programming(cont)

- Place the Move Tank icon from the Mexican Wave unit the middle branch. This should send the robot forward at full power for 1 second.
- Add a steering icon to the top and bottom branches.
- Select "On" and 50 % power.
- Adjust the steering slider to turn left for the bottom icon and turn right for the top icon.

This is the Simple Simon Soccer Player. It will allow you to have fun and play a game of GEN II Soccer. Save it and keep it in case your more complex programs fail.

Adjustments for Improvement

A fast robot will beat other robots to the ball. However if a robot is scanning too quickly it may scan past the ball and miss it when it is straight ahead.

- Increase the speed of the turn until the robot scans past the ball.
- Go back to your previous setting and use this as your optimum scan speed.

Experiment by clicking the "Switch to Tabbed View" icon
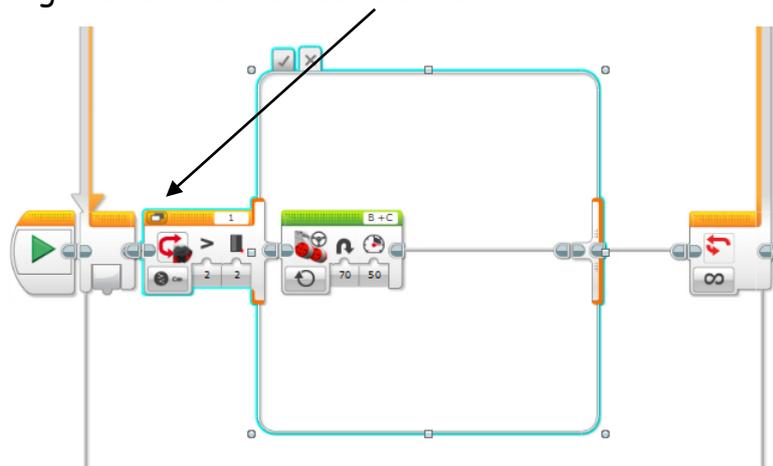
You will see that only one of the branches will be displayed. To view the other branch just click on the True or False icons   Notice how much room this creates on your screen?
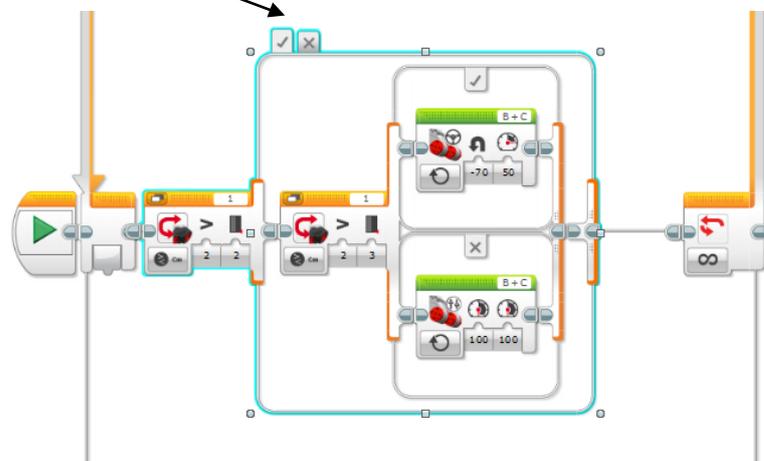
Ball Chase

Overview

You are now ready to use the full facilities offered by the EV3 programming and the Tris10 sensor to keep the ball under control once you have it, and dribble it down the field.

Robot Setup

You will now need to modify your robot to retain the ball. Read the rules on www.robocupjunior.org regarding robot size and ball capturing zones and build a "bull bar" that will help to control the ball.

You still only need to have motors plugged into outputs B and C and the Tris10 Findball Sensor plugged into Sensor Port 1.

Method

The Simple Simon is not totally smooth. This program utilizes the 6 IR sensor readings allows you to adjust how sharply the robot is turning and gives your robot a command to go directly at the ball.

