**B31DG-EMBEDDED SOFTWARE**

**ASSIGNMENT- 1.**

**GITHUB REPOSITORY:** [**GautamiAlagarsamy/desktop-tutorial: GitHub Desktop tutorial repository**](https://github.com/GautamiAlagarsamy/desktop-tutorial)

**TASK-1**

This program generates two waveform signals, **Signal A** and **Signal B**.

The waveform consists of repeated cycles, and **signal** **B** should be 50 microseconds.

There are two switch inputs to generate the signals, **Switch1** and **Switch2**, and four parameters, **a**, **b**, **c**, and **d**.

* If **Switch1** is 0, it enables the stream of pulses.
* If **Switch1** is 1, it disables the stream of pulses.
* Similarly, if **Switch2** is 0, the program runs in normal mode,
* If **Switch2** is 1, it runs with a new waveform cycle.

The new waveform cycle parameters are defined as follows:

* **a** is the width of the first pulse, the 2nd pulse is **a + 50 microseconds**, the 3rd pulse is **a + 100 microseconds**, and so on.
* **b** is the width of the space between pulses (all spaces are the same).
* **c** is the number of pulses in a block.
* **d** is the space between pulse blocks.

**TASK 2**

* Write a C++ program for the following question.
* Each student will have a set of (a, b, c, d, and mode) parameters. Calculate your set of parameters using the following information.  
    
  The alphabet is numbered -  
  a=1, b=2, c=3, ... m=13  
  n=13, o=12, p=11, ... z=1
* Using the first 5 letters of your surname (repeat the last letter if less than 5) the parameters are  
  calculated as follows :  
    
  Parameter Example (James Herd)  
  a = first letter \* 100μS a = h \* 100μS = 8 \* 100μS = 800μS  
  b = second letter \* 100μS b = e \* 100μS = 5 \* 100μS = 500μS  
  c = third letter + 4 c = r + 4 = 9 + 4 = 13  
  d = fourth letter \* 500μS d = d \* 500μS = 4 \* 500μS = 2.0mS  
  mode = remainder (fifth letter/4) +1 mode = rem(d / 4) +1 = rem(4 / 4) +1 =1  
    
  Therefore ‘James Herd’ would be given the parameter set 800μS, 500μS, 13, 2.0mS and mode  
  1. The “rem” function is the integer division REMAINDER function, i.e. the remainder when  
  the numerator is divided by the denominator. E.g. rem (10/3) = 1.

**PYTHON CODE-ESP32-C3 DEVKIT**

int sw1 = 4; // declaring pin 4 as switch 1

int sw2 = 6; // declaring pin 6 as switch 2

int sigA = 1;// declaring pin 1 as signal A or LED 1

int sigB = 3;// declaring pin 3 as signal B or LED 2

int rsw1 = 0;// declaring a variable to read from switch 1 initially set as LOW

int rsw2 = 0;// declaring a variable to read from switch 2 initially set as LOW

int a = 100;// parameter 'a' calculated as first letter\*100 = 1\*100 = 100

int r = 1600;// parameter used in mode '2' where we reverse the signal, hence highest value is a+(c-1)\*b = 1600

int b = 1200;// parameter 'b' calculated as second letter\*100 = 12\*100 = 1200

int c = 5; // parameter 'c' calculated as third letter+4 = 1+4=5

int d = 3500;// parameter 'd' calculated as fourth letter\*500 = 7\*500 = 3500

// mode is calculated as rem(fifth letter/4) + 1 = rem(1/4) + 1 = 2. Hence we use mode 2

void setup() {

// put your setup code here, to run once:

pinMode(sw1, INPUT); // setting sw1 pin(switch 1) as INPUT

pinMode(sw2, INPUT); // setting sw2 pin(switch 2) as INPUT

pinMode(sigA, OUTPUT);// setting sigA pin(LED 1/signal A) as OUTPUT

pinMode(sigB, OUTPUT);// setting sigB pin(LED 2/signal B) as OUTPUT

}

void loop() {

// put your main code here, to run repeatedly:

rsw1 = digitalRead(sw1); // reading from sw1 and storing it in rsw1

rsw2 = digitalRead(sw2); // reading from sw2 and storing it in rsw2

if(rsw1 == HIGH) // using if else to initialize the input for switches

{

digitalWrite(sigA, LOW);

digitalWrite(sigB, LOW);

}

else{

if(rsw2 == LOW)// Switch2 is 0, the program runs in normal mode

{

digitalWrite(sigB, HIGH);

delay(50); // set delay 50us

digitalWrite(sigB, LOW);

for(int i =0;i<c;i++)

