NANYANG POLYTECHNIC
EGR204 Microcontroller Applications

Laboratory Session 6

Course: Diploma in Robotics and Mechatronics

Module: EGR204 Microcontroller Applications

Experiment: 6

Title: A Simple Security System programming using the keypad and LED.

Objective:

- The students will learn how to write 'C' program for the 8051 microcontroller to design a simple security system using the 4x4 keypad as a pin number entry pad.

Learning Objectives:

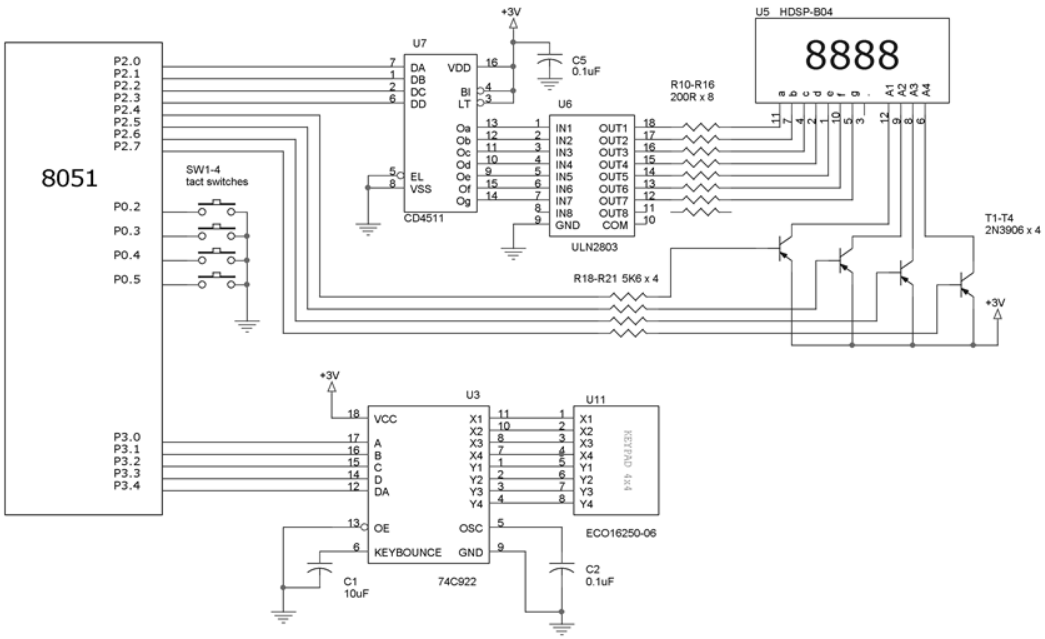
- Recall from lab 5 how to write 'C' program to read the 4x4 keypad.
- Learn how to use software algorithm to read a series of entry from the keypad.
- Apply knowledge of keypad and I/O programming to design a simple security system.

1. Introduction

Figure 1-1 shows how the 8051 is interfaced to a 4-digit 7-segment LED and a 4 x 4 keypad via a 74C922 keyboard encoder chip. The speaker is interfaced to the Port P0.5 of the 8051.

Figure 1-1

Multiplexing and Keypad Circuit



2.1 Exercise 1: Displaying Value Entered At Keypad

The program in listing 2-1 makes use of the keyscan( ) function to get the value of the key being pressed from the 4x4 keypad and display it on the 4-digit LED.

Listing 2-1

```
#include <f200.h>

void delay(unsigned long duration)
{
   wile((duration--)!=0);
}

void setSystem();

void mux_display(a,b,c,d)
unsigned char a,b,c,d;
{
   …….
}

void display(unsigned int number)
{
   …….
}

unsigned char keyscan(unsigned char *key)
{
   ……..
}


void main()
{
   unsigned char key;
   setSystem();

   for (;;)
   {
      if (keyscan(&key)!=0) display(key);
   }
}
```

2.2 Exercise 2: Displaying A Sequence of Key Entries.

In your exercise 1, the 4-digit display shows whatever was just pressed on the keypad. The previous number pressed disappears.

How do you write a program such that when you pressed "1" for example, the display will show "0001"? And when the second key pressed is "2", you will see "0012". If 4 keys, say "1", "2", "3" and "5" are pressed in sequence, you will see the display showing "1235".

Analyze and modify the program on listing 2-2 to accomplish exercise 2.

Listing 2-2

```
void main()
{
   unsigned char key,press=0;
   unsigned int number=0;
   setSystem();

   for (;;)
   {
      display(number);
      if ((keyscan(&key)!=0)&&(press<=4))
      {
         press++;
         number = (number * 10) + key;
         while (P34==1);
      }

      if (press >4)
      {
         number=0;
         press=0;
      }
   }
}
```

3.1 Assignment 1: Simple Security PIN Entry System

Design a simple security PIN number entry system with the 4x4 keypad and the 4-digit LED. The system should come with a display self-test.

The PIN is a 4 digit number coded in your software. As the user enters the PIN number, the number will be displayed on the 4-digit LED.

For example, when the user enters "1", the display shall show "0001". When the 2nd number the user enters is "2", for example, the display will show "0012", and so on for the 3rd and 4th numbers the user enters.

When the 4 digits are entered, the software shall compare it with the correct PIN number. If the entry is correct, the 8 LEDS connected to Port 0 will light up. If wrong, all the LEDs will remain off.

To reset the system after the 4 digits are entered, user has to press any key.

Listing 3-1

```
void main()
{
   unsigned char press,key;

   for (;;)
   {
      while (press<=4)
      {
         display(number);
         // This portion tries to capture
         //  the 4 digit the user enter.

         // Comparison.
         if (number == 1235)
         {
            // what do you want to do for
            // correct PIN?
         }
         else
         {
            // what do you want to do for
            // wrong PIN?
         }
      }
      //reset as 5th digit is entered
   }
}
```