

Assignment

by Jae Mears

Submission date: 08-May-2023 12:52AM (UTC+0100)

Submission ID: 205114452

File name: 40189_Jae_Mears_Assignment_489678_998529467.docx (26.2K)

Word count: 1398

Character count: 6358

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Integrating Project

ACHA4008

Lego Mindstorms Project

Introduction and explanation:

The overall problem is that to plan, construct, and program a robot using the application Lego EV3 software. This software allows us to navigate around and through the maze. We also have been set the task of programming the robot to identify and then follow a coloured line and move around any obstacles that is in its way, then back into the maze. The robot should be able to move around the mase with ease if programmed correctly. We can do this by the help of the sensors which allows the robot to know when to stop and turn or turn away from a wall.

The EV3 software is what is needed for the robot to be programmed on because this software allows us to do multiple things for example Loops and sensors to help the robot and us with completing the maze.

Tools and Techniques:

There are a few main tools we use for the robot but mainly colour sensor and ultrasonic sensors. For the colour sensors, these follow a coloured line that we need to follow that is just a bit outside of the maze and this tool will allow us to do this task with ease, we just need to code the robot correctly in the program.

For the ultrasonic sensors on the robot which we use 2. It allows the robot to see and track how far away the walls are from the robot/sensors. The ultrasonic sensors measure in CMS and its very important tool and instruction from the program and also the robot to be following this. This will allow the robot to follow walls and inner walls inside the maze with ease. What we want is too have one set of code that allows the robot to follow the right wall for the whole maze, with this trick it's going to get out and it makes it easy for us.

Using the colour sensor:

The sensor can detect seven different colours: black, blue, green, yellow, red, white, and brown. An object that is not one of these colours may be detected as "No Colour", or it may be detected as a similar colour. For example, an orange object might be detected as red or yellow, depending on how much red the orange has in it, or as brown or black if the

orange is very dark or too far away from the sensor. In Reflected Light Intensity mode, the Colour Sensor detects the intensity of light that enters the sensor. The intensity of the light is measured as a percentage from 0 to 100, with 0 being very dark, and 100 being very bright. [1]

When the Colour Sensor is in Reflected Light Intensity mode, a red LED light on the front of the sensor will turn on. If the sensor is close to an object or surface, this red light will reflect off of the object and then enter the sensor to be detected. You can use this to measure shades of colour on a surface or object, because darker shades of colour will reflect less of the red light back to the sensor. [1]

Following a wall:

Build your robot: First, build a robot using the EV3 kit. Make sure it has at least two motors and a touch or ultrasonic sensor to detect obstacles. Program your robot: Use the LEGO Mindstorms programming software to create a program for your robot to navigate the maze. You can use pre-existing programming blocks or create your own custom blocks. Calibrate your sensors: Before you start navigating the maze, you'll need to calibrate your sensors. For example, if you're using an ultrasonic sensor, you'll need to set the distance at which it detects obstacles. Start the maze: Place your robot at the entrance of the maze and start the program. Your robot

will use its sensors to detect walls and obstacles and use its motors to move through the maze.

Follow a path: There are different strategies you can use to navigate a maze. One common strategy is to follow a wall or obstacle on one side, using the sensor to stay close to it. Another strategy is to use the ultrasonic sensor to detect the distance to the walls and move in the direction with the most open space.

Finish the maze: When your robot reaches the end of the maze, it should stop moving. You can program it to perform a specific action, like playing a sound or displaying a message on the EV3 screen. Remember, navigating a maze can be a complex task, so it may take some trial and error to get it right. You may need to adjust your programming or the sensors to make sure your robot can navigate the maze successfully.

Explaining ultrasonic sensor:

The ultrasonic sensor is very useful for navigating through a maze, detecting the presence of objects, and determining the size and shape of objects. It is also commonly used in autonomous vehicles, where it can help the vehicle avoid collisions with obstacles. In summary, the ultrasonic sensor is an important component of the EV3 Lego Mindstorms kit that

allows robots to sense and respond to their environment based on the distance to nearby objects.

Explaining the engine on the robot (Motors):

The large motor included in the EV3 Lego Mindstorms kit is a robust and sturdy motor capable of moving heavy objects and providing high torque. This motor is usually utilized to power the wheels of a robot or to move larger mechanical parts. Its built-in rotation sensor enables precise movement control, allowing for exact angles to be achieved. Furthermore, it can rotate continuously, making it perfect for driving wheels or other mechanisms requiring constant motion.

The medium motor is a smaller, more compact motor that is designed for lighter loads and provides a lower level of torque than the large motor. It is typically used for more delicate movements or to control smaller mechanical parts. The medium motor also has a built-in rotation sensor that allows it to rotate at a precise angle, and it can rotate continuously like the large motor.

Both motors can be programmed to move in different directions and at different speeds, and they can be used together to power different parts of a robot. For example, the large motor can be used to drive the wheels of a robot, while the medium motor can be used to control a robotic arm or gripper.

The Planning:

Firstly, the problem we had was the lack of time and lessons we have in one week, so we needed to make every lesson count. Our first couple of lessons was getting used to the programming and assembling the robot that we will be using and making sure that all of the sensors, wheels, etc are working and on.

Next, we progressed on the coding aspect of things with such tasks in class using the robots we built and some test code to copy. After that we started working on more advanced programming for example getting the sensors working with multiple other things within loops. My role in our team and in this section was to program side sensors and to get them to follow the maze and move around the block. This was a difficult task, but I managed to overcome this task and programming difficulty.

Design of our robot:

The design of our robot was very simple. We had two ultrasonic sensors, a colour sensor and the block and wheels of course. All of these items needed something to power it, so we have two motors and a steering ball at the back of the robot to power and turn the robot if we ask it to do in the program. This is all we needed for this task because if we had

anything else it would have been too much weight and may have weighed down our robot for the maze.

Placement:

Two wheels at the front of the robot with one steering wheel ball at the back of the robot. Then we had the ultrasonic sensors on the top of our robot one looking at the right side of the robot because we're following the maze all way around the maze. Also, one looking in front for the walls so it can turn.

Bibliography

https://ev3-help-online.api.education.lego.com/Retail/en-us/page.html?Path=editor%2FUsingSensors_Color.html

Assignment

GRADEMARK REPORT

FINAL GRADE

46/100

GENERAL COMMENTS

Instructor

ASSESSMENT COMPONENT 1 (60%)

Project Introduction 3/5

Background research 7.5/15

Project plan 4/10

Design Process 18/40

Evaluation and results 0/30

Total: 32.5%

Comments:

Be careful not to use the active tense "we" or "I" or "the user" in academic reports. Use the passive instead, so for example, instead of "We have been set the task of programming the robot" write instead "A task of programming a robot has been set"

Introduction is OK, but it would help the reader to have a picture of the task, to help them to visualise it.

Background research is OK, but it mainly refers to the EV3 equipment, you need to look at techniques eg what algorithms for traversing a maze are available?

Planning is presented informally. You need to make a list of tasks and show the order in which they will be completed, timescales etc.

Design is limited and it would be helpful to include pictures as this is a very visual assignment.

No evaluation/results provided.

ASSESSMENT COMPONENT 2 (40%)

Technical knowledge/skill 14/20

Analytical and problem-solving skills 14/20

Quality of result (performance of the finished application or suitability of the design) 38/60

Total: 66%

Comments: A good attempt, although there were limitations in the maze section

OVERALL TOTAL FOR MODULE: 46%

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