



While you're waiting for us to get started, why not checkout our website?
<https://robocupjunior.org.au>

Welcome

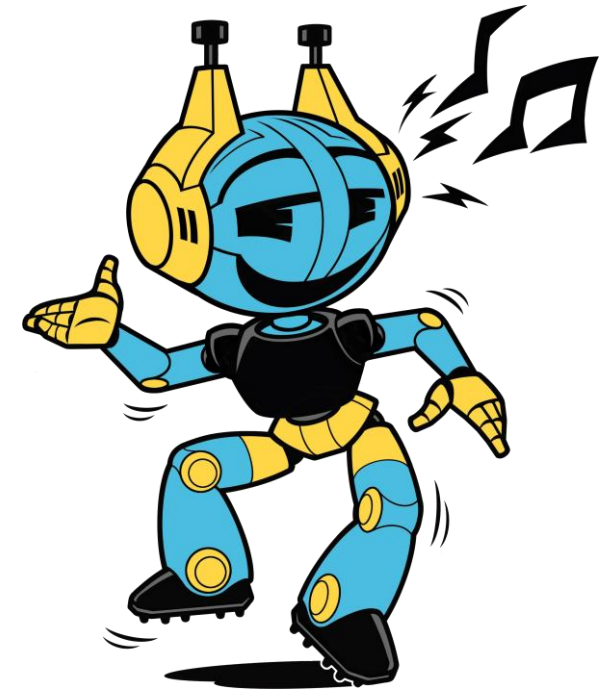
Thank you for joining us for our 2023 Online National Mighty Maisy Maze Launch Workshop

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Tim Ronchi (Victorian Rescue Maze Coordinator)

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Interruption Policy

Please interrupt at any
time as often as you like*

This is a Workshop *not* a Lecture

Structure of Today's Online Workshop

- Introductions
- The Challenge
- The Maze
- The Robot
- Programming the Robot
- Q & A session



Overview of Competition



“Real world” robot challenge



Modular, flexible game design



Accessible to a wide range of robot platforms



Many possible solutions



Easy for beginners but with a high ceiling



Simple scoring



Engaging and fun

Now even easier for beginners!



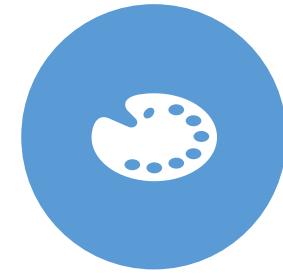
CAN BE
COMPETITIVE WITH
A LEGO EV3
OR SPIKE ROBOT



CAN USE EV3 OR
SPIKE CLASSROOM
SCRATCH
PROGRAMMING



PATHWAY TO MORE
ADVANCED
SOLUTIONS



LOTS OF DESIGN
FLEXIBILITY

Scenario

- There has been a disaster in a factory building.
- Several workers are trapped inside but it is not safe to send in rescue teams. Tokens have been placed to represent trapped (green) and seriously injured (red) victims
- The role of your robot is to enter the building, identify the number and classification of victims, and exit the building.
- Your robot will then report on the victims found.



The Competition

- There is a minimum of 5 victims in the maze. You get points for each one you find. The red victims are worth more points than the green
- Bonus points for exiting and for accurately reporting the number for each type of victim
- The robot must avoid black holes in the ground
- The robot can be return to last found victim if stuck without penalty but program cannot be restarted
- Robot run can be restarted with loss of points at any time
- READ THE RULES !!!!



The Maze

A4 Maze
designed for
low barrier to
entry into
competition.

Open Maze
usable if you
already have it.

New flat pack
Open Maze
design coming
soon.



The Maze – What You Need – A4 Maze

- The simplest way to get started is using reams of A4 paper on their side for walls.
- For the coloured victim marker squares, reflective start/end tile and black hole tile you can use the course instructions PDF available from the Rescue Maze Challenge page of the Robocup Junior Website:
- <https://www.robocupjunior.org.au/rescue-maze/>



The Maze – What You Need – A4 Maze

A4 Maze:

