Pre-Lab 4 Report

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ECE 100-02
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Teammates:
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Proposal-

Design and construct an autonomous robot which utilizes two light sensors to navigate through a maze under a time constraint of 1 minute while using Interactive C and a HandyBoard. The robot is an outline for a search and rescue robot.

Research

The use of touch sensors were useful as they could detect any obstacle in front of the robot, but with light sensors, which are created with photocells, are more useful and more efficient. Light sensors are sensor components that take in a source of light in order to operate. The strength of the signal detected by the sensor corresponds with the strength of the light source. The intensity of the light source co-relates to the torque of the motor. Taking the reference- “cross-wired—each to the motor on the opposite side—with stimulatory effect” (Martin 76). Therefore, during the construction of the robot the light sensors must be cross-wired. According to the theory, the light will affect the robot in a different way compared to if they were not cross-wired. If the right sensor is closer than the left sensor to the light source, the left motor will begin to speed up causing the robot to make a right turn. If the sensors weren’t cross-wired, the light would have caused the robot to execute a left turn instead.

The robot when configured correctly should turn towards and approach light sources. This is called negative feedback.’ Negative feedback brings the “system toward a goal state” (Martin 77)’. As the system is goal-oriented,the robot has to find the light and approach it in order to complete and execute a turn. Positive feedback is the exact opposite. Instead of being goal-oriented, the robot would go away from its stable state. Therefore, the robot would not follow or look for the light source, if the robot were to detect the light source, it would turn away from the light and direct itself into a darker area since it will be drawn to darkness.

The robot will be built step by step and the first trial will be for the robot to detect the light and started moving. As the robot will approached the light source, it will begin to speed up and possibly overshot the light since its not having the function of steering or slowing down when it reaches the light. In order to tackle this
Braitenberg then created Vehicle 2 which contained two motors and two sensors that were cross-wired with the motors. The outcome elicited better results because Vehicle

2 is able to slow down and execute turns so that it could follow the light, while Vehicle 1 was only able to go in a straight path towards a light without slowing down.

Solution

The first trial is to check if the sensors are functioning. testLight.ic is a program that allows the sensors of the robot to be tested. This is the simplest form of the code that continuously prints the value of analog inputs 2 and 3 to the HandyBoard LCD screen. The second trial is normal.ic, using variables it can be seen that MAX_LIGHT has a value of 10 and MIN_LIGHT has a value of 100. The value 0 is considered very bright while the value 100 is considered very dark. The expression gives smaller numbers with brighter light. With the last trial, the program uses an infinite loop to continually set left and right motor powers based on the normalized value of the opposing sensor. The solution with the best outcome for the robot is to place both light sensors at the front of the robot, one on the left side and one on the right side. While the robot is moving forward, the robot will approach the light that is within' the maze. Once the robot detects the light in the maze, it will conduct right angle turn to avoid the obstacles in its path. Optimum flowcharts for the programs are as follows-

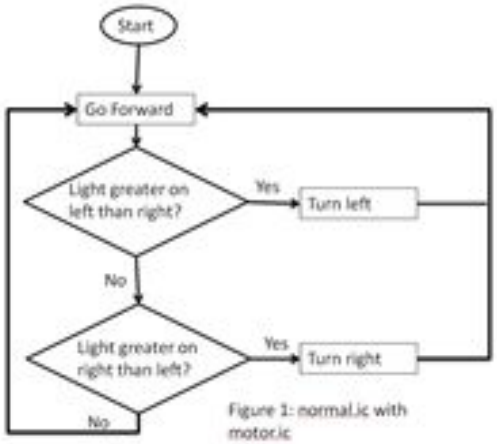

Figure 1: normal.ic with motor.ic

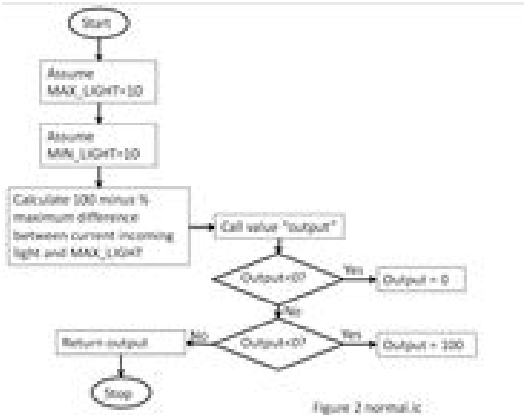

Figure 2 normal.ic

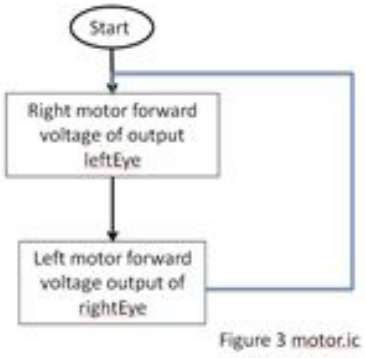

Figure 3 motor.ic

References Used

1. Martin, Fred G. 2001. Robotic Explorations: A Hands-On Introduction to Engineering. New Jersey: Prentice Hall.

2. Oruklu, Erdal. 2018. ECE 100 Lecture Notes. Chicago: Illinois Institute of Technology, Electrical and Computer Engineering Department.

Appendix

```
/* normal.ic */
/* converts light sensor reading to 0-to-100 motor power levels */
int normalize(int light){
        int MAX_LIGHT = 10;
        int MIN_LIGHT = 200;

        int output = 100 - ((light - MAX_LIGHT) * 100 / (MIN_LIGHT - MAX_LIGHT));

        if (output < 0)
       output = 0;
        if (output > 100)
        output = 100;
        return output;
}

void main()
{
        while(1)
{
```

```
        printf("sensor 0=%d sensor1=%d\n",
                analog(2), analog (3) =);

       motor(LEFT_MOTOR, normalize(2);
        motor(RIGHT_MOTOR, normalize(3);

        }
}
```