Programming

- Start with a new program
- Start with a loop. Leave it at the unlimited(loop for ever setting).
- Place the Ultrasonic(cm) block from the yellow palette inside the loop
- Select Measure/Distance cm
- Add switch and this time select Numeric from the drop down menu
- Wire the Ultrasonic block to the switch by left clicking and dragging the cm jigsaw block to the # slot.
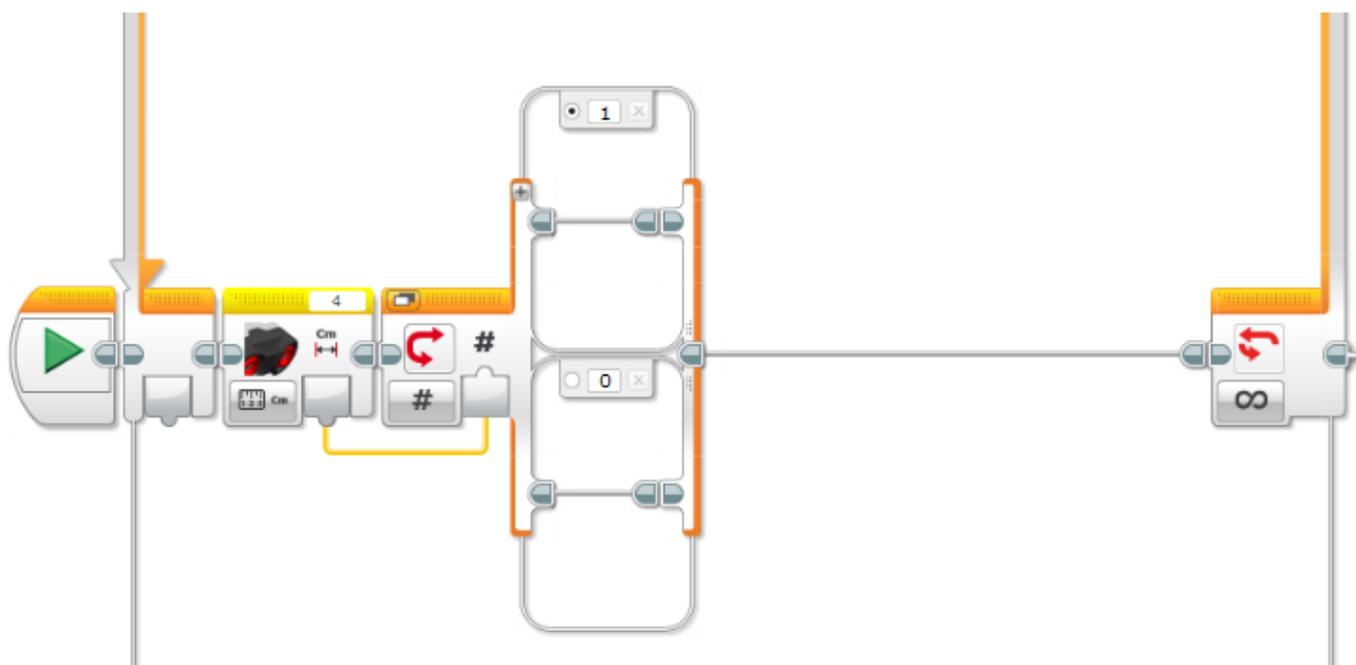
Now we can use a new feature of the EV3 software,
Click on the + symbol on the switch. Repeat this 4 times.