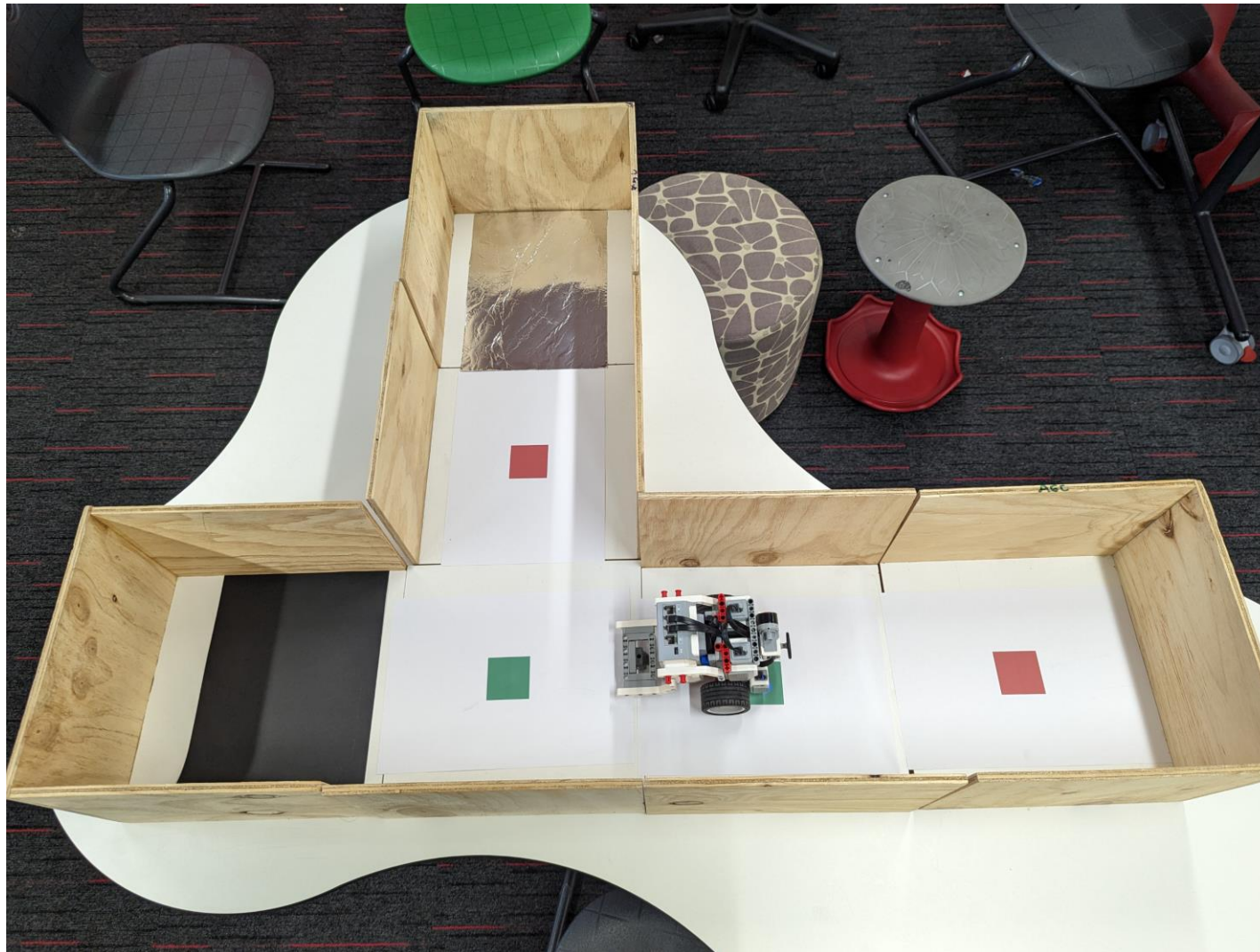


The Maze – What You Need – Open Maze

- If you have Open Maze course tiles, they can also be used.
- The same victim markers can be used as before.
- If you have reflective tiles and black tiles for the Open Maze course, they can be used instead.

The Maze – What You Need – Open Maze

Open Maze:



The Robot

Does not
have to be
Lego

However,
Lego EV3 or
Spike Prime is
a great way
to get started
in robotics

Can be built
with single
set

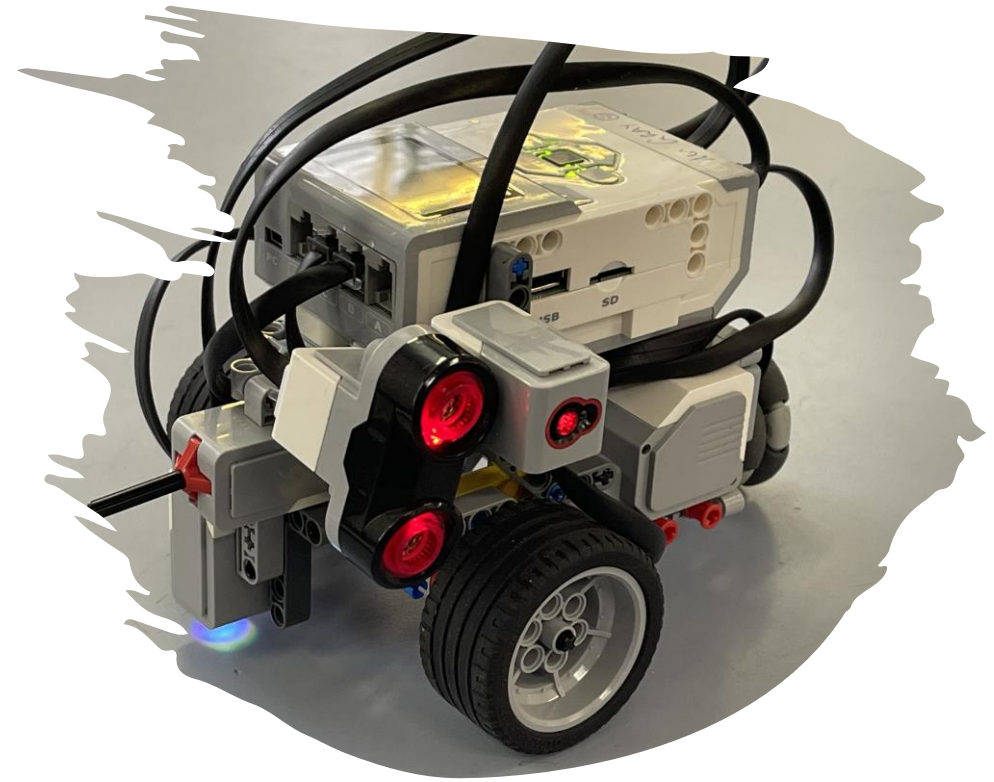


The Robot – What You Need – EV3

Basic EV3 robot

- 1 X Colour sensors (pointing down). Can add a second Colour sensor, if desired*
- 1 X Ultrasonic sensor (facing wall)
- 1 X Touch sensor on front of the robot

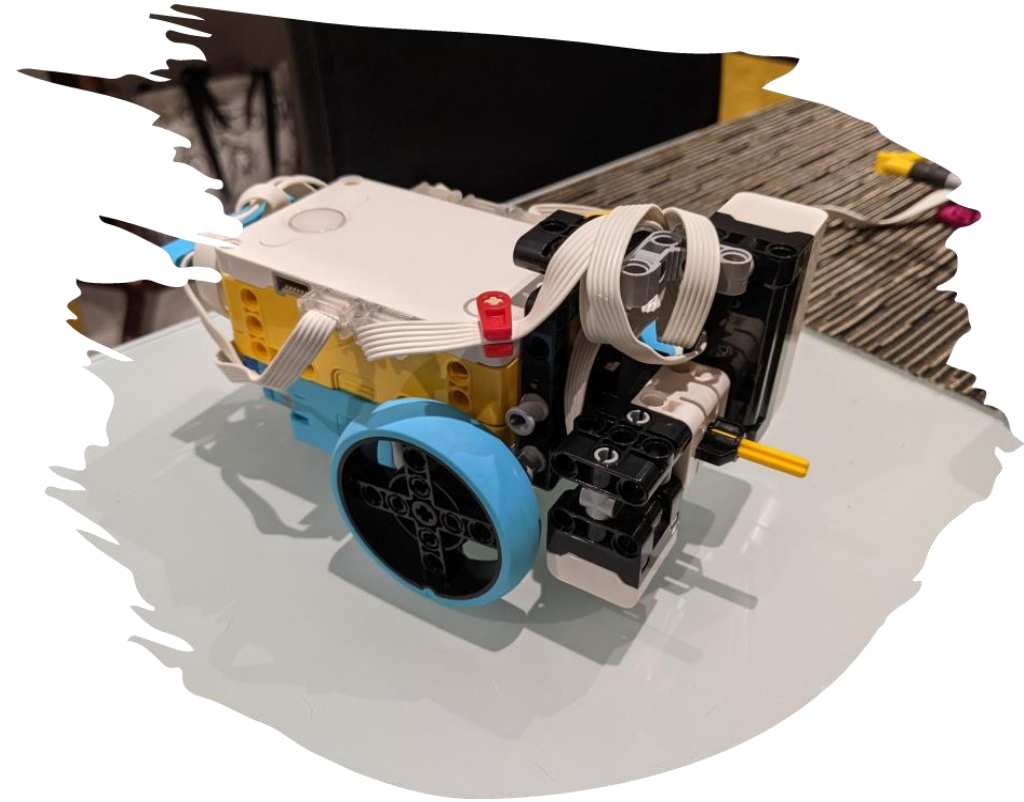
* Second colour sensor can help with detecting silver reflective tile



