



Integrating project report

Explanation/background to Lego spike prime

This project's concept is to get our robot to follow a line at first and then follow a maze successfully from one end to the other. The kit we are using is the LEGO spike prime robot V3 which allows you to customize a robot using various Lego pieces included with the kit to construct something to aid you in whatever task that is, whether it's using a grabber tool to grab an object like a piece of paper or using a sensor to detect a wall.

Relevance of the project

Robotics is quite relevant in today's world; robotics includes elements from all of STEM which includes stuff from science, mathematics, and coding etc. Through robotics projects students learn coding, a touch of electronics depending on the kit you are using, and there are even mechanical engineering aspects, not to mention working with robotics lets students apply their theory into practice, when it comes to robotics that would mean applying their code to whatever problem they are trying to solve.

Working with robotics can also enhance creativity, in a university setting students are faced with a problem and are required to use critical thinking methods to solve it. These solutions could include adjusting bits of code or in our case using the Lego spike prime kit to change our design.

Also, robotics is very prevalent in today's world, take biodiversity for example robots help all the time with conservation efforts, from [howtorobot.com](https://howtorobot.com/expert-insight/robots-biodiversity-solutions-conservation-sustainability-and-ecological) (https://howtorobot.com/expert-insight/robots-biodiversity-solutions-conservation-sustainability-and-ecological) robots help frequently when it comes to things like pollination, robots have been made to “Assist in the pollination of crops and wild plants” not only that in the article it is mentioned that robots are deployed for pest control by identifying pests and removing them all entirely done by robots, there are many more examples when it comes to robots such as unmanned aerial vehicles(UAV's) which help monitor wildlife, autonomous underwater vehicles(AUV's) which help in marine biology study, collecting data in aquatic environments.

The role of robotics in driving innovation and technological advancement

Robotics plays a huge role in driving innovation; one example of innovation is the use of collaborative robots(cobots) which are frequently used in production and manufacturing, innovation can be developed from these robots by overcoming presented challenges, according to (<https://www.universal-robots.com/products/collaborative-robots-cobots-benefits/>) most cobots are easy to program, flexible, and safe to work with.

Another way robotics plays a role in driving innovation is the use of robotics in rehabilitation, robotics can assist in a person's rehabilitation in numerous ways, for example after a person has had surgery or suffered an injury something like a robotic exoskeleton can help (source: <https://stepsrehabilitation.co.uk/technology/exoskeletons/#:~:text=A%20combination%20of%20exoskeleton%20training,mobility%20and%20active-based%20therapy.>).

Similarly, robotics have immensely helped progress when it comes to prosthetic limbs, offering solutions to missing limbs by replacing parts of either arms or legs using sensors to track the muscle and nerve movements.

Not only that but robots are leading in innovation when it comes to disaster response, robots are used in critical situations where there are so many variables and environments to adapt to, such as in an earthquake under a destroyed building robots are often deployed to search and rescue survivors. Robots are used in manmade environmental disasters, there are robots that can be used to monitor the severity of the damage by using sensors and cameras.

Construction

One of the many challenging aspects of the process would have to be building and designing it, figuring out what would be the best design can be challenging because of the many variables that come with it such as height, width, and length etc.

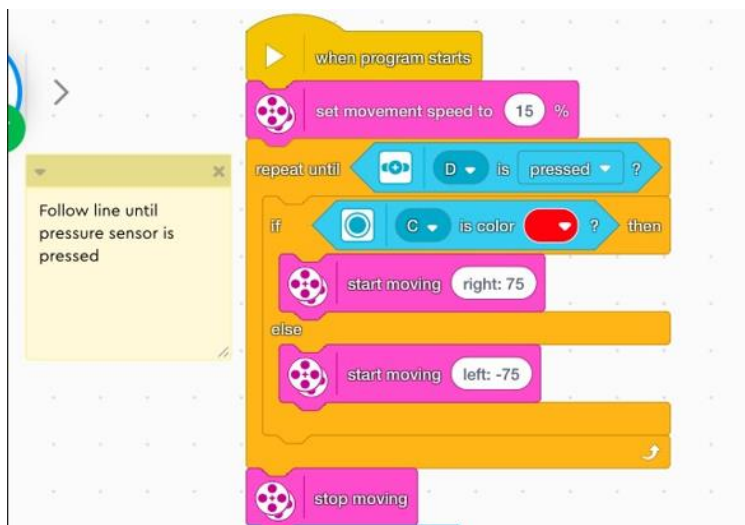
When it comes to building and adjusting our spike prime, we would need to take several sources of information into account, there are many sources online that point out what it takes to build and look out for in a robot, not only that but sources also list the potential components that would be needed such as cameras, servos, and motors. And that there is also not just building our robot, but we would have to code it too. (<https://sphero.com/blogs/news/how-to-build-a-robot>)