Label each section starting at the top 5,4,3,2,1,0
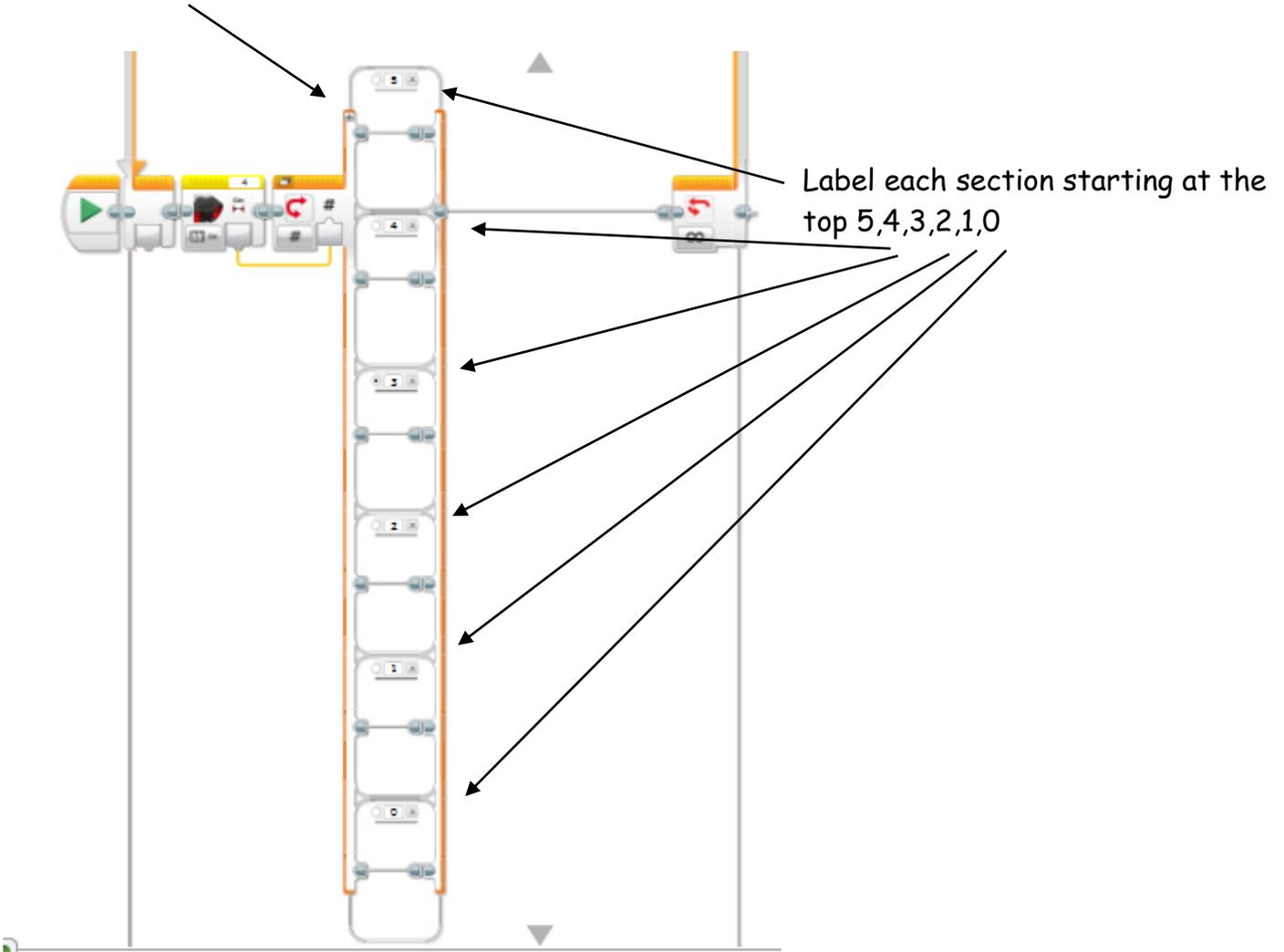
Now inset the steering motor icon into each of the steps.