The Robot – What You Need – Spike

Basic Spike Prime robot

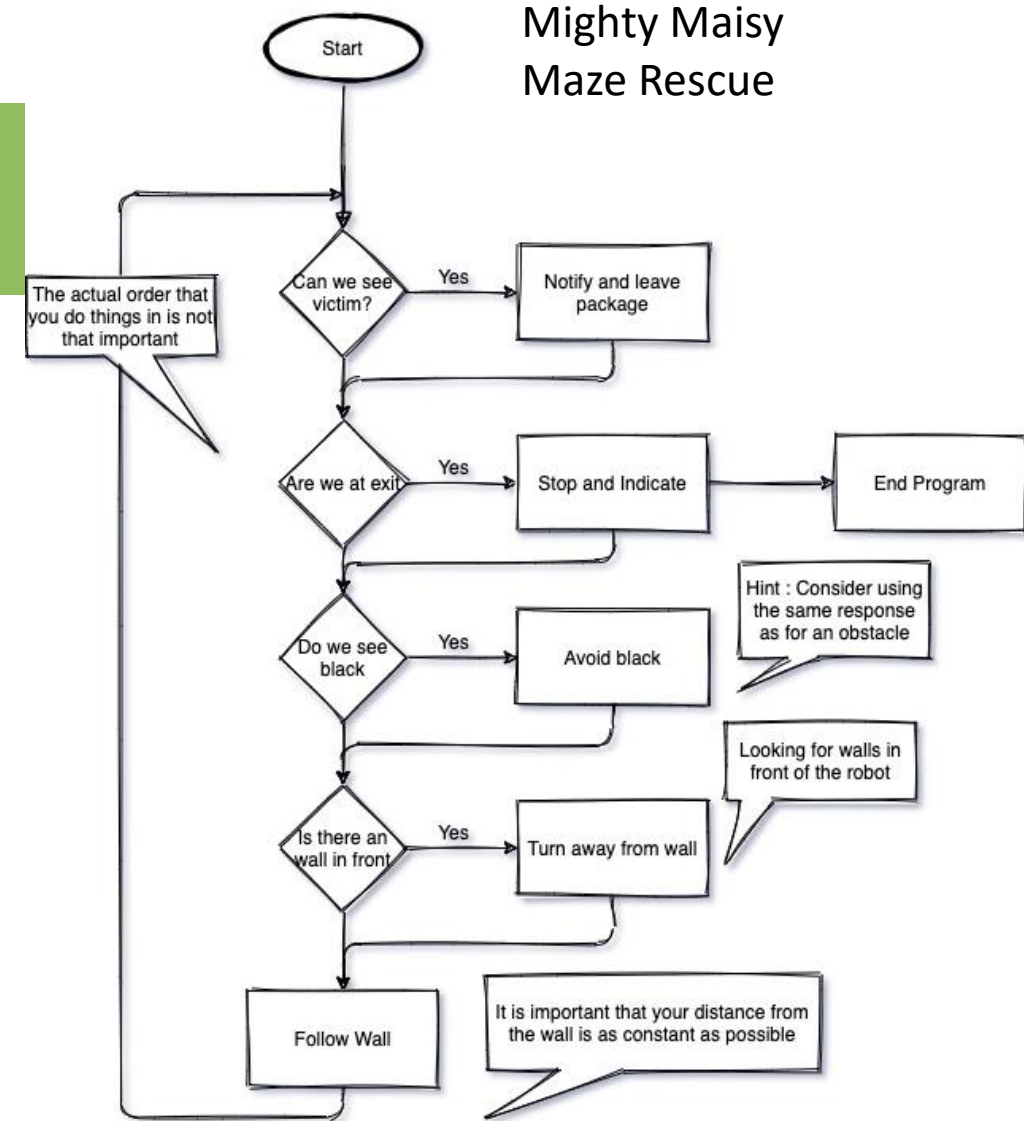
- 1 X Colour sensors (pointing down)
- 1 X Ultrasonic sensor (facing side)
- 1 X Touch sensor on front of the robot



