**COMSATS University**

**Islamabad**



**Lab Report # 03**

**Real Time Embedded Systems**

**(EEE-446)**

|  |
| --- |
| **Keypad Interfacing and ADC.** |

**Submitted By:**

**Arwa Aamir (FA16-EEE-002)**

**Submitted To:**

**Dr. Ahsen Malik**

**Lab # 03**

**Keypad Interfacing and ADC**

## Objectives

* Learn working principle to interface keypad with micro-controller.
* Understand Analog to Digital and Digital to Analog Converter.
* Simulate and hardware demo of above three modules.

**Softwares Used**

* Arduino IDE
* Proteus (Version 8.4)

## Pre Lab

Please read the theoretical background of the interfacing keypad and ADC input.

Reading a Keypad

You have a matrix keypad and want to read the key presses in your sketch.

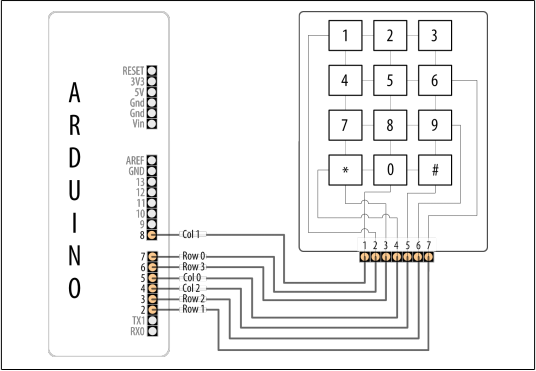


Figure 1: *Connecting the keyboard matrix*

**In Lab Task 1:**

**Interface numeric keypad with Arduino and display the value on Virtual Terminal.**

|  |  |
| --- | --- |
| **ARDUINO IDE CODE** | **PROTEUS SCHEMATIC** |
| const int ROWS = 4; //four rows  const int COLS = 3; //three columns  char keys[ROWS][COLS] = {  {'1','2','3'},  {'4','5','6'},  {'7','8','9'},  {'\*','0','#'}  };  byte rowPins[ROWS] = {5,6,7,8}; //connect to the row pinouts of the keypad  byte colPins[COLS] = {2,3,4}; //connect to the column pinouts of the keypad  void setup(){  Serial.begin(9600);  for (int i=0;i<4;i++)  {  pinMode(rowPins[i],OUTPUT);  digitalWrite(rowPins[i],HIGH);  }  for(int j=0; j<3;j++)  {  pinMode(colPins[j],INPUT\_PULLUP);  }  }  void loop(){  char key=key\_read();  if(key!='\n')  {  Serial.println(key);  delay(100);  }  }  char key\_read()  {  for (int i=0;i<4;i++)  {  for(int j=0;j<4;j++)  {  digitalWrite(rowPins[j],HIGH);  }  digitalWrite(rowPins[i],LOW);  for(int k=0;k<3;k++)  {  int flag1=digitalRead(colPins[k]);  if(flag1==LOW)  {  delay(50);  while(digitalRead(colPins[k])==LOW);  return keys[i][k];  }  }  }  return '\n';  } |  |

**In Lab Task 2 + Post Lab Task**

**Interface numeric keypad with Arduino and display the value on LCD.**

|  |  |
| --- | --- |
| **ARDUINO IDE CODE** | **PROTEUS SCHEMATIC** |
| #include <LiquidCrystal.h>  const int Rows = 2;  const int Cols = 16;  LiquidCrystal lcd(13,12,11,10,9,8);  const int ROWS = 3; //four rows  const int COLS = 3; //three columns  char keys[ROWS][COLS] = {  {'1','2','3'},  {'4','5','6'},  {'7','8','9'}  };  byte rowPins[ROWS] = {5,6,7}; //connect to the row pinouts of the keypad  byte colPins[COLS] = {2,3,4}; //connect to the column pinouts of the keypad  void setup(){    lcd.begin(Cols, Rows);  for (int i=0;i<3;i++)  {  pinMode(rowPins[i],OUTPUT);  digitalWrite(rowPins[i],HIGH);  }  for(int j=0; j<3;j++)  {  pinMode(colPins[j],INPUT\_PULLUP);    }    }  void loop(){    char key=key\_read();  if(key!='\n')  {  lcd.setCursor(1, 0);  lcd.print(key);  char thisChar = key-48;  lcd.setCursor(0, 1);  lcd.println(thisChar,BIN);  }  }  char key\_read()  {  for (int i=0;i<3;i++)  {  for(int j=0;j<3;j++)  {  digitalWrite(rowPins[j],HIGH);  }  digitalWrite(rowPins[i],LOW);  for(int k=0;k<3;k++)  {  int flag1=digitalRead(colPins[k]);  if(flag1==LOW)  {  delay(50);  while(digitalRead(colPins[k])==LOW);  return keys[i][k];  }  }    }  return '\n';  } |  |

**Post Lab Task 1:**

**Take two-digit decimal number from user using keypad and display this value subsequently on LCD, and display its equivalent binary value subsequently on next row of LCD.**

|  |  |
| --- | --- |
| **ARDUINO IDE CODE** | **PROTEUS SCHEMATIC** |
| #include <LiquidCrystal.h>  const int Rows = 2;  const int Cols = 16;  LiquidCrystal lcd(13,12,11,10,9,8);  const int ROWS = 3; //four rows  const int COLS = 3; //three columns  char keys[ROWS][COLS] = {  {'1','2','3'},  {'4','5','6'},  {'7','8','9'}  };  byte rowPins[ROWS] = {5,6,7}; //connect to the row pinouts of the keypad  byte colPins[COLS] = {2,3,4}; //connect to the column pinouts of the keypad  void setup(){    lcd.begin(Cols, Rows);  for (int i=0;i<3;i++)  {  pinMode(rowPins[i],OUTPUT);  digitalWrite(rowPins[i],HIGH);  }  for(int j=0; j<3;j++)  {  pinMode(colPins[j],INPUT\_PULLUP);    }    }  void loop(){    char key=key\_read();  if(key!='\n')  {  lcd.setCursor(1, 0);  lcd.print(key);  char thisChar = key-48;  lcd.setCursor(0, 1);  lcd.println(thisChar,BIN);  }  }  char key\_read()  {  for (int i=0;i<3;i++)  {  for(int j=0;j<3;j++)  {  digitalWrite(rowPins[j],HIGH);  }  digitalWrite(rowPins[i],LOW);  for(int k=0;k<3;k++)  {  int flag1=digitalRead(colPins[k]);  if(flag1==LOW)  {  delay(50);  while(digitalRead(colPins[k])==LOW);  return keys[i][k];  }  }    }  return '\n';  } |  |

**Critical Analysis/Conclusion:**

|  |
| --- |
| In this lab we scanned a keypad and displayed it’s results on Virtual Terminal and LCD.  We also displayed the binary equivalent of these keypad inserted numbers on LCD.  A numeric keypad is often used in calculators, ATM Machines, Vending Machined etc and are used to as user based input mediums.  We scanned this keypad by declaring rows as outputs and columns as inputs. Then we float a ‘1’ at each row one at a time.  As soon as a key from the keypad is pressed the column pin is grounded and we get the location of the pressed key and display it’s respective value on LCD or the Serial Monitor (whichever is readily available). |