Stage-wise assessment- Following the line

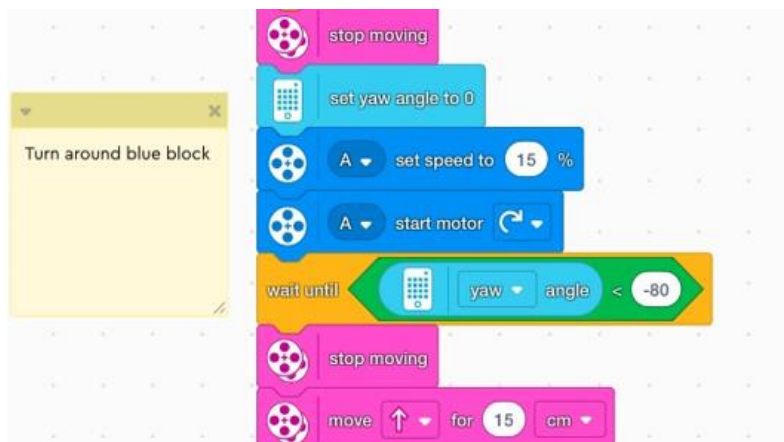
In the code below it is shown what was used to follow the said line.

For our first challenge it was to make the spike prime follow the line our challenges we faced here was making sure it's not too long, so it does not disturb itself when following the line, not to mention the weight of the robot needs to be somewhat light and not bulky and clunky.

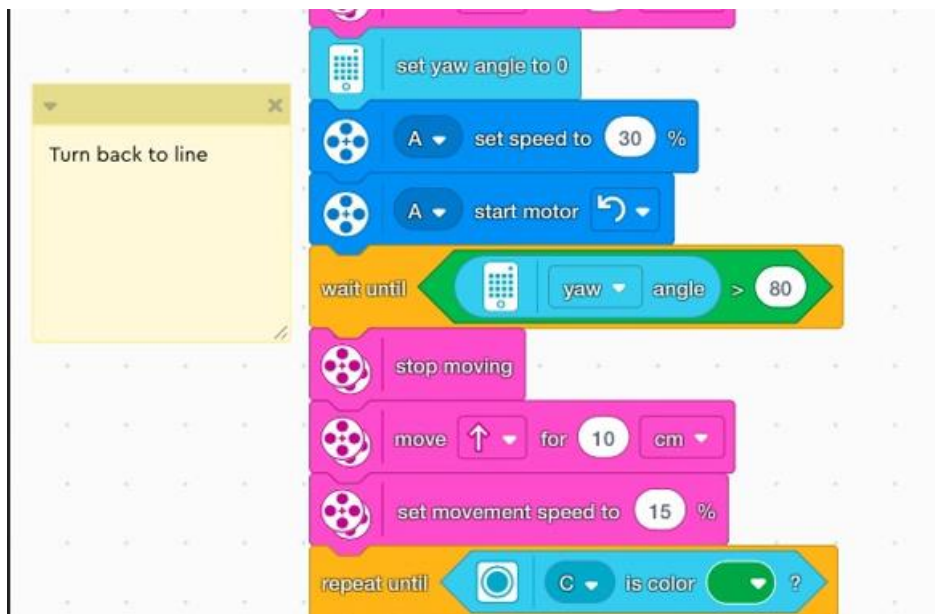
For the first lines of code, it is shown that if the sensor detects the colour red and starts moving right at 75 degrees but if it doesn't it will start moving left at -75 degrees which can assist with finding the line.