Maze Algorithm

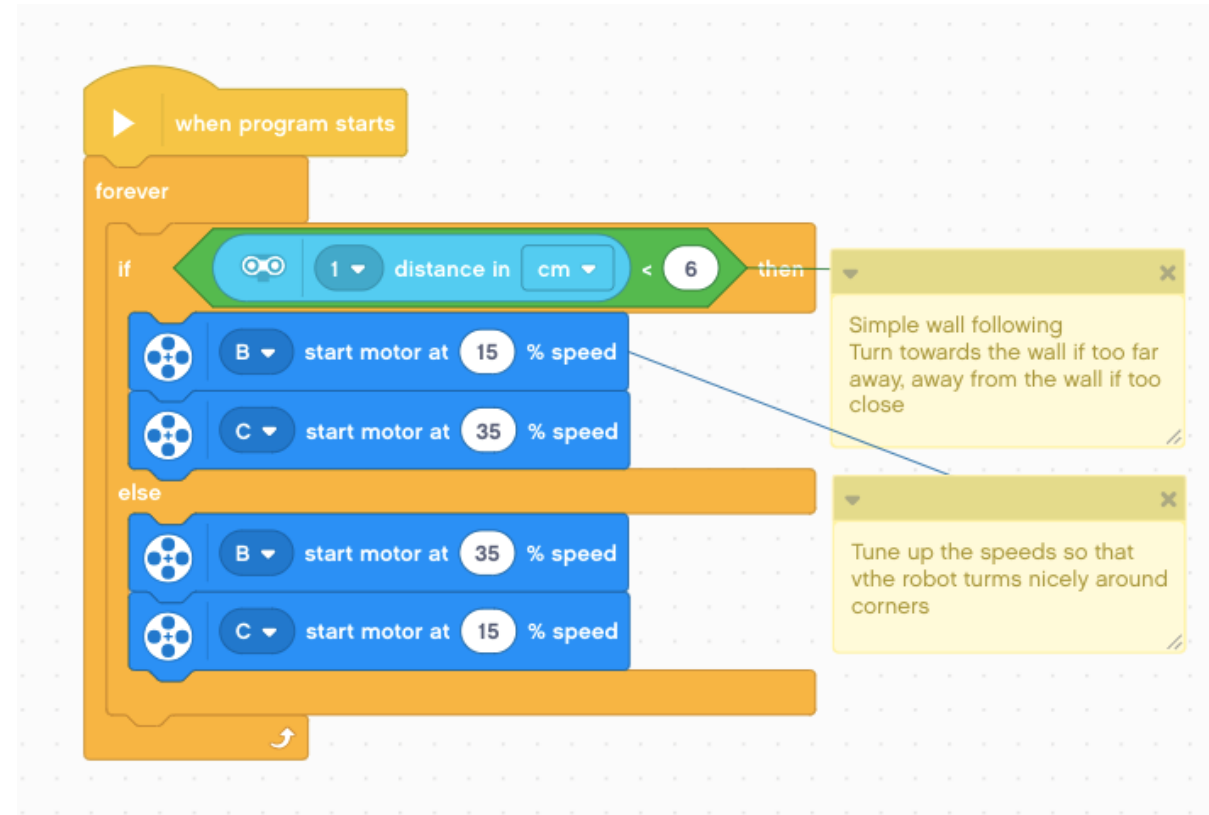
- Keep it simple and work on one element at a time.
- Make your wall follower as smooth as possible. You want to stay at a constant distance from the wall.
- The rate at which the robot turns is important for reliable performance
- A good development strategy is
 - ✓ Follow a wall
 - ✓ Detect an obstacle in front
 - ✓ Detect a black hole
 - ✓ Find a victim
 - ✓ Find exit and report

We “nest” a series of if ... else statements one at a time to get the robot behavior that we are after.



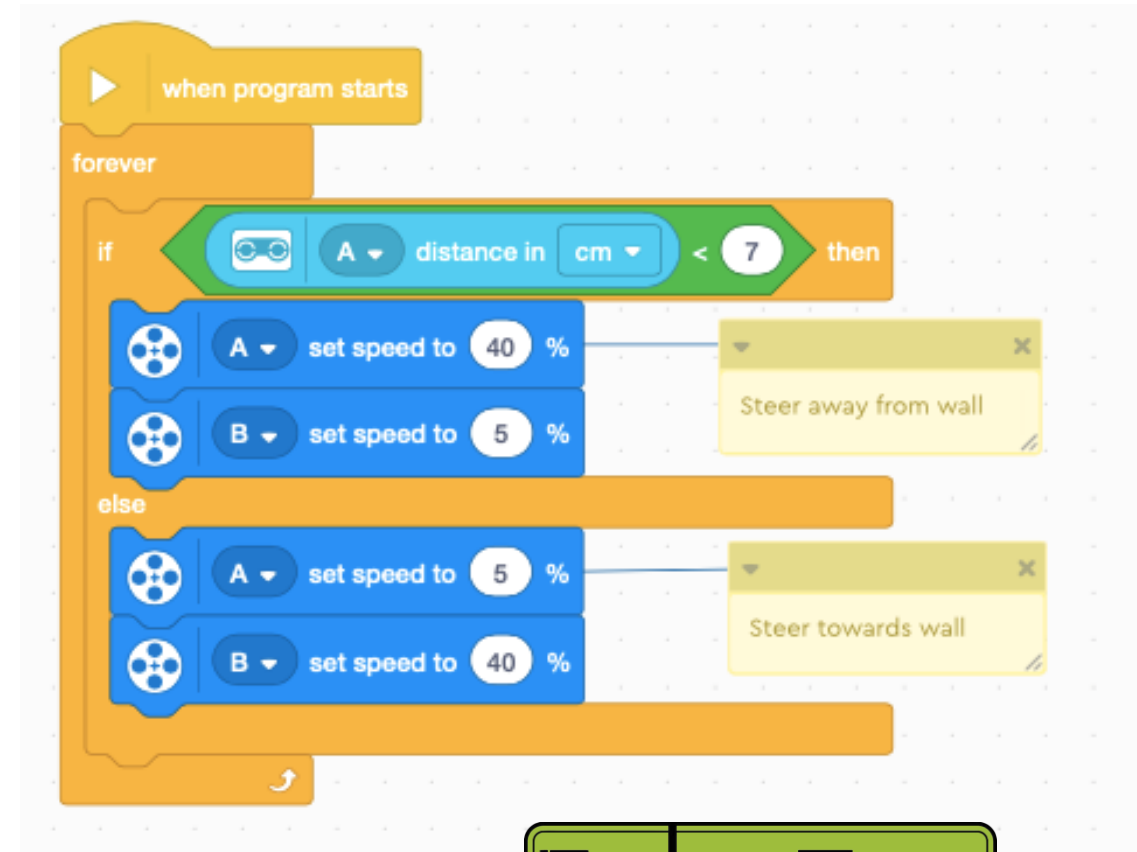
Simple Wall Following

- Wall following is simple. The robot either steers towards the wall if too far away or away from the wall if too close.
- The key issue is carefully calibrating your robot turn rates. The robot should follow a constant arc around a wall divider.
- Individual motor speed control works better than steering for EV3.



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- Individual motor speed control or steering works for Spike.



