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To: Dr. Morton

From: Xiao-Yang Michael Min

Subject: Proposal for Scribbler Bot Project

Proposal

For our team's robot, a possible project would be to program the robot to successfully complete a maze. The maze would be easy for a human to solve, but a challenge for a robot. The maze will be constructed on a paper surface using cardboard as walls. By inserting a pen in the pen port, the scribbler is able to trace its path of movements on a piece of paper placed on the ground [1, p.23]. The goal would be for our robot to navigate through different mazes without human intervention as efficiently as possible and beep when it has completed the maze.

Adding onto the previous idea, we could take advantage of the light sensors to attempt more difficult mazes once the robot is able to complete simple mazes by itself. By directing a flashlight at the correct path to guide the robot towards the exit, we could program the robot to recognize the light source and move towards it. However, the flashlight will be used sparingly and only as a hint in order to direct the robot in the correct path as shown in Figure 1. This way the robot will be able to complete more difficult mazes. A possible end goal would be for the robot to complete many mazes of varied difficulty levels with the assistance of the flashlight.

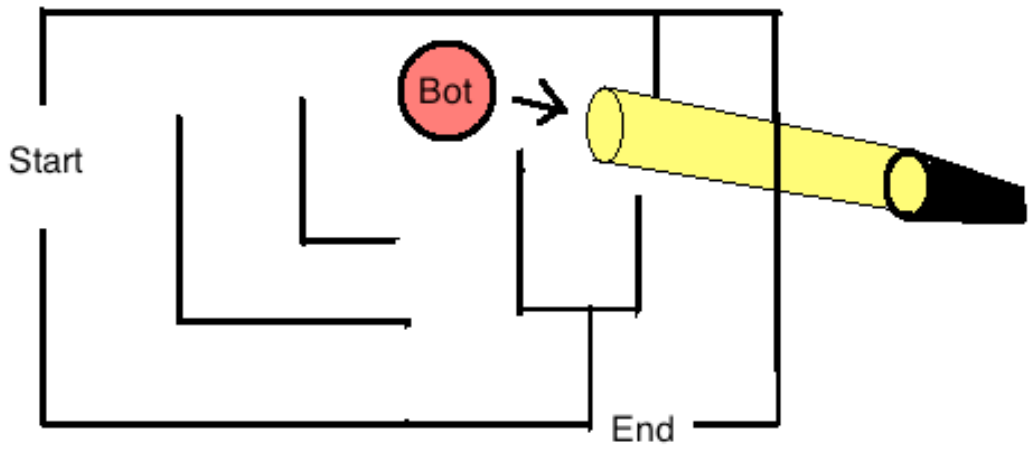

Figure 1 Use of a light source to guide the robot

Necessary features and modules

In order to complete this project, various hardware components are necessary. First of all, the motors will be needed to move through the maze. Secondly, the proximity detectors must be used to detect the maze walls to avoid collision. Of these detectors, we will use the three infrared obstacle sensors on the Fluke dongle. If the light that is emitted by these sensors get reflected by the presence of an obstacle, then the light will bounce back towards the robot and is captured by the IR sensor that is present in the tiny notch in the middle of the two IR emitters [2]. Another necessary component is the light sensor in order for the robot to be able to follow the light source. Finally, the speaker is needed to output the beeping noise once the robot has exited the maze.

The features found in the Myro Manual should provide the majority of functions we need. All the motor movements, sensors and sounds are covered by functions such as getBright() and getIR() [1]. However, we may possibly need certain math functions from the math module when dealing with movement through the maze. Additionally, the time module will be required when dealing with turning. For example we will need to know how long it takes for a 90 degree rotation.

Design Challenges and Risks

The accuracy of the robot's infrared collision sensors will have to be tested, so exact dimensions of the maze will have to be adjusted accordingly. Furthermore, the speed and precision of the motors have to be taken into consideration when designing the maze. Paths that are too narrow will not allow enough time for the robot to react if the sensors and motors are slow and inaccurate. Also, an efficient algorithm to navigate through the maze might be a challenge. We will need to find a way so that the robot does not get stuck and does not make the same mistakes repeatedly. Getting the robot to respond to the flashlight may pose problems since the light sensors may not detect the light in a bright room, so a dark environment may be necessary.

Time Estimate

The first stage of the project will be designing a maze with reasonable dimensions that allow enough time for the robot's sensors and motors to react. At the same time, members from the

group can work on adjusting the code from the object avoidance test so that the robot can maneuver in the maze without collisions. Both these tasks should take a combined 25 hours. The next steps would be making an algorithm to navigate through the maze without human intervention and incorporating the light sensors so that the robot follows light sources which should take 30 and 20 hours respectively. The remaining time will be left to spend on designing more difficult mazes and testing for bugs.

References

[1] D. Kumar, *Learning Computing With Robots,* Institute for Personal Robots in Education, 2008.

[2] G. Martin, “Introduction to Scribbler Robots,” http://www.garfieldcs.com/2010/05/introduction-to-scribbler-robots/. Accessed September 30, 2014.