Experiment-7: Introduction to the LPC2378 Microcontroller

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Part 1: LEDs and switches

Task 1

Problem statement

Complete the following program to cause the LEDs on the ARM board to blink.

Code

```
#include "LPC23xx.h"
int main ()
{
    while(1)
    {
        FIO3DIR=0xFF;
        FIO3PIN=0x01;
        for(int i = 0;i < 0xFF;i++)
        {
            for(int j = 0;j < 0xFF;j++);
        }
        FIO3PIN=0x00;
        for(int i = 0;i < 0xFF;i++)
        {
            for(int j = 0;j < 0xFF;j++);
        }
    }
    return 0;
}
```

Output

Video of the LED blinking. The frequency depends on the delay created by the
'for' loop.

Task 2

Problem statement

In the previous task, we focused on the output of the LEDs. In this task, we will take input. In particular, read the settings of an 8-way DIP (Dual Inline Package) switch and display it on the LEDs. Use FIO4DIR AND FIO4PIN for data input.

Code

```
#include "LPC23xx.h"
int main ()
{
    FIO3DIR=0xFF;
    FIO4DIR=0x00;
    while(1)
    {
        int q;
        FIO3PIN=q;
        q=FIO4PIN;
    }
    return 0;
}
```

Output

Video of LED blinking according to the input from the dip switches

Task 3

Problem statement

Write a C program to read a DIP switch, split into two nibbles (4 bits), multiply them and display the product on the LEDs.

Code

```c
#include "LPC23xx.h"

int main()
{
    int a;
    int highByte;
    int lowByte;
    FIO3DIR = 0xFF:
    FIO4DIR = 0x00;
    while(1)
    {
        a = FIO4PIN;
        highByte = a & 0xF0;
        highByte = highByte >> 4;
        lowByte = a & 0x0F;
        FIO3PIN = highByte * lowByte;
    }
    return 0;
}
```
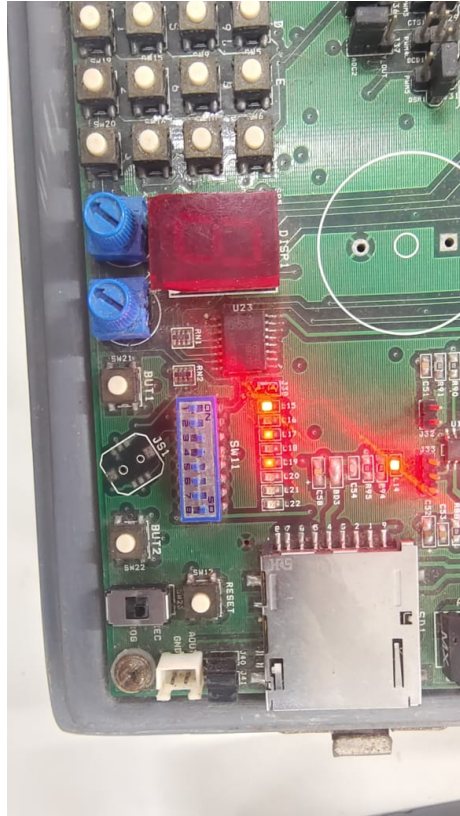
Output

Figure 1: Displaying the result of 1100*1110 in LEDs.

Part 2: Working with stepper motors

Task 1

Problem statement

The first task in this experiment involves completing the program given below
to make the motor rotate in a specific direction at a fixed speed.

Code

```
#include "LPC23xx.h"

void delay()
{
    int i, j;

    for(i = 0;i < 0x1A;i++)
        for(j = 0;j < 0x1A;j++);
}

int main()
{
    IODIR0 = 0xFFFFFFFF;

    while(1)
    {
        IOPIN0 = 0x00000280;
        delay();
        IOPIN0 = 0x00000240;
        delay();
        IOPIN0 = 0x00000140;
        delay();
        IOPIN0 = 0x00000180;
        delay();
    }
    return 0;
}
```

Output

Video of the stepper motor rotating at a constant speed in a single direction

Task 2

Problem statement

Modify the program given in Task 1 to cause rotation of the stepper motor in both clockwise and anti-clockwise directions. That is, the motor should make a few rotations in the clockwise direction, stop and then make a few rotations in the anti-clockwise direction.

