

Experiment 4: ARM C-Interfacing – Emulation of Switch LED and Stepper Motor Control

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Brief outline of the target in the experiment:

Using C-interfacing, use C-programming, to implement the following tasks:

- Learn the architecture of ARM processor.
- Learn basics of ARM instruction set, in particular the ARM instructions pertaining to computations.
- Write assembly language programs for the given set of (computational) problems.

Questions

1. Write a program (in C) to dis-assemble a byte into two nibbles from the DIPswitch states, multiply and display the product in the LED.

a. Code

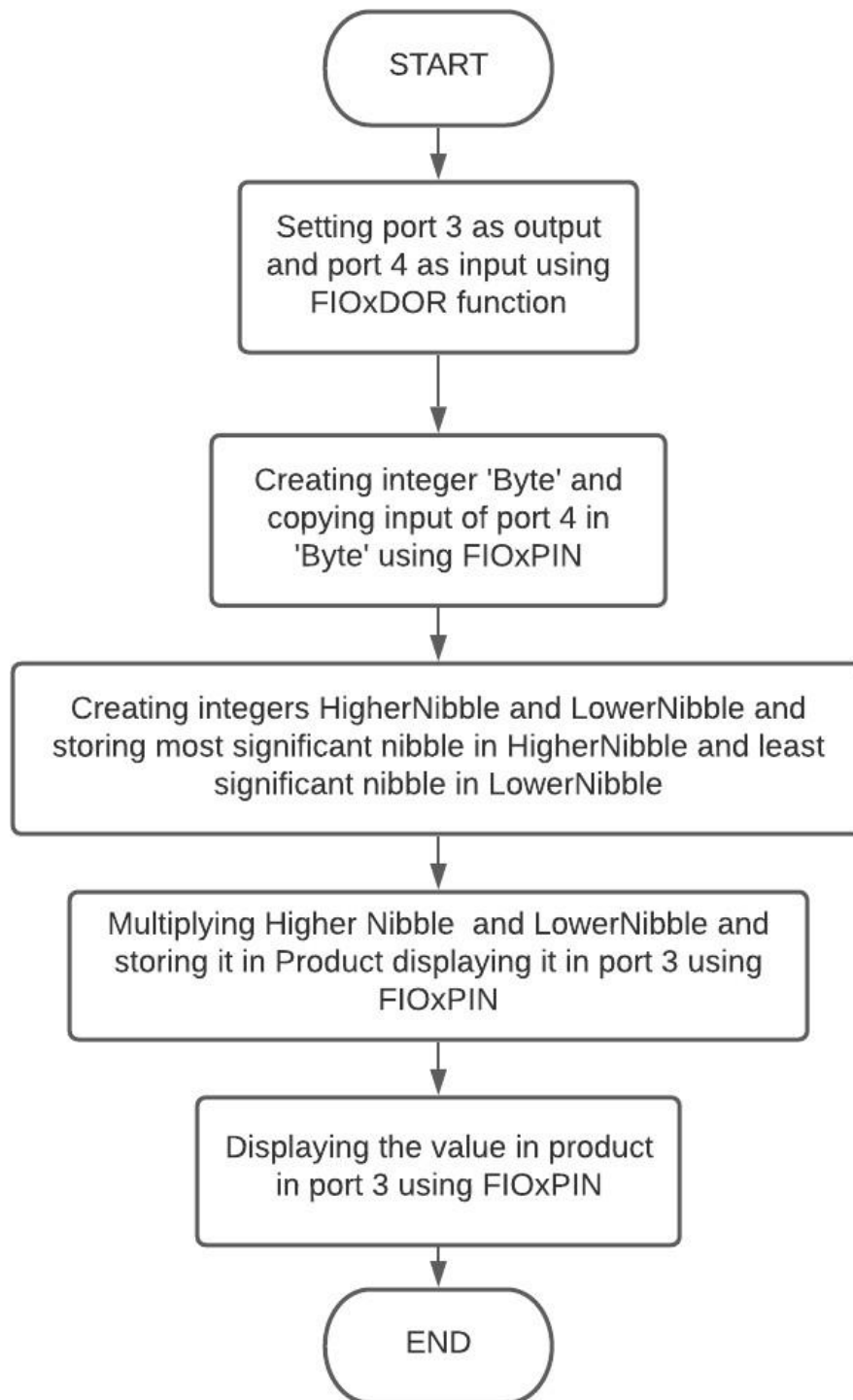
```
#include "LPC23xx.h"
int main ()
{

    int Byte, HigherNibble, LowerNibble, Product;

    FIO3DIR = 0xFF; // making pin 3 as an output port
    FIO4DIR = 0x00; // making pin 4 as an input port

    While (1)
    {
        Byte = FIO4PIN; // copying input of pin 4 to Byte
        LowerNibble = Byte & 0x0F; // Storing the least significant nibble of Byte in
        LowerNibble
        HigherNibble = Byte & 0xF0; // Storing the most significant nibble of Byte in
        HigherNibble
        HigherNibble = HigherNibble >> 4; // Shifting the HigherNibble by 4 bits right
        Product = HigherNibble * LowerNibble; // Storing the product of
        HigherNibble and LowerNibble in Product
        FIO3PIN = Product; // Displaying the value in Product through Port 3
    }
    return 0;
}
```

