STUDENT ACTIVITY SHEETS

INTRODUCTION

Self-driving vehicles driven using code are on the horizon. In the future, cars and vehicles will have more in common with programmable robots and drivers will be more like passengers. Using your micro:bit programming skills, help drive our prototype robo-vehicles around Auto City, our testing environment.

CAN YOU PROGRAMME A SIEMENS ROBO BUGGY?

In the following classroom tasks you will be programming a three-wheeled micro:bit buggy to travel autonomously around the map of Auto City (on page 2). Each buggy is steered using the left and right motors, with the front wheel turning on a pivot (see the diagram below). You may have used similar robots in Design & Technology or Computing lessons at your school.

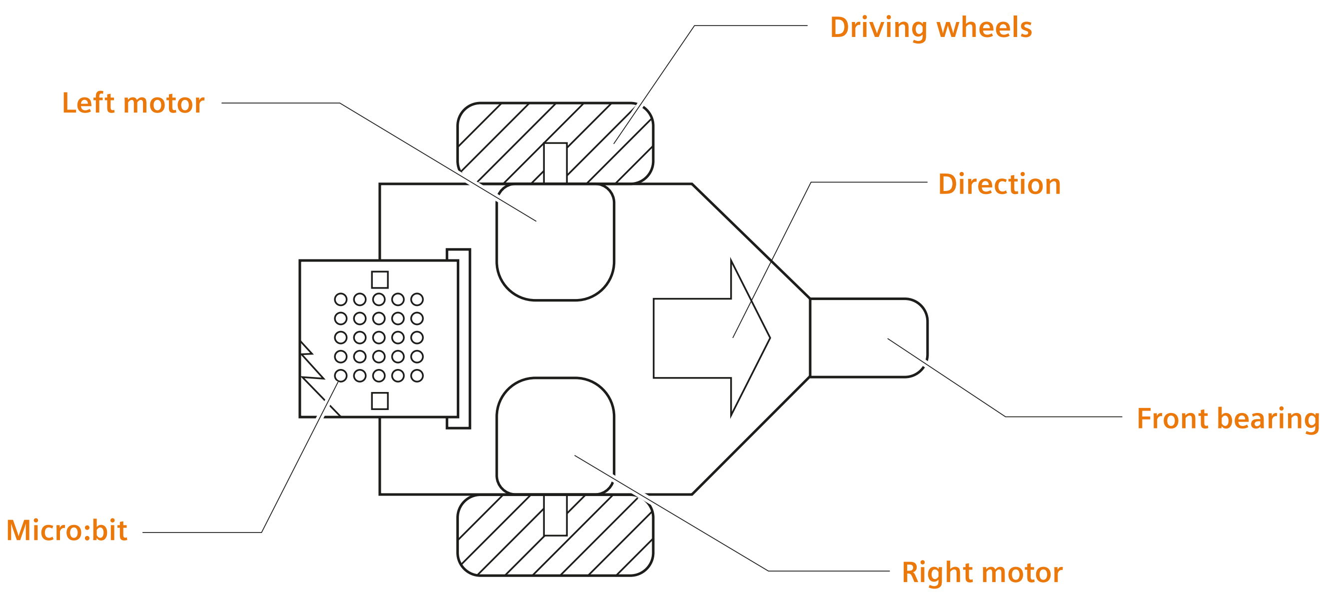

Diagram 1: Siemens Robo Buggy

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STEERING TIPS

Steering on these buggies is different to the cars you may be familiar with. These hints will help you to code your Siemens Robo Buggy (summarised in Table 1).

- To drive forward, both motors must be set to forward.
- To turn left, the right motor should be set forward and the left motor should be off or in reverse.
- To turn right, the left motor should be set forward and the right motor should be off or in reverse.
- The buggy can also be driven in reverse.

