BIRZEIT UNIVERSITY

Faculty of Engineering & Technology

Electrical & Computer Engineering Department

ENCS4380

Maze Robot

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Algorithm

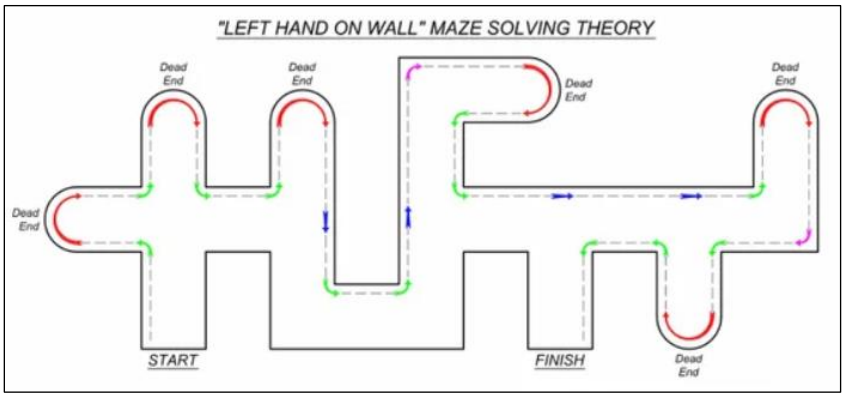
We will choose the left hand rule approach in solving the maze. Our robot will always turn left in the maze if there is a left way, otherwise it will continue forward. If the robot can't turn left, go forward, it will turn right. If the robot can't turn left or right or stay forward, it will turn around and search in another ways. It will continue in this approach until he reached the desired point. The method of solving the maze for a shorter path is by keeping track of the turns made, and reducing the list of turns as you add the latest turn to the list with known substitutions.

From our approach, we can notice a lot of substitutions:

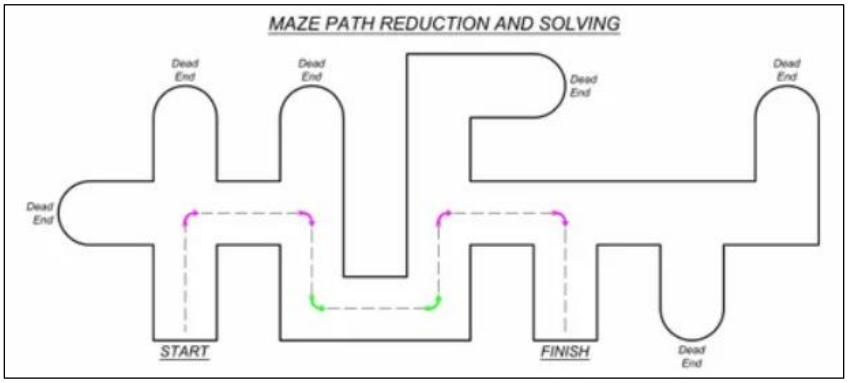
Left, Back, Right → Back
Left, Back, Forward → Right
Left, Back, Left → Forward
Forward, Back, Left → Right
Forward, Back, Forward → Back
Right, Back, Left → Back

In the second time we put the robot in maze, it will substitute the above cases to get the desired point by the shortest path avoiding any dead ends. We will use the algorithm by writing it as a code for Arduino compatible micro controller.

As an example, the next figure shows the first path which will the robot walk, it is a long path to reach the finish.



Before the robot reach the finish, he has met 6 dead ends which he must avoid them in the next time, so the second one he walked in the maze, it will has the shortest path as shown in the figure below.

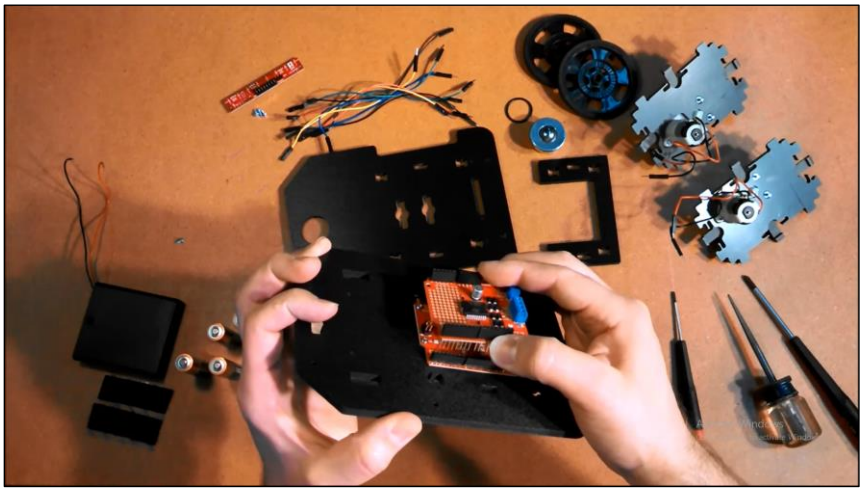


Components & Tools

- Raspberry Pi: to use its input/output pins which allow controlling electronic components for physical computing.
- Motor driver: acts an interface between the motors and the control circuits.
- 2 Stepper Motors: to convert electrical energy into kinetic energy.
- Array of sensors: helping to estimate the available ways for the robot in different directions.
- LEDs, motor brackets and Electrical tapes
- Scissor, Poster board and screwdrivers
- Robot base: to set the design in it.
- DC batteries and, Small Wires

