**Introduction to Embedded System Design**

**Lab Report**

* Lab date： 2023-5-3 (year-month-day)
* Group number：
* Group members: (student ID) (name)

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1. **Lab Title:**

打地鼠

1. **Lab Goal:**

結合LED 、LCD 、七段顯示器和蜂鳴器，讓使用者玩打地鼠遊戲。

1. **Lab Description and Steps:**

1.首先當使用者按下reset，LCD會顯示出game cover 。

2.開始後，LCD會顯示出九宮格，在九宮格裡會隨機出現地鼠，LED燈會亮四顆，代表有四條命。

3.玩家可以藉由Keypad來打地鼠，例如地鼠出現在左上角，可以按下 1 ，如果有打到，蜂鳴器會響一聲。

4.每打到一次，蜂鳴器會響一聲，七段顯示器上的數字會加一，當玩家分數越高，地鼠出現的速度會越來越快，如果沒打到，LED燈會由右至左熄滅一顆，直到所有的LED燈熄滅即代表遊戲結束。

5.當遊戲結束後，LCD會顯示玩家的分數。

6.按下reset可以重新開始遊戲。

1. **Code:**

#include <stdio.h>

#include <stdlib.h>

#include "NUC100Series.h"

#include "MCU\_init.h"

#include "SYS\_init.h"

#include "LCD.h"

#include "Draw2D.h"

#include "Seven\_Segment.h"

#include "Scankey.h"

#define DELAY\_TIME 500000

unsigned char DrawBuffer[128\*8]; // display buffer

unsigned char bmp\_mouse[16] = {

0x00,0x70,0x18,0x7D,0x36,0x34,0x3C,0x3C,0x3C,0x3C,0x34,0x36,0x7D,0x18,0x70,0x00};

unsigned char cover[128\*8] = {

0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,

0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x80,0xC0,0x60,0x20,0x30,0x10,0x10,0x18,0x08,0x08,0x08,0x08,0x08,0x08,0x08,0x18,0x10,0x10,0x30,0x20,0x60,0xC0,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,

0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0xC0,0x70,0x1C,0x06,0x03,0x01,0x00,0x40,0x40,0xC0,0x80,0x80,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x80,0x80,0x80,0xC0,0x40,0x40,0x00,0x01,0x03,0x06,0x1C,0x70,0xC0,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,

0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0xF0,0x1F,0x01,0x00,0x00,0x00,0x00,0x00,0x00,0x08,0x08,0x08,0x38,0x28,0x38,0x00,0x00,0xC0,0x40,0xC0,0x00,0x00,0x38,0x28,0x38,0x08,0x08,0x08,0x00,0x00,0x00,0x00,0x00,0x00,0x01,0x1F,0xF0,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,

0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x3F,0x20,0x20,0x20,0x20,0x20,0x25,0x25,0x25,0x20,0x20,0x20,0x20,0x20,0x2C,0x26,0x3F,0x31,0x3F,0x31,0x3F,0x26,0x2C,0x20,0x20,0x20,0x20,0x20,0x25,0x25,0x25,0x20,0x20,0x20,0x20,0x20,0x3F,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x20,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,

0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x80,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,

0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x07,0x3C,0xC0,0xF0,0x0E,0x07,0x3C,0xC0,0xF0,0x0F,0x01,0x00,0xFF,0x04,0x04,0x0C,0xF8,0x00,0x60,0x94,0x94,0x94,0xF8,0x00,0x30,0x48,0x84,0x84,0x84,0x00,0x00,0xFF,0x30,0x48,0x84,0x84,0x00,0x10,0x10,0x10,0x00,0x60,0x94,0x94,0x94,0xF8,0x00,0x00,0x10,0x10,0x10,0x00,0x00,0xFC,0x04,0x04,0xFC,0x08,0x04,0x04,0xF8,0x00,0x30,0xCC,0x84,0x84,0x84,0x78,0x00,0x00,0xFF,0x00,0x70,0xDC,0x94,0x94,0x98,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,

0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00

};

void displayRound(uint16\_t round)

{

uint8\_t digit;

uint16\_t tmp=round;

digit = round / 1000;

CloseSevenSegment();

if(digit!=0) ShowSevenSegment(3,digit);

CLK\_SysTickDelay(5000);

round = round - digit \* 1000;

digit = round / 100;

CloseSevenSegment();

if(digit!=0) ShowSevenSegment(2,digit);

CLK\_SysTickDelay(5000);

round = round - digit \* 100;

digit = round / 10;

CloseSevenSegment();

if(digit!=0) ShowSevenSegment(1,digit);

CLK\_SysTickDelay(5000);

round = round - digit \* 10;

digit = round;

CloseSevenSegment();

if(digit!=0) ShowSevenSegment(0,digit);

CLK\_SysTickDelay(5000);

displayRound((tmp\*10)%10000);

}

void Display\_7seg(uint16\_t value)

{

uint8\_t digit;

digit = value / 1000;

CloseSevenSegment();

ShowSevenSegment(3,digit);

CLK\_SysTickDelay(1500);

value = value - digit \* 1000;

digit = value / 100;

CloseSevenSegment();

ShowSevenSegment(2,digit);

CLK\_SysTickDelay(1500);

value = value - digit \* 100;

digit = value / 10;

CloseSevenSegment();

ShowSevenSegment(1,digit);

CLK\_SysTickDelay(1500);

value = value - digit \* 10;

digit = value;

CloseSevenSegment();

ShowSevenSegment(0,digit);

CLK\_SysTickDelay(1500);

