Southern Polytechnic College at Kennesaw State University
Electrical Engineering Department
EE 3501 Laboratory Exercise 4: GPIO, Scanning a Keypad

Name:_____ Date: _____

Learning Objectives:

- Write a real time polling routine.
- Control various delays using C.
- Extend first two objectives to design a program that will handle inputs from a common key matrix.

Prelab

1. **Read the C++ class manuals on DigitalIn and DigitalOut in mbed:**
   https://os.mbed.com/docs/mbed-os/v6.11/apis/digitalin.html

   https://os.mbed.com/docs/mbed-os/v6.11/apis/digitalout.html

Laboratory procedure

1. **Write a C or C++ program to output a high (one) on four GPIO pins (ROW1, ROW2, ROW3, and ROW4). Then, output a low (zero) for 10ms on one output at a time as shown in the diagram:**

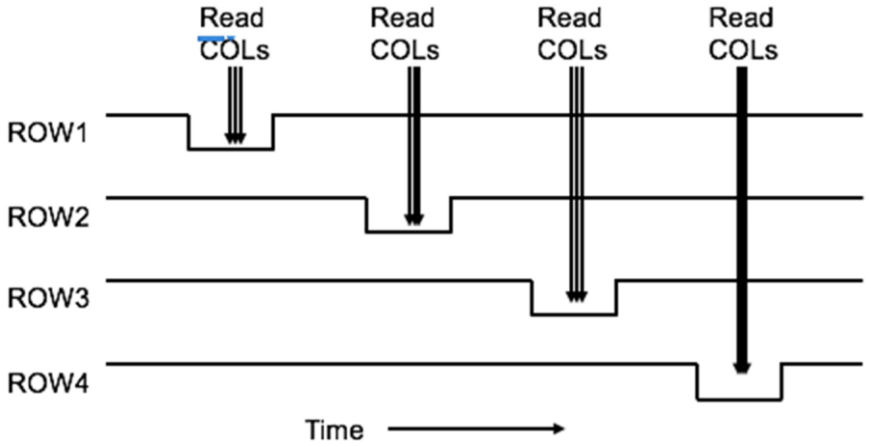

Figure 1 - Digital Output Timing Diagram for Keypad Rows

2. **Add C or C++ code to configure four GPIO pins as inputs with internal pullups. Read each of the four pins at the 5 ms point in the delay in step 1.**

3. **Connect the keypad matrix as shown in Figure 2.**

   Connect the rows in the diagram to the output bits you programmed in step 1.
   Connect the columns in the diagram to the input bits you programmed in step 2.
   By energizing rows in a sequence and reading what bit is low in the columns, you will know what key is pressed.

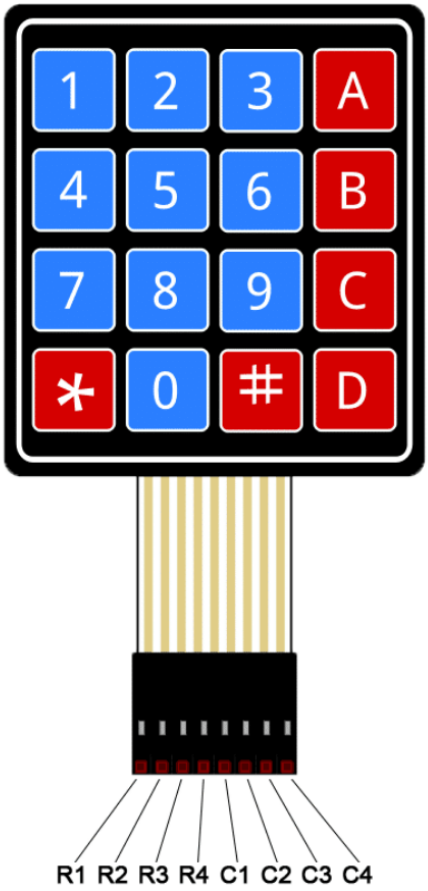

Figure 2 - Keypad Pinout Diagram

4. **If a key is pressed, the input will be low when there is a low on the ROW that key is on. Add to your current C code a code section to detect key presses and send the number or character you pressed to the terminal using a printf or cout statement.**

5. **Modify the program you created in steps 1 – 4 to detect a PIN number sequence of 2021# and turn LED1 on. Turn LED1 off when * is pressed.**

   You may find including the <string> library to be helpful. Specifically,

   a) You can add individual characters to a string using the += operator
   b) You can determine the length of a string object using the string.size() function.
   c) You can also compare two strings to determine if they are equal using the == operator.

Discussion

1) Refer to the webpage below and state the 4 input pin modes of a DigitalIn object? https://os.mbed.com/docs/mbed-os/v6.11/mbed-os-api-doxy/classmbed_1_1_digital_in.html#a12ffae4af877bdcd41ad2fc6a0a444ad

2) Describe the two methods for setting the value of a DigitalOut object.

3) Describe how the code is able to detect individual keys when in a 4x4 matrix.

Approved by:_____ Date:_____ Results due: _____