Video: ON/OFF



Video: PROPORTIONAL

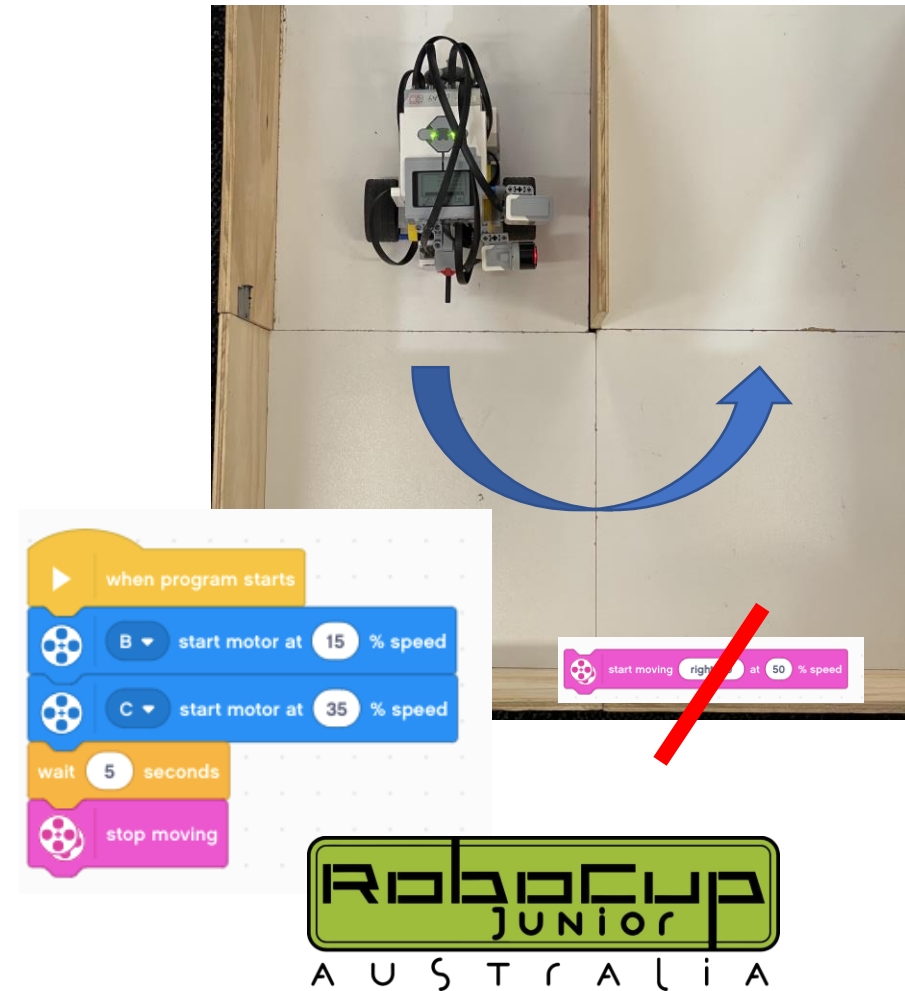


Video: FAST PROPORTIONAL



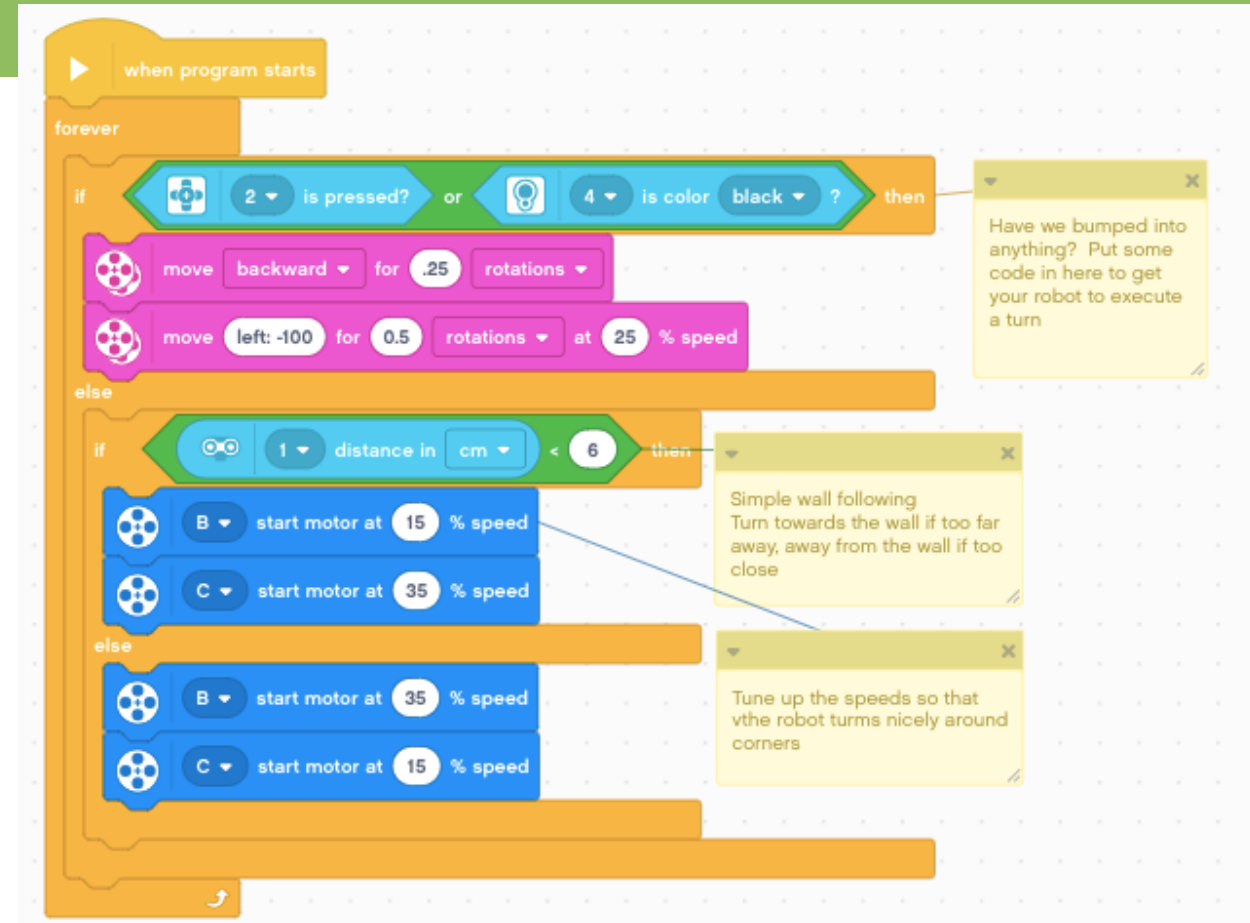
Setting the Turning Radius

- When your robot comes to the end of a wall it will try to turn towards where it thinks the wall is.
- Setup your motor speeds so that your robot will do a smooth arc around the wall.
- There is a relationship between speed and turning plus every robot has different characteristics. Play around until you get it right.
- Individual motor speed works much better than using “steering” (for EV3).