Adjust each of these according to the following page.
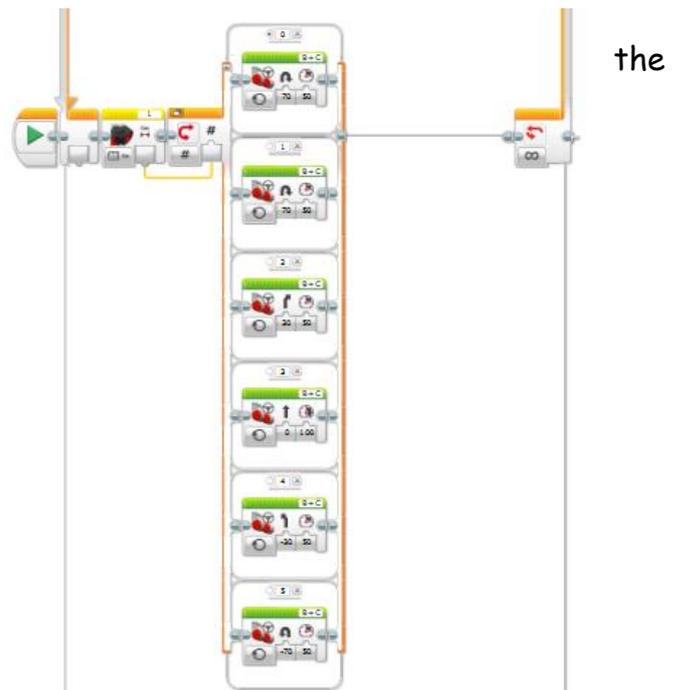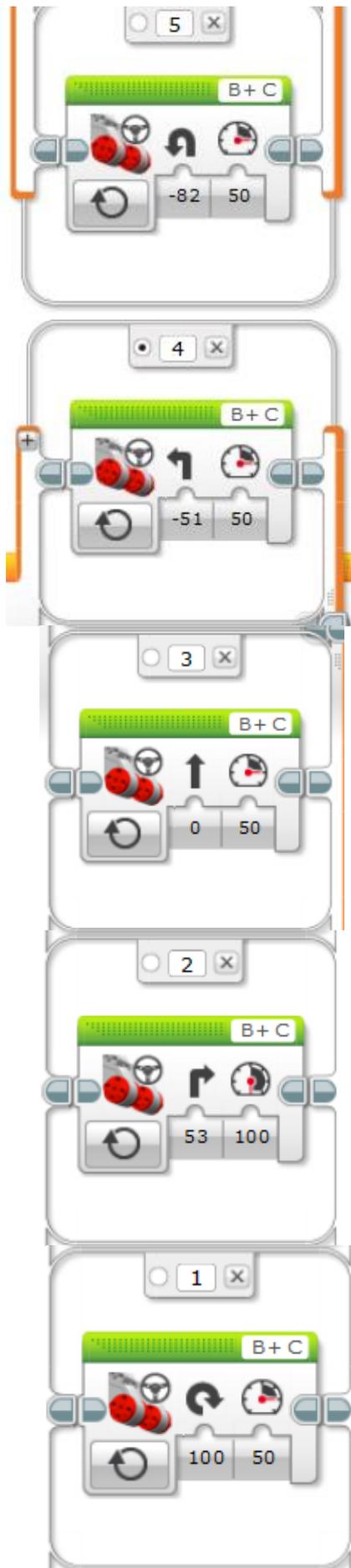
Method

A common problem for robots is that they continually get stuck on the walls or against the goals. The reason for this is that the program does not have a reverse command in it. If a robot is stuck against the wall it can be assumed that the robot cannot see the ball. Consequently this is an ideal time to get the robot to reverse and to turn around.

Programming

Select Tabbed view on your switch to now give yourself a bit of room on the screen.

Click on the "0" tab at the top of the switch to get to the only branch that should be blank at this stage. Add two Move Steering icons to the branch.

- On the first icon, Select On for Seconds
- Steering 0
- Power -100
- Time for .3 – 1 second
- On the second icon
- Steering 70-100
- Power 50-100
- Time for .3 – 1 second to get the robot to turn from 90 -180 degrees according to your needs
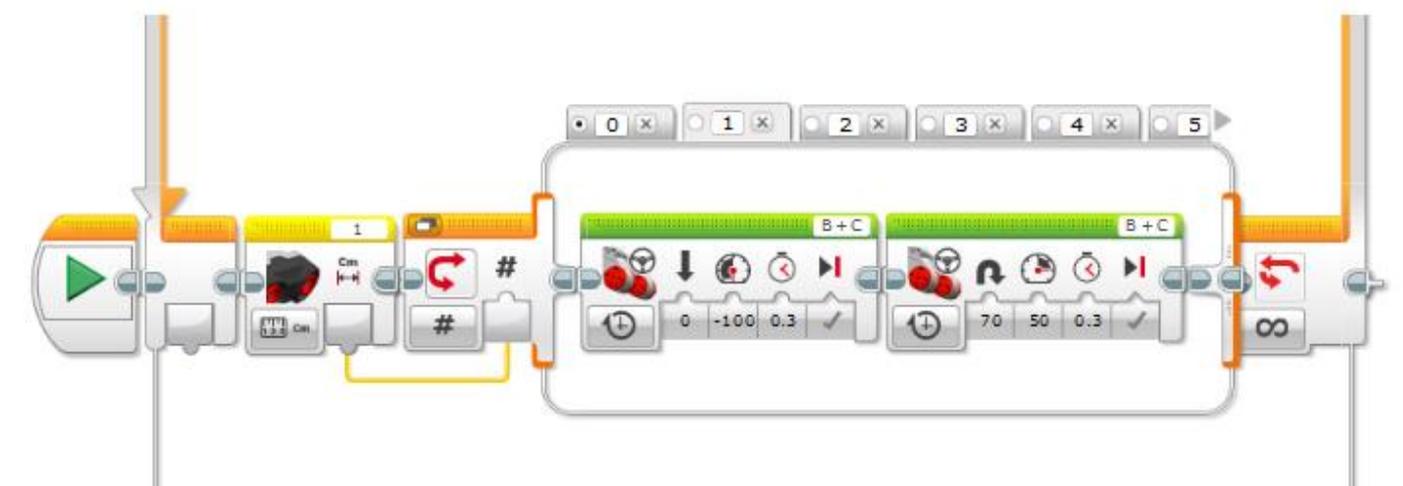
How well does your robot go now???

