Compute (Classify) Input GPIO Signal Frequency

HW1: write C code to toggle a GPIO pin as fast as possible.

HW2: write C code to sample a GPIO pin and then compute the input GPIO signal frequency based on sample values.

Given: Input frequency range from 1Hz to 50MHz.

Goal: Do your best to cover as wide frequency range as possible.

Hints: Need handle differently for low frequency and high frequency.

With a limited memory resource, how do you sample input GPIOs? How fast do you sample?

High Frequency: try sample as fast as possible.

Low Frequency: added sleep between samples.

How much sleep you need? How do you adjust sleep values between two GPIO reads

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*REPORT\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

1. Sandeep and VK worked together on this HW. We both spent around 20 hours on this report.
2. We created a code to toggle GPIO port0pin7 and loaded it on 1 board
3. We created another code to sense this toggling through another Mbed board.
4. We played with the buffer size and the toggling frequency.
5. With the sensing code we ran, the best we could sense a signal was in 40Machine Cycles or 400ns. We tried toggling delays from 400ns, 1us, 10us, and for all the delays we saw the counts of consecutive lows or highs was around 25. Here the buffer size didn’t matter.
6. If the delay was too much then also by the time the sensing was done, the signal was either
7. All the output was printed to the serial terminal.

**GPIO Toggling Code**:

#include "mbed.h"

int main()

{

uint32\_t volatile \*FIO0DIR0 = (uint32\_t \*)0x2009C000;

uint32\_t volatile \*FIO0SET0 = (uint32\_t \*)0x2009C018;

uint32\_t volatile \*FIO0CLR0 = (uint32\_t \*)0x2009C01C;

uint32\_t volatile \*FIO0MASK0= (uint32\_t \*)0x2009C010;

\*FIO0MASK0 = 0x7F; //Pin 7 port 0

\*FIO0DIR0 = 0x80; //Pin 7 port 0

\*FIO0CLR0 = 0x80; //Pin 7 port 0

while(1){

\*FIO0SET0=0x080;

wait\_ms (0.01); //10us delay

\*FIO0CLR0=0x080;

wait\_ms (0.01); //10us delay

//return 0;

}

}

**GPIO Sensing Code:**

#include "mbed.h"

Serial pc(USBTX, USBRX); // tx, rx

int main()

{

uint32\_t volatile \*FIO0DIR1\_VK =(uint32\_t \*)0x2009C001;

uint32\_t volatile \*FIO0SET1\_VK =(uint32\_t \*)0x2009C019;

uint32\_t volatile \*FIO0CLR1\_VK =(uint32\_t \*)0x2009C01D;

uint32\_t volatile \*FIO0MASK1\_VK =(uint32\_t \*)0x2009C011;

uint8\_t volatile \*FIO0PIN1\_VK = (uint8\_t \*) 0x2009C015;

\*FIO0MASK1\_VK =0xFE; //Masking Port0 GPIO8 or DIP6

\*FIO0DIR1\_VK =0x00; //Set Port0 GPIO8 or DIP6 as Input

int size=8192;

uint8\_t volatile sense\_pin[8192] ={}; //Creating an array to hold the sensed values

int i=0;

pc.printf("\r\n\*\*\*\*\*\*\*\*Start of GPIO Sensing \*\*\*\*\*\*\*\*\*\r\n");

for (i = 0; i < size;i=i+8 ) //

{

sense\_pin[i]=\*FIO0PIN1\_VK; //Reading the Pin Status and storing in array

sense\_pin[i+1]=\*FIO0PIN1\_VK; //Reading the Pin Status and storing in array

sense\_pin[i+2]=\*FIO0PIN1\_VK; //Reading the Pin Status and storing in array

sense\_pin[i+3]=\*FIO0PIN1\_VK; //Reading the Pin Status and storing in array

sense\_pin[i+4]=\*FIO0PIN1\_VK; //Reading the Pin Status and storing in array

sense\_pin[i+5]=\*FIO0PIN1\_VK; //Reading the Pin Status and storing in array

sense\_pin[i+6]=\*FIO0PIN1\_VK; //Reading the Pin Status and storing in array

sense\_pin[i+7]=\*FIO0PIN1\_VK; //Reading the Pin Status and storing in array

//sense\_pin[i+8]=\*FIO0PIN1\_VK; //Reading the Pin Status and storing in array

//sense\_pin[i+10]=\*FIO0PIN1\_VK; //Reading the Pin Status and storing in array

//sense\_pin[i+11]=\*FIO0PIN1\_VK; //Reading the Pin Status and storing in array

}

//Printing of all elements of array

pc.printf("\r\n\*\*\*\*\*\*\*\*End of GPIO Sensing \*\*\*\*\*\*\*\*\*\r\n");

pc.printf("\r\n\*\*\*\*\*\*\*\*DUMP THE ARRAY \*\*\*\*\*\*\*\*\*\r\n");

// dump array

int j=0;

for (j = 0; j < size; j++) {

//if (j%15==0 or j%31==0 or j%47==0)

//{

//pc.printf("%d\t",sense\_pin[j]);

//}

if (j%63==0)

{

pc.printf("%2d\r\n",sense\_pin[j]); //formatting array display for 64 elements in each line

}

else

{

pc.printf("%2d",sense\_pin[j]);

}

}

//count zeros and ones

int counter=1;

for (j = 0; j < size; j++) {

if (sense\_pin[j]==sense\_pin[j+1])

{

counter=counter+1;

}

else

{

pc.printf("Count of %2d --->%6d\r\n",sense\_pin[j],counter); //formatting array display for 64 elements in each line

counter=1;

}

}

pc.printf("\r\nend of code\n");

}

\*\*\*\*\*\*\*\*\*\*sample serial port output\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

\*\*\*\*\*\*\*\*Start of GPIO Sensing \*\*\*\*\*\*\*\*\*

\*\*\*\*\*\*\*\*End of GPIO Sensing \*\*\*\*\*\*\*\*\*

\*\*\*\*\*\*\*\*DUMP THE ARRAY \*\*\*\*\*\*\*\*\*

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end of code

**Frequency Calculation:**

**Avg count of lows or highs = 25**

**Total MC: 25\*40 ( each sensing takes around 40) = 1000 Machine Cycles or 10uS.**

**The GPIO toggling was set at 10uS delay.**