b. Flow Chart



2. Modify the demo code (StpprMtrCntrl.c) supplied to demonstrate the control of stepper motor to rotate in opposite direction.

a. Code

```
/* ARM C program to run Stepper Motor */
#include "LPC23xx.h"

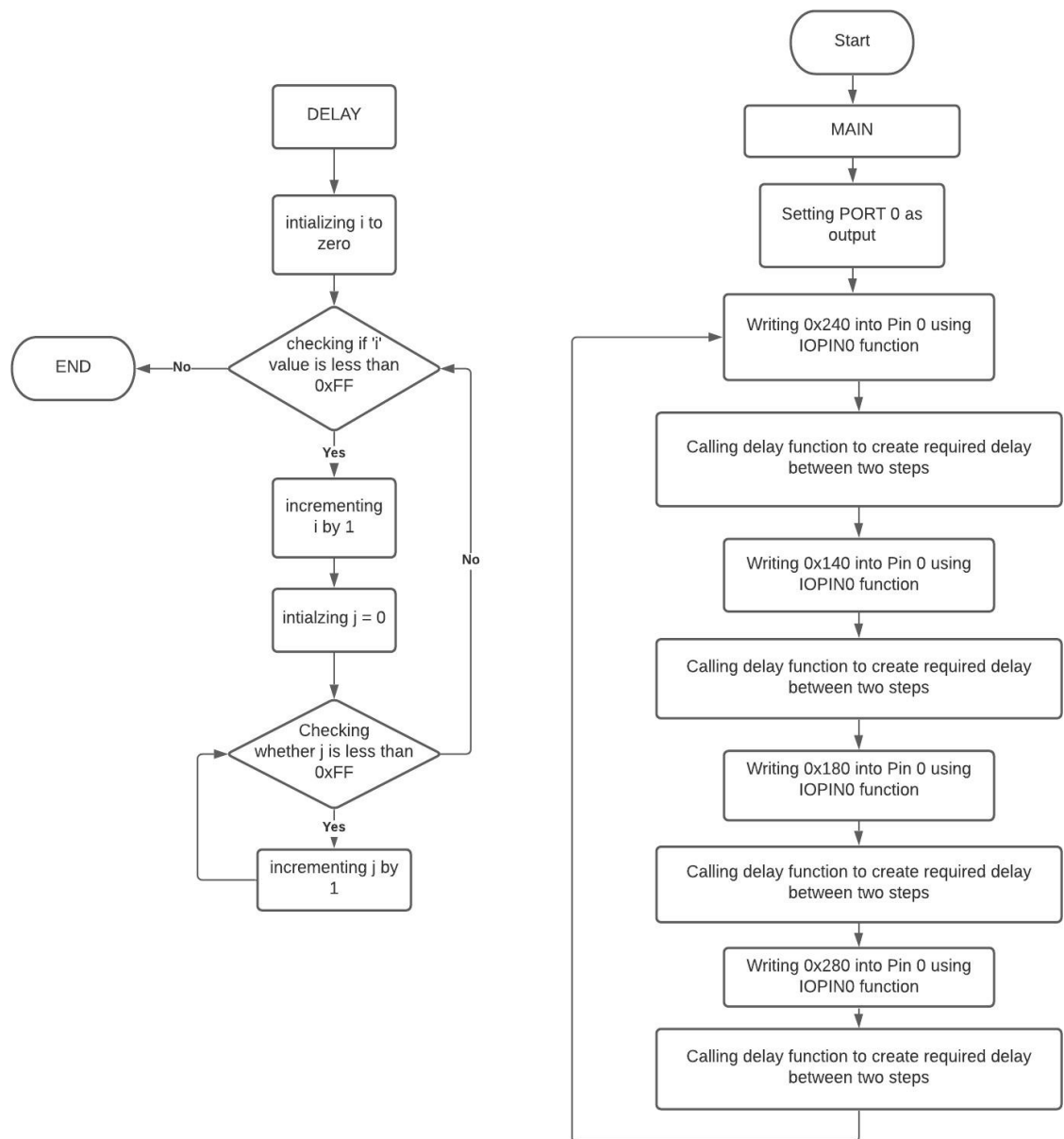
void delay (void)
{
    int i, j;
    for (i=0; i<0xff; i++)
        for (j=0; j<0xFF; j++);
}

int main (void)
{
    IODIR0 = 0xFFFFFFFF; // making port 0 as output port
    while(1)              // To rotate stepper motor in anti-clock wise direction
    {
        IOPIN0=0X00000240;
        delay();
        IOPIN0=0X00000140;
        delay();
        IOPIN0=0X00000180;
        delay();
        IOPIN0=0X00000280;
        delay();
    }
    return 0;
}
```