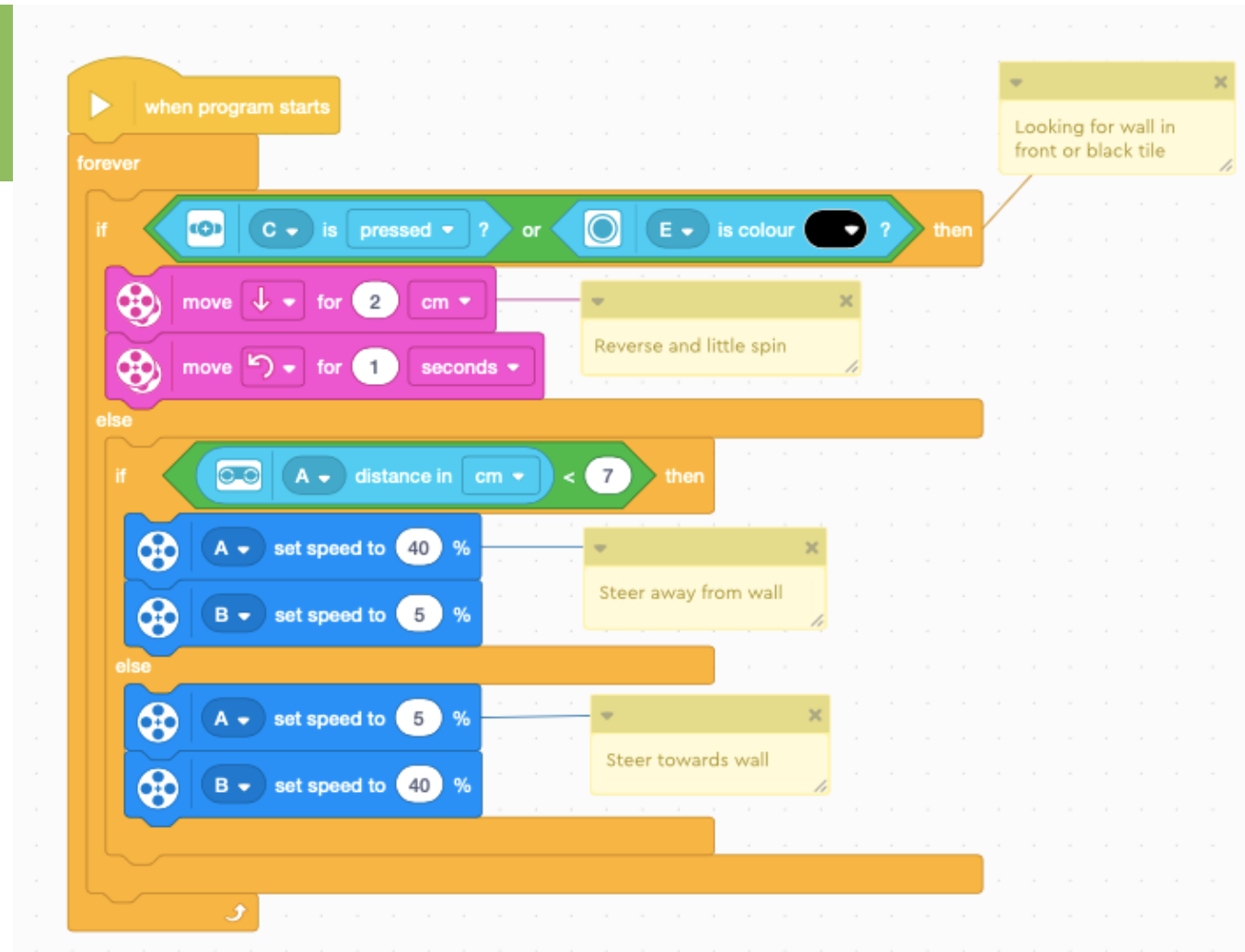
Obstacle Avoidance

- When you see an obstacle in front of the robot you need to react in some way.
- This can be a wall or an obstruction. Even a black hole can be treated as an obstacle as seen in the example on the right.
- If you see a wall in front of you for example you could reverse a little and then turn away from the wall.
- Keep the movements small – it is not unusual to take a few attempts at getting around the obstacle.
- With this simple program you have a robot that can solve a basic maze!