STEERING TIPS - TABLE 1

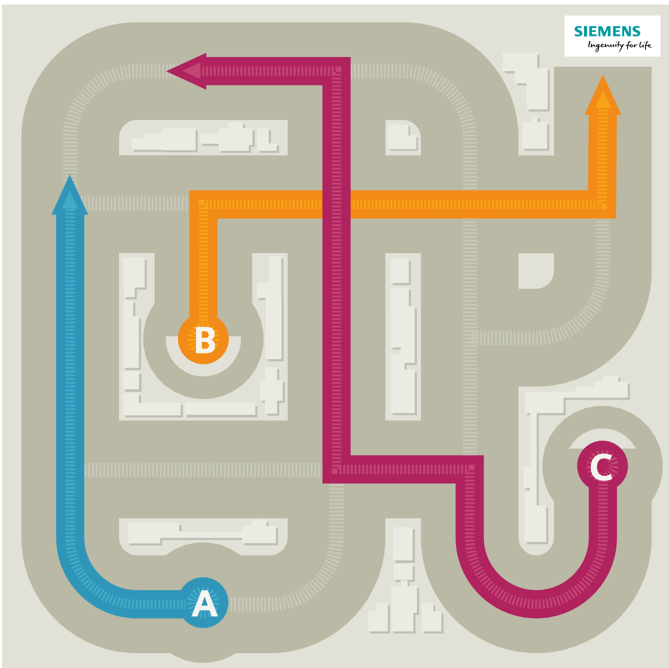
Direction of Siemens Robo Buggy travel	Left Motor	Right Motor
Forward	Forward	Forward
Left	Off or Reverse	Forward
Right	Forward	Off or Reverse
Reverse	Reverse	Reverse

USING YOUR OWN BUGGIES

You are welcome to use your own buggies throughout this activity, however due to the differences in motors, wheel sizes and power, you will have to adjust the motor speed of '310' that we have used in the codes supplied. Ask your teacher for the correct speed for your robot buggy, or use trial and error on route A to find this out for yourself!

AUTO CITY - A TESTING ROAD MAP

This is our testing environment for Siemen's Robo Buggies. Each street is the width of one buggy. Use this map to help you write code for the following activities, following routes A, B and C. A full sized printable version is available from Siemens Education (www.siemens.co.uk/education) for use with your own buggies. You may need to adjust the motor speeds for your own buggies, and similar codes could be created in programming environments like Crumble.



SIEMENS
Ingenuity for life

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SIEMENS DRIVERLESS CAR CHALLENGE: ROUTE C

Radio is set to become an important part of driverless car technology. In the same way that you can listen to music travelling on radio waves, your driverless vehicle can send and receive important coded information in order to navigate the streets safely. Radio waves can also be used by vehicles to sense their surroundings.

STUDENT ACTIVITY 1: ROUTE C – RADIO CONTROL DRIVE!

Using the micro:bit block editor (https://makecode.microbit.org/), copy the codes below onto two micro:bit controllers, with one acting as a receiver to control the buggy motors and the second as a transmitter to send instructions.

If you have your own buggy, test the code on your own printout of the Auto City map. You will have to adjust the speed of the motors for your own buggy.

If you have more than one buggy in operation, you will have to choose a different radio channel for each micro:bit pair.

CONTROLLER INSTRUCTIONS:

Forward: A + B | **Left: A** | **Right: B** | **Brake: Shake!**

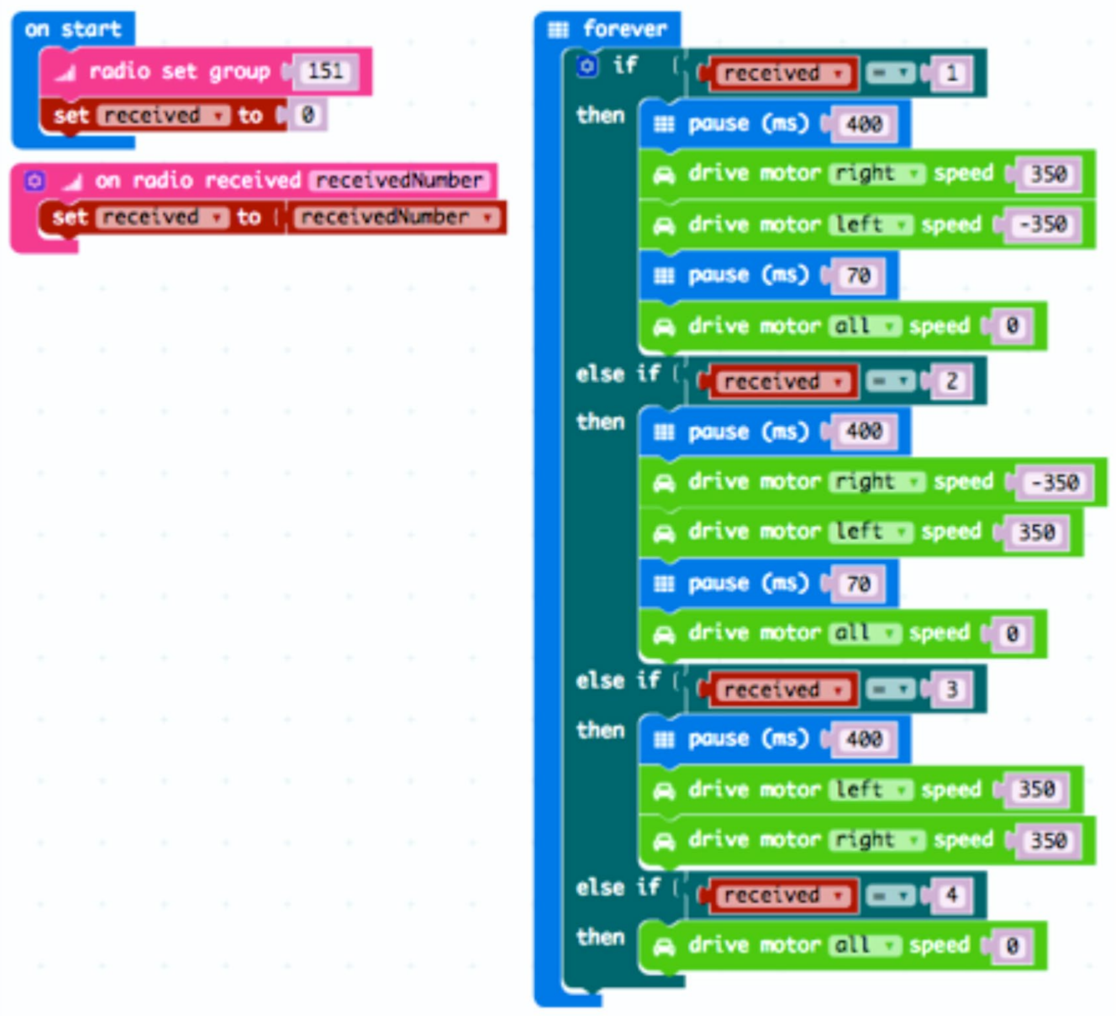
CONTROLLER TRANSMITTER CODE

```
on start
    radio set group 255
    set received to 0

on radio received receivedNumber
    set received to receivedNumber

forever
    if button A+B is pressed
    then
        radio send number 3
    else if button B is pressed
    then
        radio send number 2
    else if button A is pressed
    then
        radio send number 1
    else if acceleration (mg) strength > 1500
    then
        radio send number 4
```

BUGGY RECEIVER CODE



ACTIVITY 2: QUESTIONS

Answer the following in full sentences

a) Radio is part of RADAR technology, and is used on sensors to detect obstacles. What does radar stand for?

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b) RADAR uses radio waves to detect how far obstacles are away from the vehicle, by bouncing radio waves off an obstacle, and using the returning wave to calculate the vehicle's distance from the object. Why is this a better way of detecting obstacles than a touch sensor?

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c) You can explore how obstacles such as pedestrians and other vehicles are detected by trying the Siemens Self-Driving Challenge interactive (http://www.siemens.co.uk/education/en/students/interactives.htm). Suggest three ways that driverless car technology could improve the experience of road users.

1 ______________________________

2 ______________________________

3 ______________________________