Experiment 4

Changing brightness of LED using potentiometer using Matlab / Simulink

Objective:

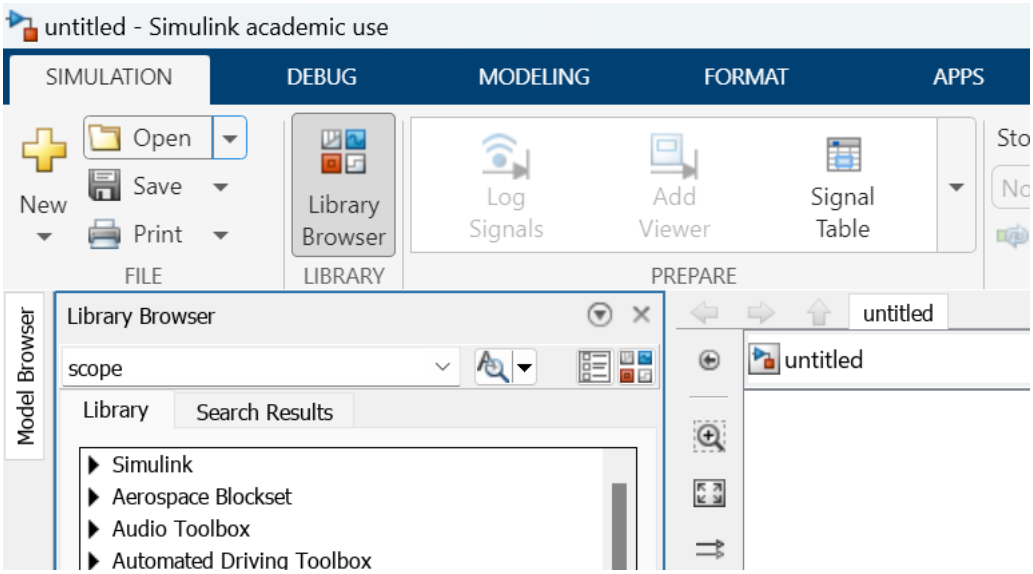
To build and simulate a model to control the brightness of the LED on the Arduino hardware using potentiometer through Matlab Simulink.

Setup Required:

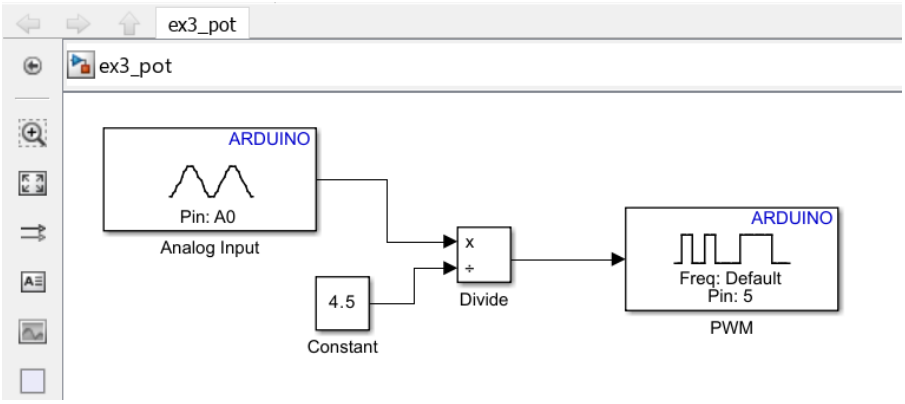
- Matlab software
- Arduino Uno with USB cable – 1 No.
- Breadboard – 1 No.
- Resistor – 220 ohm – 1No.
- Potentiometer – 1 No.
- LED – 1 No.
- Jumper wires – few Nos.

Procedure:

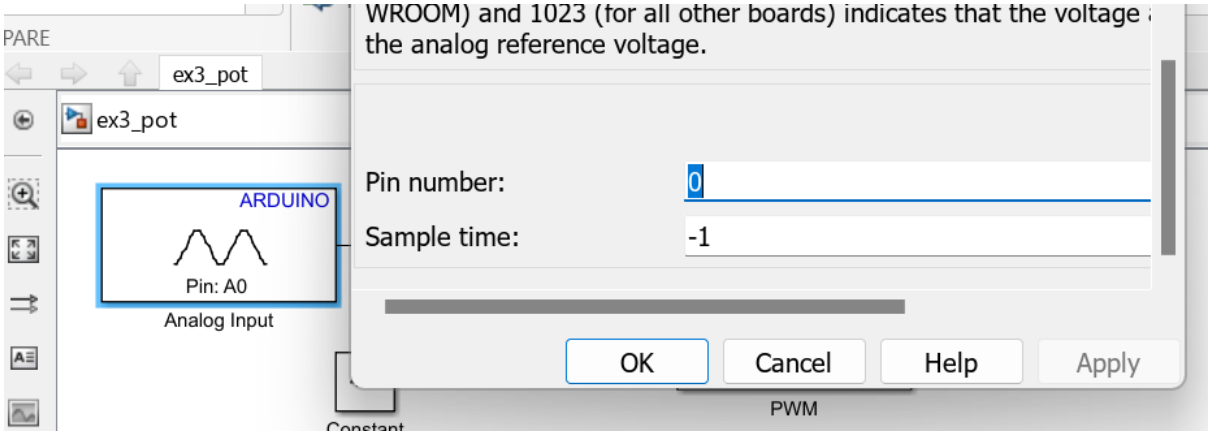
Go to Matlab -→ Simulink -→ open Blank Model, as shown below. Open the Simulink library browser.



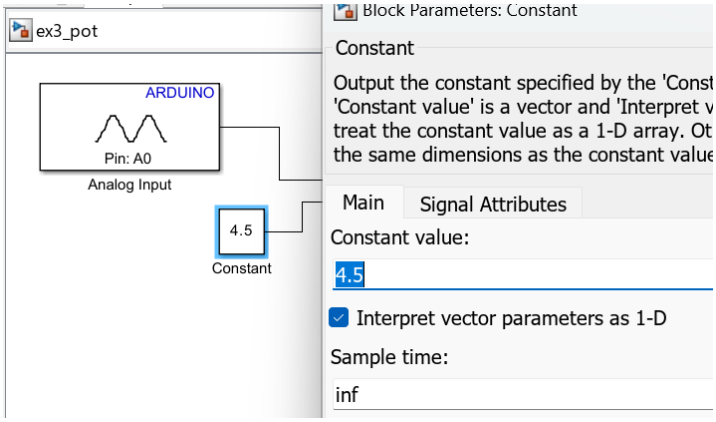
From the library browser drag & drop the following blocks:
Simulink support package for Arduino -→common -→Analog input, Simulink -→commonly used blocks -→constant, Simulink -→math operations -→divide. Connect the blocks and save the file (without any spaces).



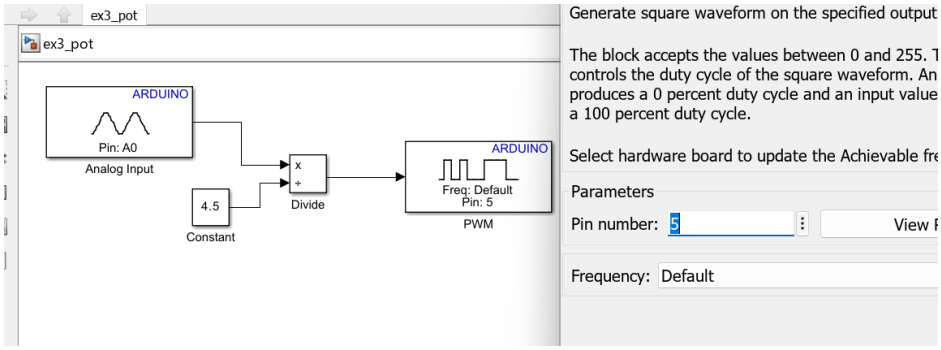
Connect the blocks as shown below and double click the Analog Input to change the parameters as follows. As the pin from potentiometer will be connected to A0 (analog pin in Arduino board).