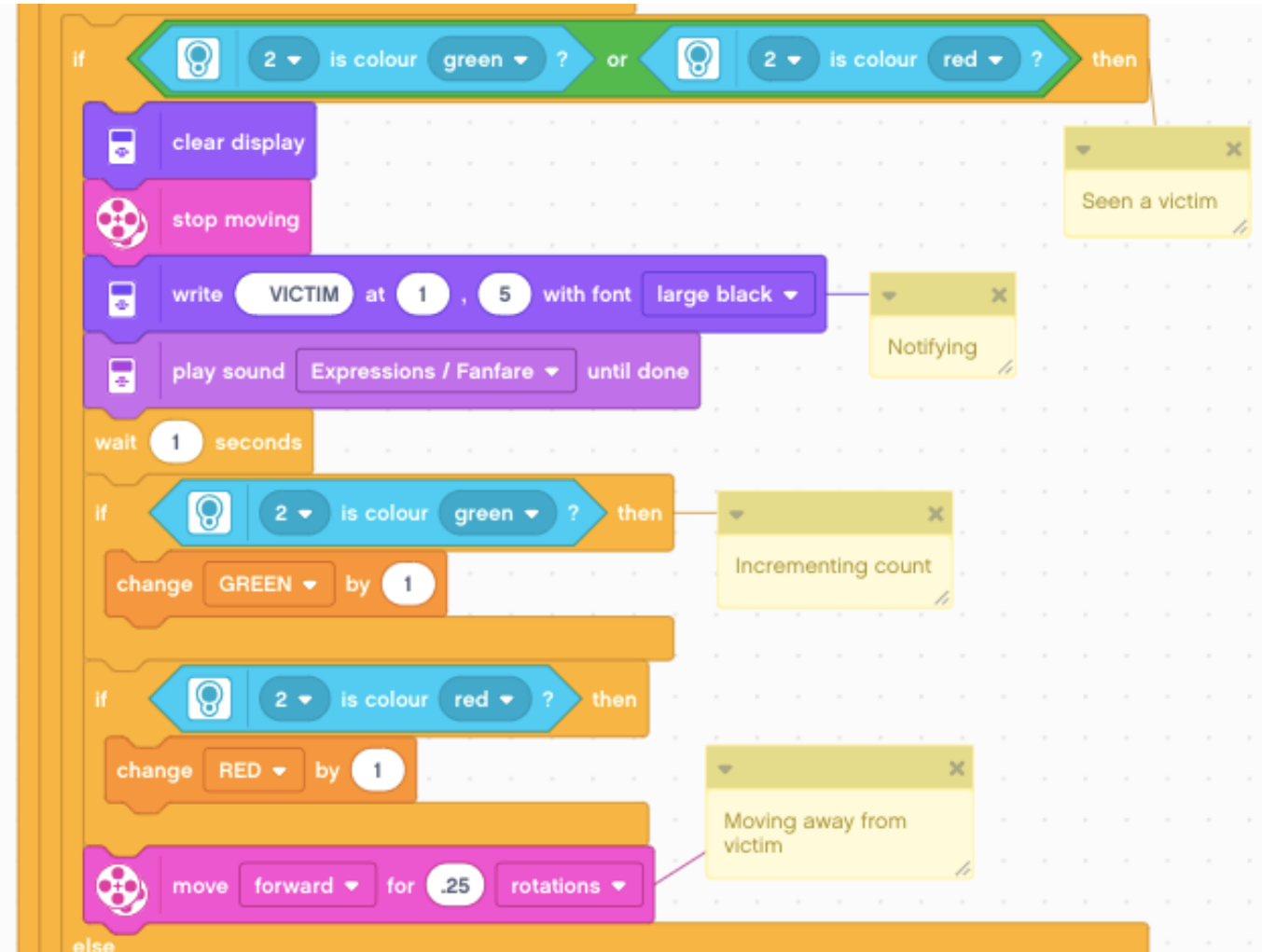
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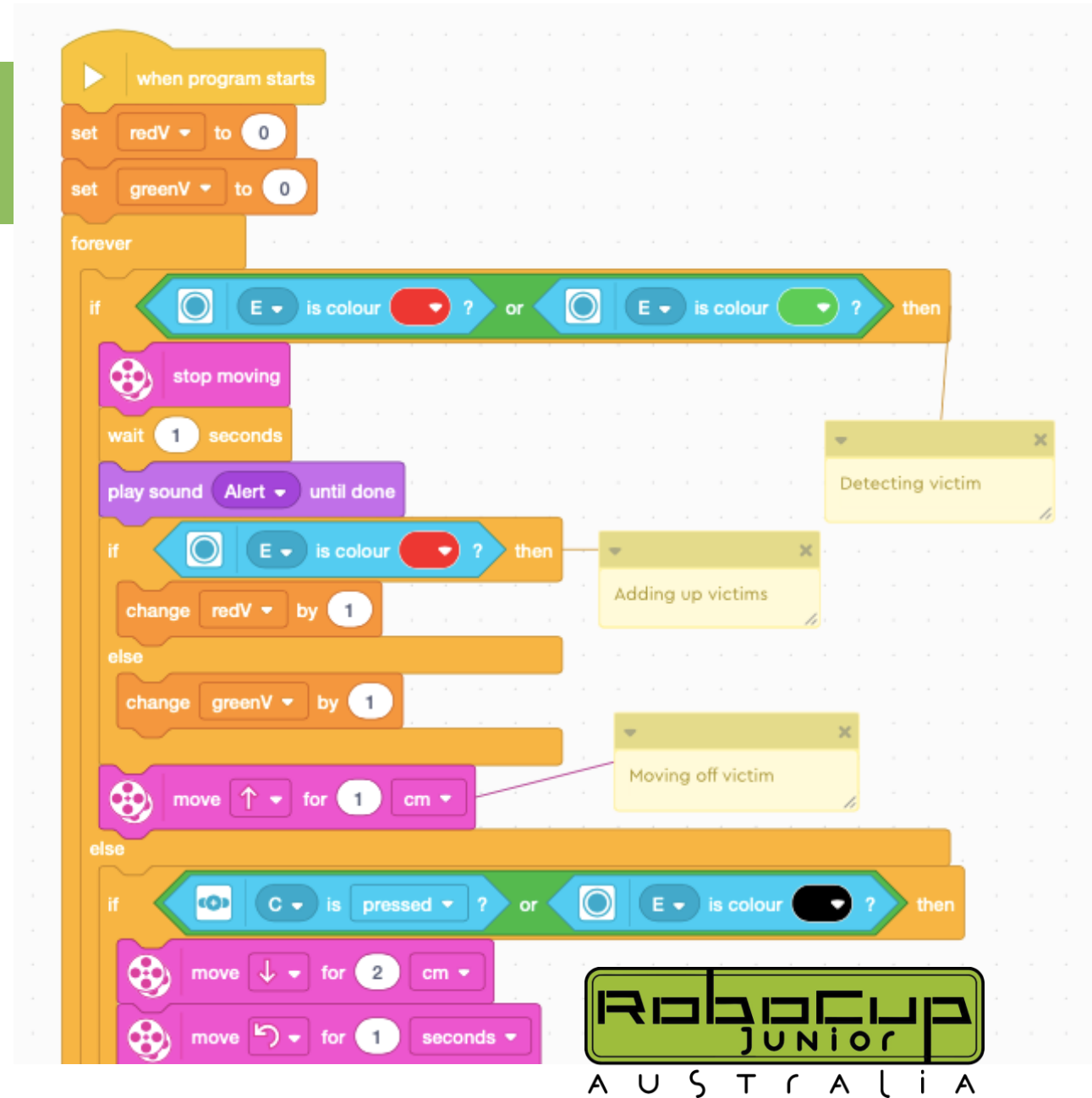
Finding the Victim

- The victims are represented by 50mm square markers in the middle of each passage through the maze. They are coloured red or green to indicate if they are in critical condition or just need to be located.
- This means we can use the Colour Sensor to identify the victim.
- When you find a victim you need to stop for 1 second and indicate in some clear way.
- It may be a good idea to move off the victim before continuing – why?
- A constant wall following distance is critical



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Finding the Exit Tile

- The start/exit tile is shiny and highly reflective.
- See if you can work out some way to sense it but only actually exit when you return back to it.
- Hint put in another nested if ... then based on reflected light to notify your success and turn the robot off.
- Now it is time to display how many and what type of victims you have found.
- Hint: Detecting Silver on a Spike Robot will need to show Block Extensions and enable More Sensors. Then use Raw Light Sensor Block.