You will need to adjust the motor power and turning direction for each of the 0-5 settings depending on how your robot behaves.

The above method can also be used on the Hitechnic IRV2 sensor, but you will need to set 10 branches for 0-9 readings.

Simple Simon Goalie

Overview

It is always an advantage to have a robot that will remain in front of the goals. Simple mathematics can tell you that a 22cm goalie in front of 45 cm goals will cut the chances of the opposition scoring a goal by close to 50%. Of course the rules state that this robot must react to the ball in a forward direction.

The IRV2 will detect the ball for the full length of the field. This is not ideal as the goalie should only react to the ball when it is within "kicking" range. It is actually an advantage to build a goalie using an NXT light sensor. These sensors will pick up a pulsed ball from 40 cm if they are calibrated correctly. You just need to program the goalie to just move forwards and back (and kick) when it sees the ball.

Many thanks to the Grade 4 students of Scotch Oakburn College in Launceston for testing and refining this program.

Robot Setup

You will need to have motors plugged into outputs A and C and an EV3 Colour sensor plugged into Sensor Port 2.

Colour Selection

The robot will see the infra red ball as black on the colour sensor.

This has a range of over 1 m.

You do not want the robot to chase the ball when it is down the table.

You may need to angle the colour sensor downwards to reduce its detection range.

