

# MYP 2: DIGITAL DESIGN

## ROBOTICS INVESTIGATION

### TASK: INVESTIGATION

#### UNIT OVERVIEW

<b>Key concept</b>	Systems
<b>Related concepts</b>	Function, innovation
<b>Global context</b>	Scientific & technical innovation (Modernisation, industrialisation and engineering)
<b>Statement of inquiry</b>	Robotic systems are an invention, undergoing continual innovation, that can perform an almost unlimited variety of functions.

#### ASSESSMENT OVERVIEW

Within this pack is a series of tasks and challenges. The tasks will be assessed against Criterion A. The challenges will form part of the assessment towards Criterion C.

Congratulations Commander, you have received a mission briefing! Read it on the next page!



## MISSION BRIEFING

To: Commander, Mars Base Alpha

A resupply vessel, bound for Mars Base Bravo, has crash landed some distance from its destination. Due to the hazardous environment and distances involved, it has been decided that a robot should be sent instead of using astronauts.

As Base Bravo lacks the proper robotics equipment, it will be your task to design and construct a robot that can find and retrieve the resupply vessel and transport it to Bravo.

Your robot will need to:

- Navigate through the roads of Alpha to safely leave the town in your base
- Drive across the *Olympus Mons* mountain ridges that don't yet have navigational markings
- Pass through the *Valles Marineris* valleys, avoiding the large rocks scattered around
- Find the resupply vessel in the *Hellas Planitia* plains
- Collect (pick up, push or pull) the resupply vessel; and
- Deliver it to Mars Base Bravo

Your robot should be autonomous enough so that it can succeed in its mission in the event communication with it is lost.

Your assistance in this matter is greatly appreciated. Successful delivery of the resupply vessel to Bravo will help ensure those astronauts don't run out of food.

Information will be provided to you in due course that will further describe each of the challenging conditions to be faced.

Yours truly,

A handwritten signature in black ink, appearing to be "Elon Musk".

Elon Musk

## TUTORIALS & CHALLENGES – LEVEL 1

### **STEP 1: BUILD A BASIC ROBOT**

On Google Classroom, you will find the "Tutorials & Challenges" post with the resources you need. Download the assembly instructions PDF. Page 1 to 46 are the steps for you to complete for now.

### **STEP 2: CREATE YOUR FIRST PROGRAM**

From the same section on Google Classroom, watch the first video to learn how to use the Open Roberta software and create your first program.

### **STEP 3: LEARN BY EXPERIMENTING**

You are now ready to experiment and attempt the level 1 challenges. No sensors are required at this stage, and no extra lego additions to the robot.

Do experiment with different blocks to see how they behave, such as the ones shown on this page.

Complete at least two level 1 challenges. Demonstrate them to the teacher for signature when ready.

- Challenge 1A: Go forward exactly 1 meter, wait for 3 seconds, reverse, stop at starting original point.
- Challenge 1B: Go in a perfect square (sharp turn on the corners)
- Challenge 1C: Go in a perfect circle (diameter at least 50cm), stopping and starting at the same point.

Challenge \_\_\_\_\_ successfully completed.

\_\_\_\_\_/\_\_\_\_\_  
signature                      date

Challenge \_\_\_\_\_ successfully completed.

\_\_\_\_\_/\_\_\_\_\_  
signature                      date

## TUTORIALS & CHALLENGES – LEVEL 2

### STEP 1: USE THE TOUCH SENSOR

Watch and follow along with the correct video on Google Classroom "Tutorials & Challenges"

### STEP 2: USE THE ULTRASONIC SENSOR

Watch and follow along with the correct video on Google Classroom "Tutorials & Challenges"

### STEP 3: USE THE COLOR SENSOR

Watch and follow along with the correct video on Google Classroom "Tutorials & Challenges"

### STEP 4: LEARN BY EXPERIMENTING

You are now ready to attempt the level 2 challenges. Each of these only requires one sensor unless otherwise specified.

Complete at least 2 of the level 2 challenges, but it is highly recommended you do at least one for each sensor. Demonstrate them to the teacher for signature when ready.

- Challenge 2A: Press **touch sensor** to start moving, press same touch sensor again to stop moving
- Challenge 2B: Drive forward and change direction based on what the **color sensor** sees. Color blue causes a left turn, color yellow causes a right turn, color red causes stop.
- Challenge 2C: Drive following a black line, turning as it turns (requires 2 **color sensors** to do properly)
- Challenge 2D: Drive forward until **ultrasonic sensor** detects an object in front, stop 5cm from the object, and sound an alarm.
- Challenge 2E: Drive forward in a straight line until **ultrasonic sensor** detects an object in front, drive around the object (the program can make assumptions about the object size rather than having to detect it all the way around), and then continue driving in the original direction as if nothing was there.

Challenge \_\_\_\_\_ successfully completed.

\_\_\_\_\_/\_\_\_\_\_  
signature date

Challenge \_\_\_\_\_ successfully completed.

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signature date

## TUTORIALS & CHALLENGES – LEVEL 3

To solve the challenges in level 3, you will have to do some of your own thinking and research. These are the harder challenges and are designed to see which students are capable of the more demanding tasks. Some students will struggle to complete these in time – remember it's ok to make mistakes – it's not ok to give up without trying!

Research, experiment, and attempt one of these challenges:

- Challenge 3A: Build a claw/gripper. Drive until ultrasonic or touch sensor detects an object in range, stop, and grip/pickup the object.
- Challenge 3B: Build a forklift style lifting arm. Drive until ultrasonic or touch sensor detects an object in range, stop, and lift the object.
- Challenge 3C: Build a drop arm that will fall around an object like a net. Drive until ultrasonic or touch sensor detects an object in front. Drop the arm to catch the object, and drive off with it.

Note: You can custom make your own "object" from spare lego. You may want to adjust it's "shape" to suit the challenge you are undertaking. For instance, an object that is thin on the base, but wider on top might help a forklift arm to slide underneath it, but would probably not suit a claw.

Challenge \_\_\_\_\_ successfully completed.

\_\_\_\_\_  
signature

\_\_\_\_/\_\_\_\_  
date