Overview of Competition

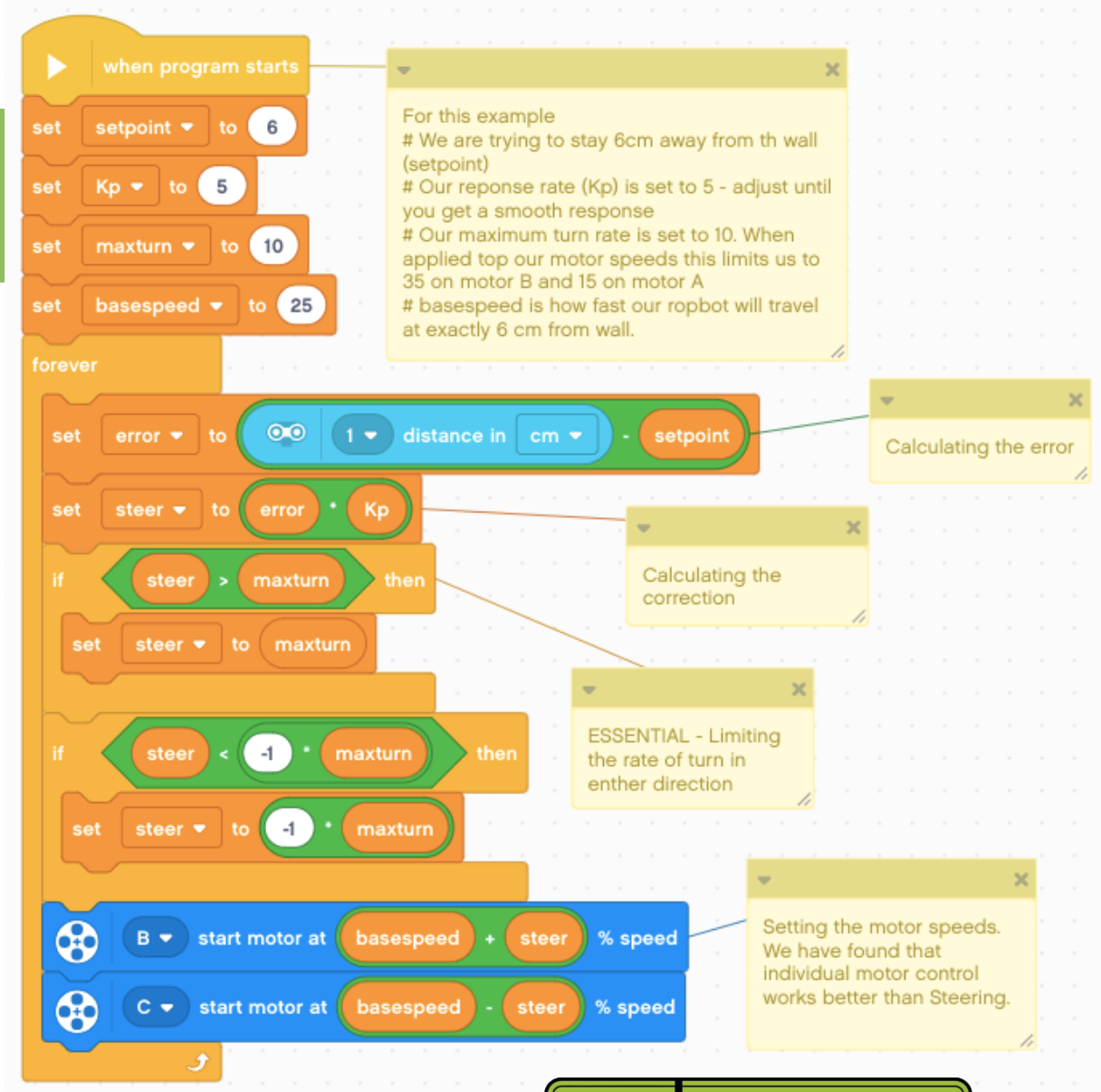
ACTION	POINTS	COMMENTS
Found green victim	10 points per victim	Robot must stop for 1 sec.
Found red victim	25 points per victim	Robot must stop for 1 sec.
Exit Bonus	25 points	Robot must stop on exit
Reporting Bonus green victims	25 points	Robot must stop on exit and display the correct number of green victims
Reporting Bonus red victims	50 points	Robot must stop on exit and display the correct number of red victims

The champion teams is decided by the cumulative total over several rounds



A Better Wall Follower

- As already noted an accurate wall follower is essential to increasing the reliability of your victim detection.
- The best way to do this is to use a proportional control algorithm.
- Seems tricky at first but pretty easy once you get the hang of it.
- Essentially you speed up the wall side motor and reduce the speed to the other to move away from the wall.
- You do the opposite if you get too far away.
- Hints : Make sure you put in something to limit the rate at which the robot turns
- Play with the Kp and basespeed until you get the response that you want.



Important Links

- RCJA Website: <https://www.robocupjunior.org.au/>
- Rescue Maze: <https://www.robocupjunior.org.au/rescue-maze/>
- Rescue Maze Resources:
<https://www.robocupjunior.org.au/resources/rescue-maze-resources/>
- David's Robotics Portal: <http://winthropdc.com/Robotics/>
- EV3 Standard Design: <https://www.robocupjunior.org.au/wp-content/uploads/2021/08/Maze-EV3-Standard-Design.pdf>
- Spike Standard Design Video: <https://youtu.be/7wiqk-wr-wo>

What questions do you have?