Programming

- Start with the loop function
- Then place the switch inside the loop
- Following this, place two Motor controls in the upper fork of the switch
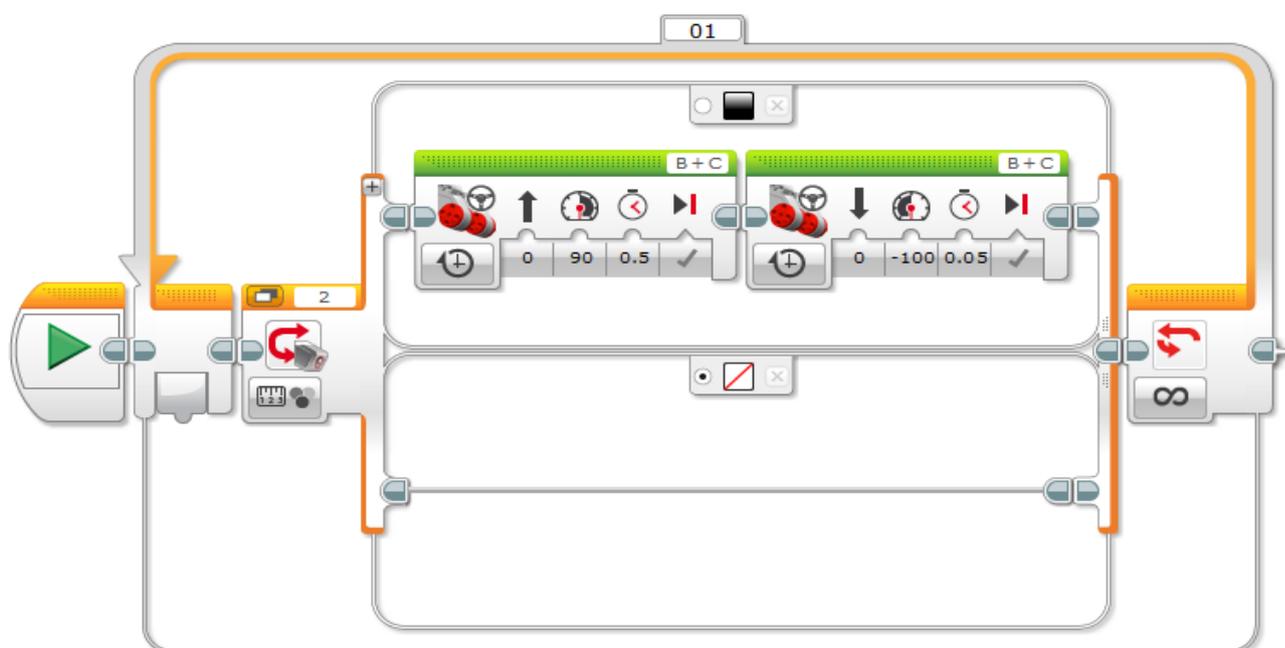
- Set the Switch to Colour Sensor-Measure -Colour
- Set the top branch to black and the bottom branch to no colour and select the default button(important)
- Set Motors to B and C and get them to run forwards 100%, then backwards - 100% for .5 seconds each
- Set the Loop Control to Forever
- Try doing the Mexican Wave with the other robots in the class.
- Adjust the angle of the sensor so that the robot only responds to the ball when it is 50 cm away.

Scanning For the Ball

It is desirable that the robot scans only the 180 degrees forward of the goal it is protecting. Consequently if it goes out to kick the ball, it will need to continue its scan from where it left off. This is achieved by scanning in small increments and by counting the number of times it does this. That way after the robot responds to the ball, it can return to its position in front of the goal and continue scanning from that count.

Programming

- Add another loop at the start of the program.
- Drag the light sensor loops to inside the first loop and place them side by side.
- Add a Move Steering icon to the lower branch of the switch.
- Set the steering to turn full left,
- Motor Power 50,
- Timer to .05 seconds.
- Select Coast to stop (important)
- Set the light sensor loops to count for 40 and the outside loop to loop forever.
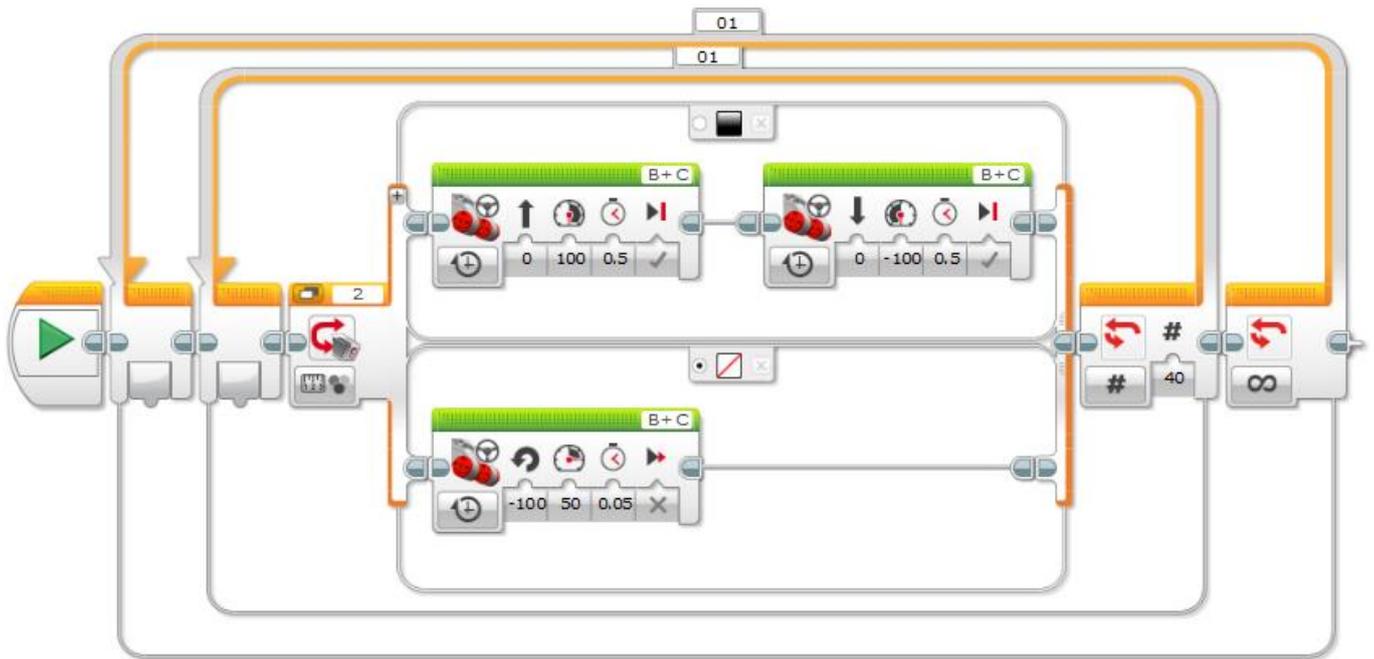
Test the program. The robot will scan to the left and attach the ball when it is close.