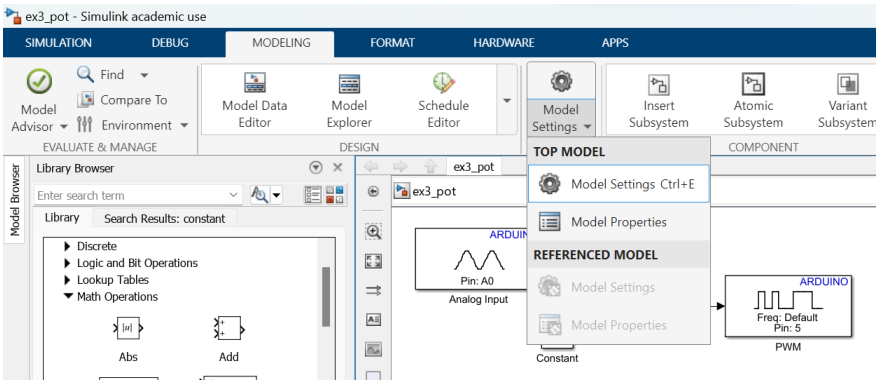
Double click the constant block and give the value as 4.5. As, Arduino supports an 8-bit wide pulse that can have 256 possible levels (0 to 255). Arduino does not have a dedicated Digital to Analog converter. But it can emulate analog signals using the PWM technique. In PWM, the digital input is converted into a Digital pulse. The Analog voltage output can be calculated by using Digital input. The Arduino can write 0 to 5V in terms of digital input range 0 to 255. Analog output voltage = (Digital Input / Resolution) = 1024 / 255 ~ 4.5.



Double click the PWM block and set the pin as 5 as shown below.



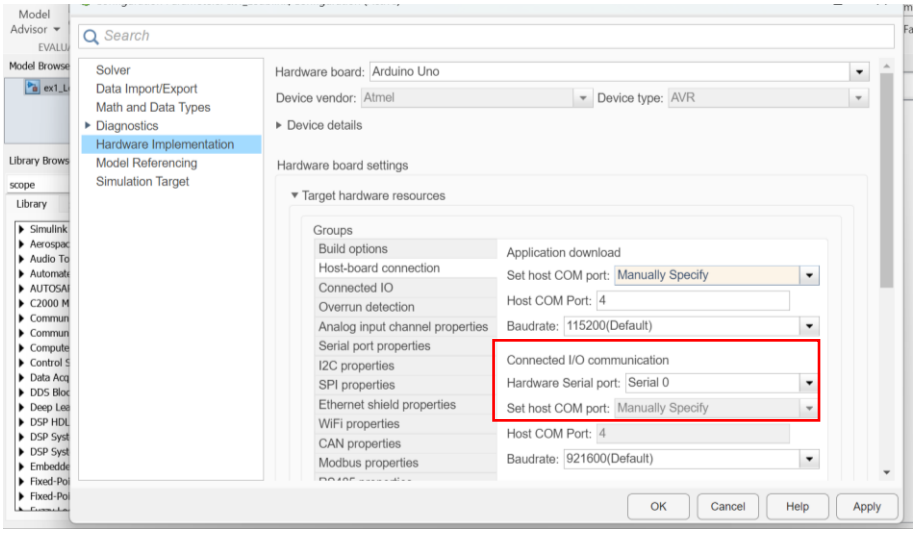
Go to Modelling tab -→ model setting -→Configure the parameters for the hardware. Select the hardware as Arduino Uno in the hardware board as shown below.



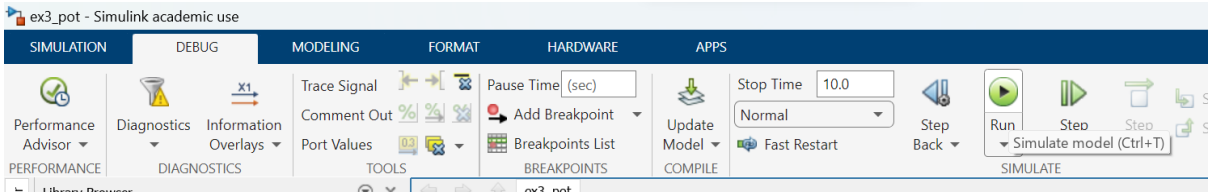
Under hardware board settings, specify the COM port number, at this time the hardware i.e. Arduino uno must be connected with the laptop using a usb cable. Check the port number in the command window using the following command.

>> a = arduino

```
Arduino Uno detected.
This device is ready for use with MATLAB Support Package for Arduino Hardwar
This device is ready for use with Simulink Support Package for Arduino Hardw

>> a=arduino
Updating server code on board Uno (COM4). This may take a few minutes.

a =

  arduino with properties:

                Port: 'COM4'
               Board: 'Uno'
       AvailablePins: {'D2-D13', 'A0-A5'}
  AvailableDigitalPins: {'D2-D13', 'A0-A5'}
     AvailablePWMPins: {'D3', 'D5-D6', 'D9-D11'}
   AvailableAnalogPins: {'A0-A5'}
    AvailableI2CBusIDs: [0]
             Libraries: {'I2C', 'SPI', 'Servo'}
Show all properties
```