Explanation for the IOPINO values:

The stepper motor is connected to the 6,7,8,9 pins of the ARM kit . So to make the stepper motor rotate in a particular direction, the currents' in the windings should be given in a particular direction. To control the current flow switches Q1,Q2,Q3,Q4 are used . For example, in one of the alienations Q1,Q2,Q3,Q4 must be 1,0,0,1 respectively . So the value that should be given to IOPINO is 001001000000 which in hexadecimal form is written as 0x240. Similarly when Q1,Q2,Q3,Q4 values are (1,0,1,0) ,(0,1,1,0), (0,1,0,1) the hexadecimal values given to IOPINO are 0x280,0x180,0x140 respectively.

b. Flow Chart



3. Modify the given demo code supplied to demonstrate the control of the stepper motor 80 degrees and stop, assuming the step angle as 2 degrees (motor rotates 2 degrees /step)

a. Code

```
/* ARM C program to run Stepper Motor */
#include "LPC23xx.h"

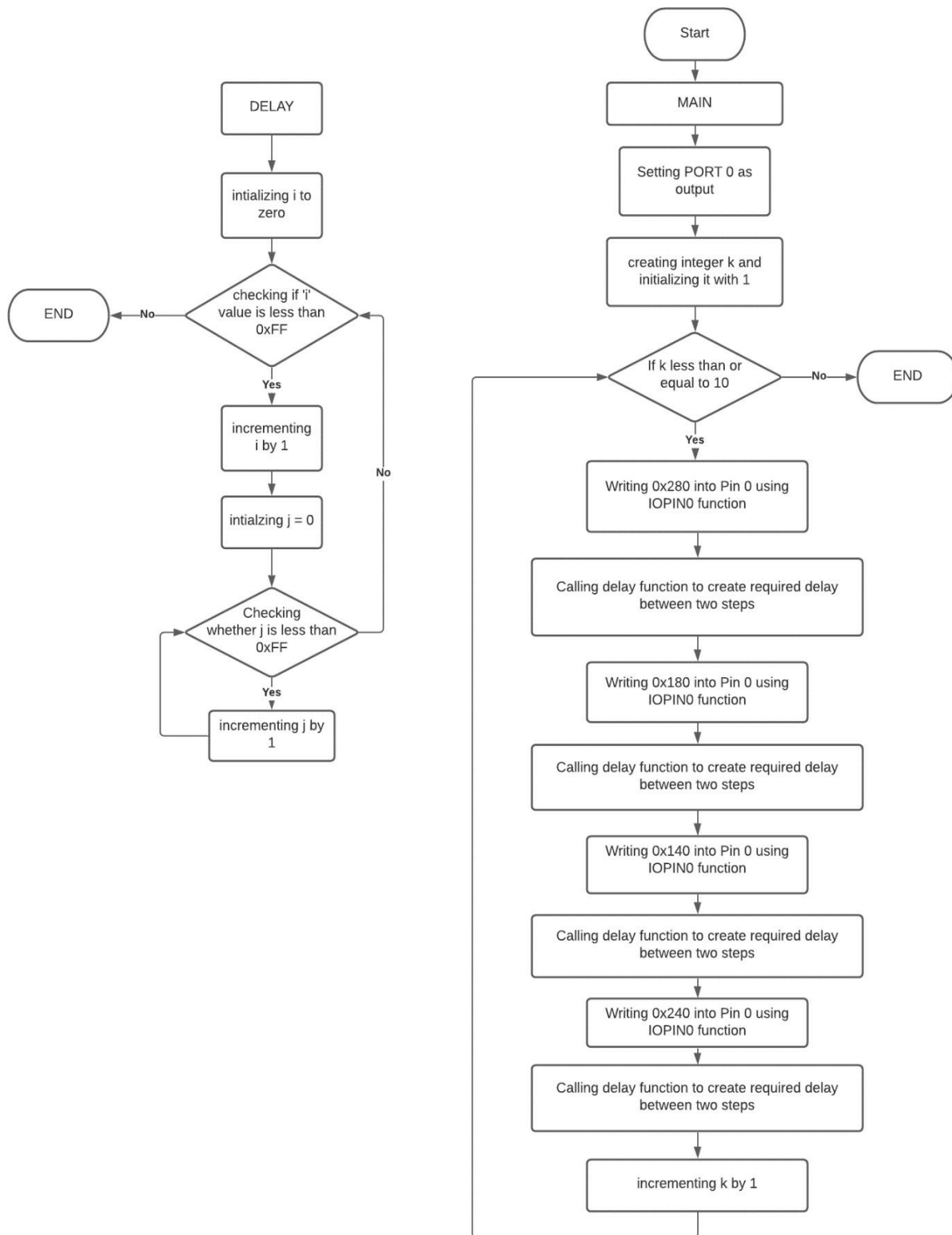
void delay(void)
{
    int i, j;
    for (i=0; i<0xff; i++)
        for (j=0; j<0xFF; j++);
}

int main(void)
{
    IODIR0 = 0xFFFFFFFF; // making port 0 as output port
    int k=1;              // initialize the counter by 1
    while(k<=10) // each step rotates by 2 degrees
                    // each cycle turns 4*2 = 8 degrees
                    // total loops that should be created are 80/8 = 10 loops
    {

        IOPIN0=0X000000280;
        delay();
        IOPIN0=0X000000180;
        delay(); // creating delay between 2 steps
        IOPIN0=0X000000140;
        delay();
        IOPIN0=0X000000240;
        delay();
        k++; // increments k by 1

    }
    return 0;
}
```

b. Flow Chart



Inferences :

- I learnt the features of ViARM-2378 development board and C-interfacing
- I learnt about stepper motor and controlling it by connecting to ViARM-2378 development board.
- I have learnt how to use FIO x PIN function to get or send the data using ports.
- I have also learnt about how to set ports as output or input using the functions like FIO x DIR.