- Copy and paste the sensor loop to beside the first loop.
- Change the motor icon on the lower branch to turn right.
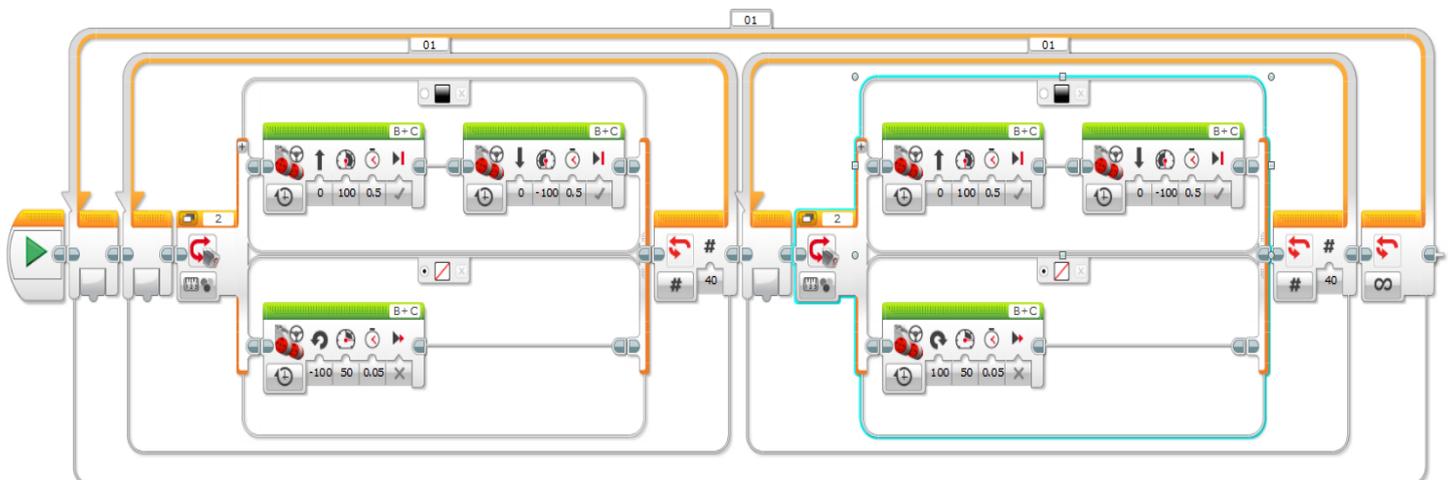
Adjustments for Improvement

- Change the count of both light sensor loops so that the robot is scanning exactly the same amount and close to 180 degrees.
- The robot must not move from its spot in front of the goal after responding to the ball. You must adjust all timings so that the robot remains in position after at least two minutes of play.
- If a robot is scanning quickly it can reduce its ball detection ability.
- Vary the angle of the sensor and the scan speed to get optimum performance.