SC2107 Lab2 Assignment Sheet (to be submitted to NTULearn before next lab)

Name: KAVYA SETHI Lab Group: SCEC Date: 23/09/24

1. **Section 6.2. Give a short 2-3 lines description on concept behind the reflectance reading process. Why does the black surface result in slower voltage decay?**

The reflectance sensors tell us the position of the robot based on the amount of IR wave reflected back. The reflectance of the surface will affect the effective resistance of the transistor which in turn affects the decay rate of the voltage at the pins. Black surface reflects less IR waves to the base of the transistor, as a result less current flows through the collector- emitter thereby reducing the voltage decay rate.

1. **Section 6.2. Which parameter do you need to tweak in the Reflectance\_Read() if the reflectance sensor reading is not accurate? Hint: check the 8 steps for Reflectance reading.**

If the sensor reading is not accurate, we need to tweak the Clock\_Delay1us parameter in the Reflactance\_Read(). By adjusting how long the system waits for the capacitor to discharge before reading the sensor values, we can increase the accuracy by either increasing or decreasing the waiting time depending on the reflectivity of the surface.

1. **Section 6.2. Write down the procedure to initialise P7.3 to be an input pin without internal pull-up resistor**

Step 1: Set GPIO:

P7->SEL0 = 0x00;

P7->SEL1 = 0x00;

Step 2: Set input:

P7->DIR &= ~0x08;

Step 3: Disable pull up   
P7REN &= ~0x08;

1. **Section 6.3. Where are the sources of the offset error between actual distance and the estimated distance return by the function Reflectance\_Position()?**

There can be several reasons for the offset error between the actual distance and the estimated distance. Some of them may be:

Measurement Error: There may be issues within the sensors such as sensor calibration or noise that may lead to erroneous readings

Changes in the lighting, environment et cetera: May affect the amount of light being reflected causing a change in the values.

1. **Section 7.2.  Figure 7. The robot state toggled between LEFT and CENTER state repeatedly when it is detected that the robot is off to the left of the line (input: ‘01’). If the outputs of the FSM states are connect to the input of the DC motor, how would the input signals to the DC motor looks like? Which wheel will move at a slower speed?**

Shape

Description automatically generated with medium confidence

1. Section 7.3. Fix the bug in the 11-state FSM design.  
   A picture containing table

   Description automatically generated
2. **Section 7.3. What is the purpose of toggling LED within the main routine or ISR?**By toggling the LEDs, we get to know the state of the robot. Based on the color of the LED, we can determine the position : LEFT, RIGHT, CENTRE, etc. This further helps us to determine the course of action, whether to turn or stop or go straight.

1. **Section 7.4. What hardware and software modifications are required in order for the robot to move within a lane, i.e. between two black lines, instead of following a line? Detail algorithm not required. Just one bullet point each for hardware and software.**

**Hardware:** Add additional sensors such that the robot is able to accurate inputs from two lines, one on the left and one on the right.

**Software:** Adjust the algorithm to be able to analyze the position of the robot based on two sensor inputs rather than one such that we have the position of the robot relative to both the lines and also change the movement strategy of the robot to be able to stay in the center of the lane( 2 black lines)