Lab 2 – Feasibility Model Phase 2

ECE 298 – S2021

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| Lab Section: |  | Group: | 90 |

# DC Motor

## Summary

| Item | Description |
| --- | --- |
| Purpose | The purpose of the DC motor/motor encoder is to function as an actuator that controls the rotation speed of the wheels. In addition to controlling the rotation speed, the motor encoder will send information back to the controller to indicate its rotation speed. In this sense it is also a sensor. |
| Device physical domain and range | The speed of rotation of the motor must have a minimum rotation speed of -400 RPM and the maximum rotation speed must be 400 RPM. These numbers are estimates of just faster than the average human walking speed. |
| Device type chosen | The motor chosen for simplicity of design is a brushed DC motor. The brushed DC motor’s rotation speed is proportional to the average value of the current applied to it. |
| Proteus Library component name | The component used to implement this function is the ECE298\_FAST\_DCMOTOR\_ENCODER. |
| Device input / output properties | The input of the motor is a current, where the rotation speed of the motor is proportional to the average value of the current through the motor. Due to the large current required by the motor, the motor will be connected in an H-circuit with 4 transistor’s whose gate voltages will be controlled by the MCU from 0-3.3V. Turning opposite pairs of transistors on will close the circuit to the DC power supply and cause the motor to spin forwards or backwards. A PWM input applied to these transistors will control the amount of average current applied to the motor.  The output of the motor are three pins, Q1, Q2, and IDX. Each of these pins output a digital signal from 0-5V, which must be sent through a voltage divider before reaching the MCU input pins in a range of 0-3.3V. The IDX pin is pulsed once per rotation, indicating the speed of the motor. The Q1, Q2 pins are pulsed once every 24th of a rotation, indicating the absolute angle of the motor. Depending on which of Q1 or Q2 rises high when the other is low, this indicates if the motor is moving forwards or backwards.  utputs can also be open drain /  open collector  , but not for the  purpose of bus signalling. The output acts as a switch to ground,  powering high  -current devices  by en  abling or interrupting the  current like a switch |
| Device input / output range | The device’s surrounding transistor’s gate voltages will be on the range 0-3.3V to turn the device on and off. The power supply will be 12 V and the duty cycle of the PWM supplied will control how long the circuit is exposed to this power supply.  The devices output is a square wave whose range is 0-5V.  State the  working voltage of the digital I/O (e.g., 3.3  V or 5.0  V).  Each digital  output  will have a  minimum  output  high  voltage  ,  V  OH  ,min  , and  maximum  output low voltage  , V  OL,max  . Each digital  input will have an  maximum  input high  voltage  , V  IH,m  ax  , and  minimum input low voltage  , V  IL,min  , respectively.  Note them here  or  note if the values are unavailabl  T |
| MCU connectivity details | The device will be connected to the MCU via an H-bridge circuit with 4 NMOS transistors. The 4 NMOS transistors will be controlled via 2 GPIO output pins of the MCU and 2 timer pins. These two timer pins will control the exposure of the motor to current using a PWM signal and the 2 GPIO output pins will control which way the current is sunk to ground across the H circuit/ |
| Device/MCU interfacing details | The input to the motor is a digital signal from 0-3.3V. The output of the motor is a digital signal rom 0-5V, which will be stepped down to 0-3.3V. Thus, the connectivity to the MCU is Digital to digital. The connection will be unidirectional for inputs and outputs separately. |

## Schematics and Simulations

# LM016L - LCD

## Summary

| Item | Description |
| --- | --- |
| Purpose |  |
| Device physical domain and range |  |
| Device type chosen |  |
| Proteus Library component name |  |
| Device input / output properties |  |
| Device input / output range |  |
| MCU connectivity details |  |
| Device/MCU interfacing details |  |

## Schematics and Simulations

# Coloured LEDs

## Summary

| Item | Description |
| --- | --- |
| Purpose |  |
| Device physical domain and range |  |
| Device type chosen |  |
| Proteus Library component name |  |
| Device input / output properties |  |
| Device input / output range |  |
| MCU connectivity details |  |
| Device/MCU interfacing details |  |

## Schematics and Simulations

# Battery Sensor Circuit

## Summary

| Item | Description |
| --- | --- |
| Purpose |  |
| Device physical domain and range |  |
| Device type chosen |  |
| Proteus Library component name |  |
| Device input / output properties |  |
| Device input / output range |  |
| MCU connectivity details |  |
| Device/MCU interfacing details |  |

## Schematics and Simulations

# ECE298\_GEN\_POTENTIOMETER

## Summary

| Item | Description |
| --- | --- |
| Purpose |  |
| Device physical domain and range |  |
| Device type chosen |  |
| Proteus Library component name |  |
| Device input / output properties |  |
| Device input / output range |  |
| MCU connectivity details |  |
| Device/MCU interfacing details |  |

## Schematics and Simulations

# ECE298\_GEN\_PBUTTON

## Summary

| Item | Description |
| --- | --- |
| Purpose |  |
| Device physical domain and range |  |
| Device type chosen |  |
| Proteus Library component name |  |
| Device input / output properties |  |
| Device input / output range |  |
| MCU connectivity details |  |
| Device/MCU interfacing details |  |

## Schematics and Simulations

# ECE298\_GEN\_SWITCH

## Summary

| Item | Description |
| --- | --- |
| Purpose |  |
| Device physical domain and range |  |
| Device type chosen |  |
| Proteus Library component name |  |
| Device input / output properties |  |
| Device input / output range |  |
| MCU connectivity details |  |
| Device/MCU interfacing details |  |

## Schematics and Simulations