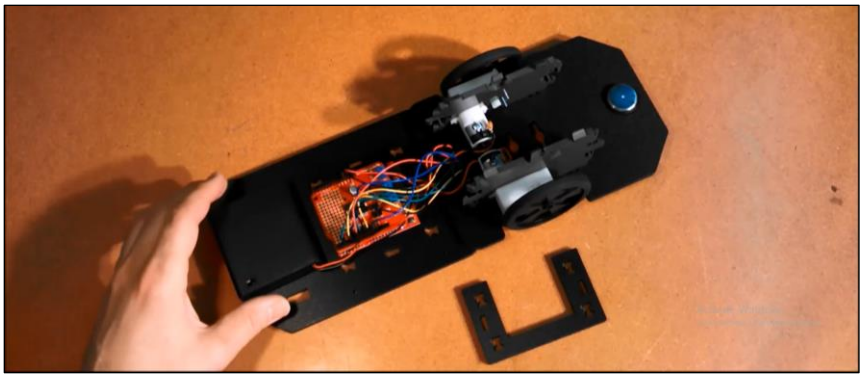
Procedure

First, we will collect the components and tools that we mentioned before. After putting the raspberry pi on the board base, we connect motor driver to the device with batteries,

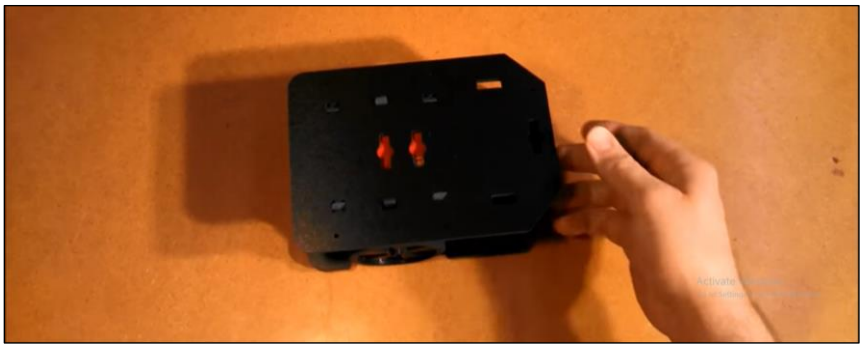


Also we need to fit the sensor array in the middle preface of the board to respond for the line (electric tape).

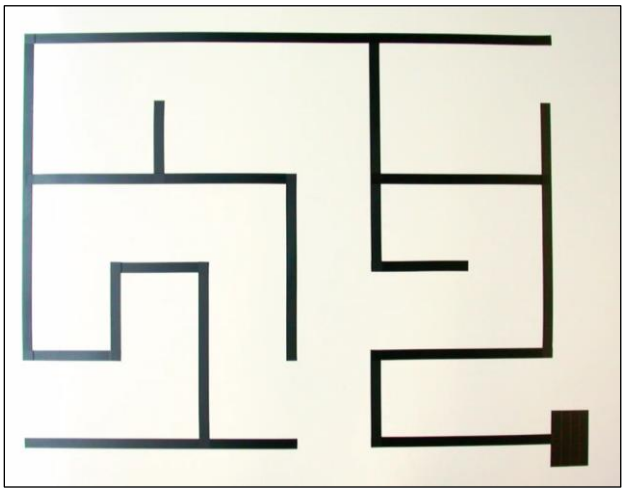
Then, we need to fit the motors in there brackets, and put the brackets in the two sides of the board. After the jumpers are put between the motors and their drivers and maybe we used LEDs to indicate the available ways for the robot when he walk in the maze.



Finally, we will test if all parts are fit and wires are connected perfectly.



For the maze, we will put the electric tapes represented the paths that could the robot passed on them, these tapes will be on whiteboard. Make the corners clean and straight lines, the intersections and corners should be overlapped to avoid white gaps.



We will write the maze solving program and load it by connecting the computer and the red board in the robot with USB cable, we will test many cases to avoid any faults in the robot's behavior and many mazes.

References

https://www.instructables.com/Robot-Maze-Solver/?fbclid=IwAR2o-_yM2GiNGoqC40C5a_N9_AGIVsrz1v3UArD-ZuBaARTUcxTVv8rzJ6w