CMPE 443 PRINCIPLES OF EMBEDDED SYSTEMS DESIGN

Term Project Interim Report #001

"LED Motor Driver Connection and Speed Sensor"

Motivation

In this report, you begin to build your robot platform. This report includes the LED,Motor Controller and Speed Sensor parts of the robot platform. By doing this report, you will learn:

- to determine the correct pins on a microcontroller board with the desired functionality
- to drive multiple LEDs
- to drive multiple DC motors
- to get feedback for DC motors

1) Problem Description

In Term Project, you will use 4-Wheel Robot Smart Car Chassis via LPC4088 Board and with various sensors and other components. This robot chassis is consist of 4 DC Motors, 4 Wheels and Battery Holder. However, in this report you will add 1 Motor Controller (L298N Dual Motor Controller), 4 LEDs and 2 LM393 Motor Speed Sensors to the system.
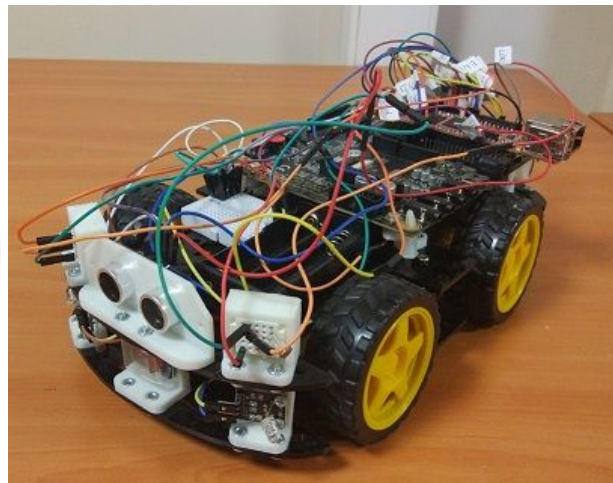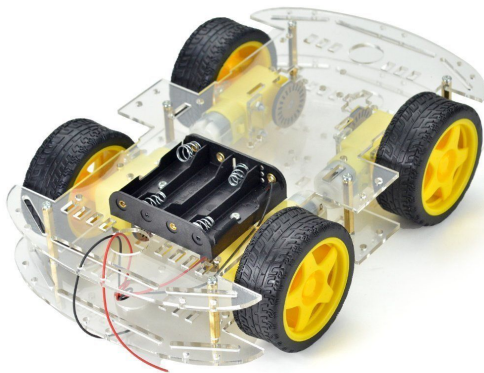
Currently your robot will be controlled via the joystick which is located on the LPC4088 Experimental Base Board. When joystick button is pressed, robot should start to perform the tasks which are listed below. However, when you release the pressed button, robot should not stop that task, it should continue to do the last task. However, when a button is pressed, robot should stop the previous task and should perform new task immediately.

➢ When Joystick Left button is pressed, your robot should start to rotate 90 degree in counter-clockwise direction (Point Turn is necessary). After the turn is completed, the car should not move.
➢ When Joystick Up button is pressed, your robot should start to travel in forward direction.
➢ When Joystick Down button is pressed, your robot should start to travel in backward direction.
➢ When Joystick Center button is pressed, your robot should stop.
➢ When Joystick Right button is pressed, your robot should rotate 90 degree in clockwise direction (Point Turn is necessary). After the turn is completed, the car should not move.

Also, your robot should have an ability to change its speed. However, this parameter will be hard-coded which means that we will give you the speed parameter. The parameters should be defined in **Parameters.h** file. The defined parameters should be ROBOT_SPEED, ROTATION_NUMBER_FOR_90_DEGREE, TURN_LEFT_FLAG, TURN_RIGHT_FLAG, FORWARD_FLAG, BACKWARD_FLAG (Whenever a task is performed, the flag of that task must be 1 and the other task flags should be 0). (Your program should use these parameters, and these parameters should be in **Parameters.h** file)

Your robot car have 4 LEDs which are located to the Front-Left, Front-Right, Back-Left and Back-Right The state of the LED is changed according to the action which robot performs:

➢ When robot stops, all the LEDs should be turned off.
➢ When robot travels in forward direction, Front-Left and Front-Right LEDs should be turned on and the other LEDs should be turned off.
➢ When robot travels in backward direction, Back-Left and Back-Right LEDs should be turned on and the other LEDs should be turned off.
➢ When robot rotates counter-clockwise direction, Front-Left and Back-Left LEDs should blink (2 times in a second) and the other LEDs should be turned off. (After 90 degree rotation is finished, all the LEDs should be turned off)
➢ When robot rotates clockwise direction, Front-Right and Back-Right LEDs should blink (2 times in a second) and the other LEDs should be turned off. (After 90 degree rotation is finished, all the LEDs should be turned off)

Hint: For 90 degree rotations, motor speed sensor should be used.

2) **Block Diagram**   *8 pts*

Show the inputs and outputs of this system with a System-Level Structural Diagram.

3) **(Functional) Sequence Diagram**   *10 pts*

Draw the (Functional) Sequence Diagram of this system. Directed edges between the blocks should show how HW and SW parts interact with each other. Note that direction of the edge is important because it shows the flow between components.

4) **LED Connection**

All the components which are controlled via LPC4088 should be connected to the board. Therefore, you should determine the pins and their functionalities.
Draw a table which shows: _____   *8 pts*

➢ The LED Name: The name of the LED which connected to pin such as Front-Left.
➢ LPC4088 Pin: Write the name of the pin which is connected to the LED.
➢ Pin Functionality: Write the functionality of the pin (used functionality).
➢ Reason: Write a small description for why you select that pin.

After you determine the all the pins, *draw the circuit schematic for the LED circuits*.
                                                    _____   *4 pts*

5) **Motor Speed Sensor Connection**

You should determine the pins of sensors and their functionalities.
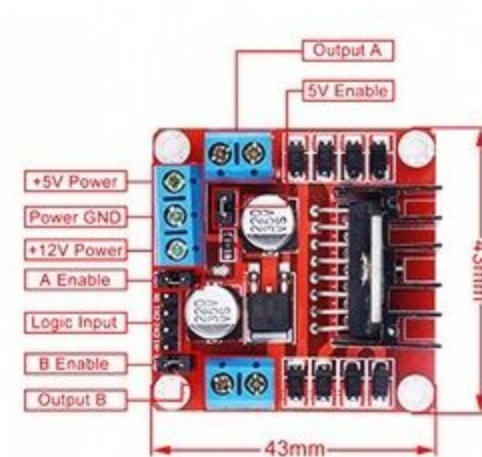Draw a table which shows: _____   *8 pts*

➢ The Speed Sensor Name: The name of the Sensor which connected to pin such as Left, Right.
➢ LPC4088 Pin: Write the name of the pin which is connected to the Sensors.

➢ Pin Functionality: Write the functionality of the pin (used functionality).
➢ Reason: Write a small description for why you select that pin.

6) Motor - Driver Connection

You will control 4 DC Motor with only 1 Motor Controller. L298N Dual Motor Controller can adjust the speed of the motors and also it can change the rotation direction.

Your robot should travel in forward and backward directions and it should also rotate CW and CCW directions. Draw a table which shows: (Do not connect driver to LPC4088 in this section)   _____   *4 pts*

➢ Motor Terminal: + or -
➢ Motor Driver Terminal: Output A +, Output A - etc...

7) Driver - Board Connection

Motor Driver should take the commands from the board. On L298N Motor Driver, there are 2 Enable pin and 4 Logic pin.

Your robot should go forward, backward and rotate CW and CCW. Also, it should have an ability to change its speed. Draw a table which shows: _____   *8 pts*

➢ Motor Driver Pin Name: The name of the Pin on the Motor Driver such as IN1.
➢ LPC4088 Pin: Write the name of the pin which is connected to motor driver pin.
➢ Pin Functionality: Write the functionality of the pin (used functionality).

➢ Reason: Write a small description for why you select that pin.

Possible Point Reduction Reasons:

- Not using the parameters in the **Parameters.h** file.
- Not implementing motor speed change functionality.
- Not rotating the robot 90 degrees (in 80 - 100 degree range)
- Not showing correct LED blink action
- Not showing correct LED turn on or off action
- Not switching between the tasks immediately
- Not showing the current task flag