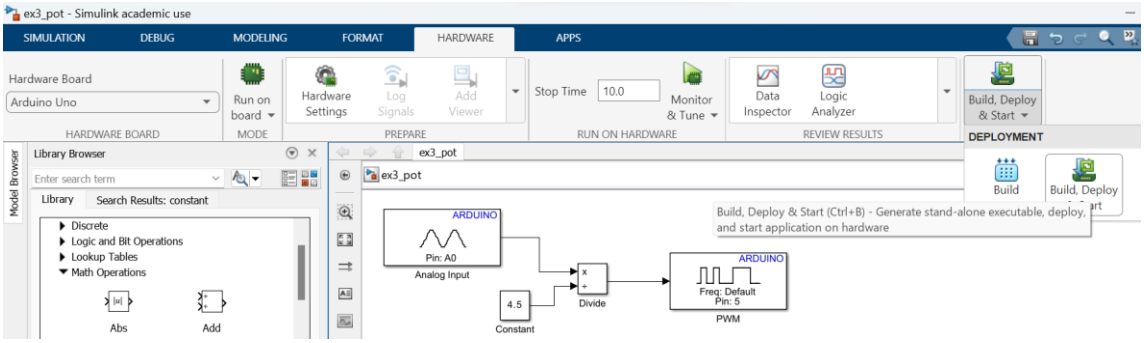
Give apply and OK. Save the model. Go to simulation tab and simulate the model.



Do the connections as shown in the schematic diagram shown below.

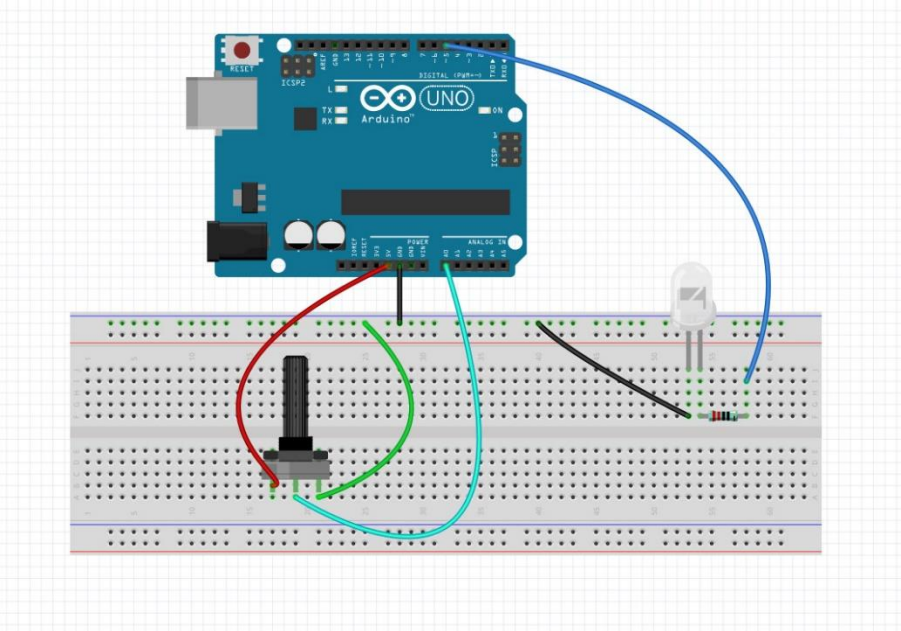
- Place the Arduino UNO and breadboard on the table.
- Connect the 5V and GND pin of the Arduino board to the Power and Ground rail of the breadboard.
- Place the Potentiometer on the breadboard such that the three legs are placed one beside each other.
- Place the LED also on the breadboard such that the legs are placed one beside the other.
- Using Jumper wires connect the Anode of the LED to one end of the 220Ω resistor and the other to the Pin5 of the Arduino board.
- Similarly, connect the Cathode of the LED to ground Rail.
- Next connect the Left and Right Pin of the Potentiometer to the Power and Ground rail of the breadboard, respectively. connect the centre Pin of the Potentiometer to ‘A0’ pin of the Arduino Board.

Go to Hardware tab -→click build deploy and start.



YouTube video for the procedure: https://www.youtube.com/watch?v=0X1TNAGgTos

Schematic Diagram:



When the Potentiometer is varied from Left to right, the Brightness of the LED fades in and out based on the concept of the Duty cycle change of the Input signal.

Conclusion:

Thus, a Matlab Simulink model was built and simulated to control the brightness of the LED using the potentiometer.