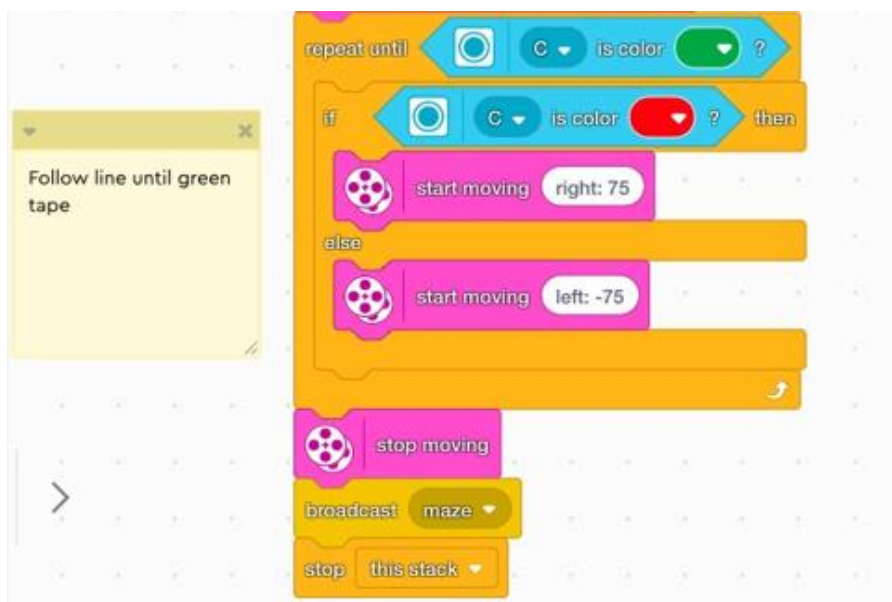
For the second part of the code, it is showing to turn around at the “blue block” which in our environment was a small blue Lego block that disturbed the path of the Lego spike prime, altering the line and blocking the route, this code bypasses that obstacle in the environment.



The next part of the challenge was to turn back onto the line after diverting away from the line because of the block.



After returning to the line the code then instructs the robot to continue follow the line by sensing for the colour red, but stopping when it senses the green tape at the end of the line.

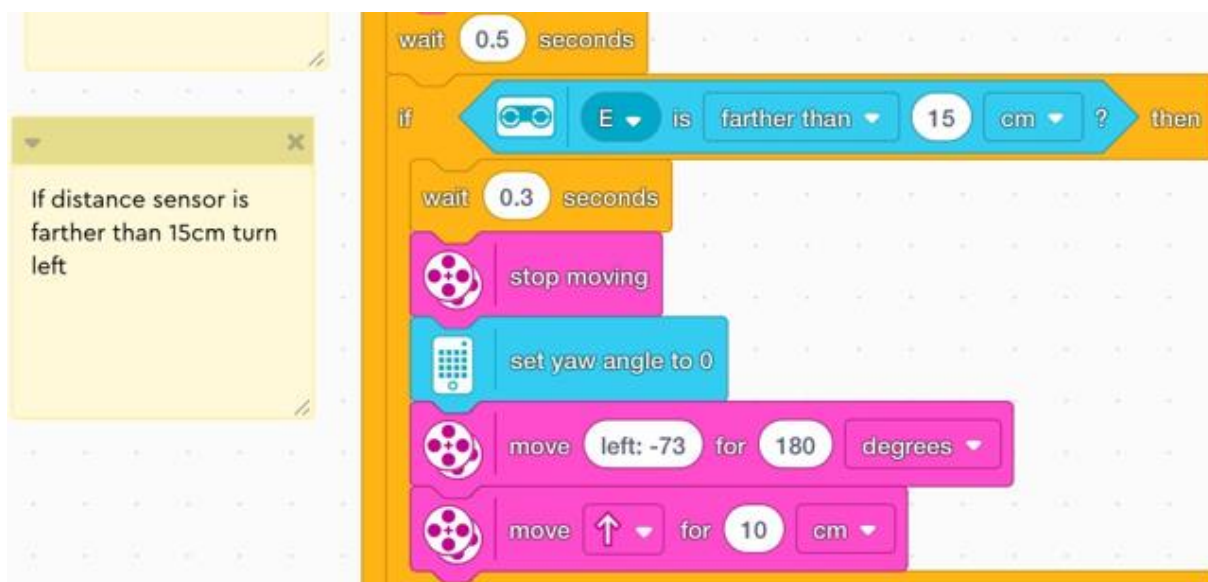


Maze route

For the second part of the challenge the robot needs to follow a maze and reach the end of it successfully, the code again begins by detecting for the colour red.



Adjusting the Lego spike prime is a constant occurrence, for the maze part of the assignment we needed to put on a distance sensor to detect the sides of the maze, below is shown that if the distance is further than 15cm to turn left.



And on the last part of the code there is a pressure sensor attached to the spike prime that if pressed will stop moving and turn right, this is important as the spike prime will be very close to the maze walls so a pressure sensor would prove very useful. The spike prime will be bumping into the maze frequently, so it is important that this is attached to the robot.



Conclusion

From this project I have learned that when it comes to working with robotics using a kit like the spike prime 3 there are so many factors that are to be accounted for, these factors often provide many challenges to overcome but with trial and error every tiny thing can be tweaked like a part of the robots front that's maybe slightly too long blocking a sensor or it could be that the turn radius is off by a mere one degree.