Code

```
#include "LPC23xx.h"

void delay()
{
    int i, j;

    for(i = 0;i < 0x1F;i++)
        for(j = 0;j < 0x1F;j++);
}

void rotation()
{
    int m;
    for(m=0 ; m< 0xFF ; m++)
    {
        IOPIN0 = 0x00000280;
        delay();
        IOPIN0 = 0x00000240;
        delay();
        IOPIN0 = 0x00000140;
        delay();
        IOPIN0 = 0x00000180;
        delay();
    }

    delay();

    for(m=0 ; m< 0xFF ; m++)
    {
        IOPIN0 = 0x00000180;
        delay();
        IOPIN0 = 0x00000140;
        delay();
        IOPIN0 = 0x00000240;
        delay();
        IOPIN0 = 0x00000280;
```

```
        delay();
    }

    delay();
}

int main()
{
    IODIR0 = 0xFFFFFFFF;
    while(1)
    {
        rotation();
    }
    return 0;
}
```

Output

Video of a stepper motor making a few rotations each in both clockwise and anticlockwise directions.

Task 3

Problem statement

The program in Task 1 causes the motor to rotate at approximately 90 rpm. Write a program which will allow the motor to rotate at four different speeds. That is, it should rotate at (say) 30 rpm for one complete revolution, then at (say) 50 rpm for another revolution, then at 70 rpm and finally at 90 rpm for the last revolution.

Code

```
#include "LPC23xx.h"

void delay1()
{
    int i, j;
    for(i = 0;i < 0x14;i++)     for(j = 0;j < 0x14;j++);
}

void delay2()
{
    int i, j;
    for(i = 0;i < 0x16;i++)     for(j = 0;j < 0x16;j++);
}

void delay3()
{
    int i, j;
    for(i = 0;i < 0x20;i++)     for(j = 0;j < 0x20;j++);
}

void delay4()
{
    int i, j;
    for(i = 0;i < 0x25;i++)     for(j = 0;j < 0x25;j++);
}

void delaymax()
{
    int i, j;
    for(i = 0;i < 0xFF;i++)
        for(j = 0;j < 0xFF;j++);
}

void rotation()
{
```

```c
int m;
for(m=0 ; m< 0xFF ; m++)
{
    IOPIN0 = 0x00000280;
    delay1();
    IOPIN0 = 0x00000240;
    delay1();
    IOPIN0 = 0x00000140;
    delay1();
    IOPIN0 = 0x00000180;
    delay1();
}

delaymax();

for(m=0 ; m< 0xFF ; m++)
{
    IOPIN0 = 0x00000280;
    delay2();
    IOPIN0 = 0x00000240;
    delay2();
    IOPIN0 = 0x00000140;
    delay2();
    IOPIN0 = 0x00000180;
    delay2();
}

delaymax();

for(m=0 ; m< 0xFF ; m++)
{
    IOPIN0 = 0x00000280;
    delay3();
    IOPIN0 = 0x00000240;
    delay3();
    IOPIN0 = 0x00000140;
    delay3();
    IOPIN0 = 0x00000180;
    delay3();
}

delaymax();

for(m=0 ; m< 0xFF ; m++)
{
    IOPIN0 = 0x00000280;
```

```
        delay4();
        IOPIN0 = 0x00000240;
        delay4();
        IOPIN0 = 0x00000140;
        delay4();
        IOPIN0 = 0x00000180;
        delay4();
    }

    delaymax();

}

int main()
{
    IODIR0 = 0xFFFFFFFF;
    while(1)
    {
        rotation();
    }

    return 0;
}
```

Output

Video of a stepper motor rotating at four different speeds in the same direction.