CloseSevenSegment();

}

void Display\_7(uint8\_t digit)

{

CloseSevenSegment();

ShowSevenSegment(0,digit);

}

void Buzz(int8\_t no)

{

while(no!=0) {

PB11=0;

CLK\_SysTickDelay(50000);

PB11=1;

CLK\_SysTickDelay(50000);

no--;

}

}

void Init\_Buzz(void)

{

GPIO\_SetMode(PB, BIT11, GPIO\_PMD\_OUTPUT);

PB11=1;

}

int main(void)

{

uint8\_t i,j, keyin, life;

int count;

long int delay = DELAY\_TIME;

char text[25];

SYS\_Init();

init\_LCD();

clear\_LCD();

OpenSevenSegment();

OpenKeyPad();

GPIO\_SetMode(PC, BIT12, GPIO\_MODE\_OUTPUT);

Init\_Buzz();

draw\_LCD(cover);

for (i=0;i<4;i++) CLK\_SysTickDelay(1000000);

clear\_LCD();

count=0, life=4;

while(1) {

i = rand() % 9 + 1;

if( count>0 &&(count/10>(count-1)/10)) delay = delay/2;

draw\_Line(24,20,101,20,FG\_COLOR, BG\_COLOR); // draw a line

draw\_Line(24,41,101,41,FG\_COLOR, BG\_COLOR); // draw a line

draw\_Line(50,0,50,63,FG\_COLOR, BG\_COLOR); // draw a line

draw\_Line(76,0,76,63,FG\_COLOR, BG\_COLOR); // draw a line

draw\_Line(24,0,101,0,FG\_COLOR, BG\_COLOR); // draw a line

draw\_Line(24,63,101,63,FG\_COLOR, BG\_COLOR); // draw a line

draw\_Line(24,0,24,63,FG\_COLOR, BG\_COLOR); // draw a line

draw\_Line(101,0,101,63,FG\_COLOR, BG\_COLOR); // draw a line

switch(i) {

case 1: draw\_Bmp16x8(30, 8,FG\_COLOR,BG\_COLOR, bmp\_mouse);

break;

case 2: draw\_Bmp16x8(56, 8,FG\_COLOR,BG\_COLOR, bmp\_mouse);

break;

case 3: draw\_Bmp16x8(82, 8,FG\_COLOR,BG\_COLOR, bmp\_mouse);

break;

case 4: draw\_Bmp16x8(30, 28,FG\_COLOR,BG\_COLOR, bmp\_mouse);

break;

case 5: draw\_Bmp16x8(56, 28,FG\_COLOR,BG\_COLOR, bmp\_mouse);

break;

case 6: draw\_Bmp16x8(82, 28,FG\_COLOR,BG\_COLOR, bmp\_mouse);

break;

case 7: draw\_Bmp16x8(30, 49,FG\_COLOR,BG\_COLOR, bmp\_mouse);

break;

case 8: draw\_Bmp16x8(56, 49,FG\_COLOR,BG\_COLOR, bmp\_mouse);

break;

case 9: draw\_Bmp16x8(82, 49,FG\_COLOR,BG\_COLOR, bmp\_mouse);

break;

default:break;

}

for(j=0;j<3;j++)

{

CLK\_SysTickDelay(delay);

keyin=ScanKey();

if(keyin==i)

{

count++;

Buzz(1);

break;

}

}

if(keyin!=i)

life--;

switch(life) {

case 1:

PC12 = 0;

PC13 = PC14 = PC15 = 1;

break;

case 2:

PC12 = PC13 = 0;

PC14 = PC15 = 1;

break;

case 3:

PC12 = PC13 = PC14 = 0;

PC15 = 1;

break;

case 4:

PC12 = PC13 = PC14 = PC15 = 0;

break;

default:

PC12 = PC13 = PC14 = PC15 = 1;

break;

}

if(life==0) break;

switch(i) {

case 1: draw\_Bmp16x8(30, 8,BG\_COLOR,FG\_COLOR, bmp\_mouse);

break;

case 2: draw\_Bmp16x8(56, 8,BG\_COLOR,FG\_COLOR, bmp\_mouse);

break;

case 3: draw\_Bmp16x8(82, 8,BG\_COLOR,FG\_COLOR, bmp\_mouse);

break;

case 4: draw\_Bmp16x8(30, 28,BG\_COLOR,FG\_COLOR, bmp\_mouse);

break;

case 5: draw\_Bmp16x8(56, 28,BG\_COLOR,FG\_COLOR, bmp\_mouse);

break;

case 6: draw\_Bmp16x8(82, 28,BG\_COLOR,FG\_COLOR, bmp\_mouse);

break;

case 7: draw\_Bmp16x8(30, 49,BG\_COLOR,FG\_COLOR, bmp\_mouse);

break;

case 8: draw\_Bmp16x8(56, 49,BG\_COLOR,FG\_COLOR, bmp\_mouse);

break;

case 9: draw\_Bmp16x8(82, 49,BG\_COLOR,FG\_COLOR, bmp\_mouse);

break;

default:break;

}

for(j = 0; j < 125; j++)

Display\_7seg(count);

}

PB11=1;

clear\_LCD();

sprintf(text,"FINAL SCORE: %3d",count);

printS(1, 30, text);

return 0;

}

1. **Lessons:**

我們原本是想做飛機大戰，但後來實作的過程中發現有點困難，會因為上方的分數條而影響飛機的移動，最後決定改做打地鼠，這次把開發板上我們有學過的都結合起來，顯得豐富且完整一點。