{

digitalWrite(sigA, HIGH);

delay(a);

digitalWrite(sigA, LOW);

delay(b);

a = a+50;

}

digitalWrite(sigA, LOW);

delay(d);

}

else

{

digitalWrite(sigB, HIGH);

delay(50);

digitalWrite(sigB, LOW);

for(int i =0; i<c;i++){

digitalWrite(sigA, HIGH);

delay(r);

digitalWrite(sigA, LOW);

delay(b);

r = r-50;

}

digitalWrite(sigA, LOW);

delay(d);

}

}

}

**OUTPUT**

**Diagram

Description automatically generated with medium confidence**

**A picture containing text, indoor, electronics, computer

Description automatically generated**

**OUTPUT DISCUSSION:**

The connections are given in the breadboard with a push button switch to pin 4 and push button 2 to pin 6 of the ESP32 C3 board. The LED1 and LED2 connections are given to Pin 1 and Pin3 respectively. The supply and ground connections are given as per the circuit diagram. The Port and boards are selected, and the program is dumped into the ESP32 C3 board. The program is compiled and debugged to get the output signal.

The push buttons are pressed to generate the stream of pulses on both LEDs as per commands.

The new waveform cycle parameters are defined as follows: a is the width of the first pulse, the 2nd pulse is a + 50 microseconds, the 3rd pulse is a + 100 microseconds, and so on. b is the width of the space between pulses (all spaces are the same). c is the number of pulses in a block, and d is the space between pulse blocks.

To calculate the parameters and mode as per task 2 the following formulae are used.

**FIRST NAME: GAUTAMI**

**LAST NAME: ALAGARSAMY**

**Parameters calculation : A=1,L=12,A=1,G=7 and A=1.**

1. Parameter 'a' calculated as first letter\*100 = 1\*100 = 100=>**a = 100**
2. Parameter used in mode '2' where we reverse the signal, hence highest value is a+(c-1) \*b = 1600=>**r = 1600**
3. Parameter 'b' calculated as second letter\*100 = 12\*100 = 1200 => **b = 1200**
4. Parameter 'c' calculated as third letter+4 = 1+4=5=> **c = 5**
5. Parameter 'd' calculated as fourth letter\*500 = 7\*500 = 3500=> **d = 3500**
6. Mode is calculated as rem(fifth letter/4) + 1 = rem(1/4) + 1 = 2. Hence, we use **mode 2.**

**C++ PROGRAM**

The program has 4 possible system modes:

1. If the mode is 1, and **Switch2** is 0, the normal waveform is generated. If **Switch2** is 1, 3 pulses are removed from the pulse block (i.e. **c - 3** pulses in the block) until **Switch2** is set back to 0.
2. If the mode is 2, and **Switch2** is 0, the normal waveform is generated. If **Switch2** is 1, the inverted form of the complete **SignalA** waveform is generated (from the largest pulse to the shortest) until **Switch2** is set back to 0.
3. If the mode is 3, and **Switch2** is 0, the normal waveform is generated. If **Switch2** is 1, an extra 3 pulses are inserted into the pulse block (i.e. **c + 3** pulses in the block) until **Switch2** is set back to 0.
4. If the mode is 4, and **Switch2** is 0, the normal waveform is generated. If **Switch2** is 1, **d** and **b** times are halved until **Switch2** is set back to 0.

#include <iostream>

using namespace std;

//initialize the input parameters, modes, and switches.

void generateWaveform(int switch1, int switch2, int a, int b, int c, int d, int mode) {

//use the switch statement to get values for switches and modes for generating waveform.

//if switch1=0 the stream of pulses is enabled. The waveform is generated.

if (switch1 == 0) {

cout << "Stream of pulses enabled." << endl;

} else {

//if switch1=0 the stream of pulses is disabled.

cout << "Stream of pulses disabled." << endl;

}

//if switch2=0 the same waveform is generated.

if (switch2 == 0) {

cout << "Running in normal mode." << endl;

} else {

//if switch2=0 the new waveform is generated.

cout << "Running in new waveform cycle mode." << endl;

//use switch case statement for generating pulses of Signal A and B waveform

switch (mode) {

case 1:

if (switch2 == 1) {

c = c - 3;

cout << "3 pulses removed from the pulse block." << endl;

}

break;

case 2:

if (switch2 == 1) {

cout << "Generating inverted form of complete Signal A waveform." << endl;

}

break;

case 3:

if (switch2 == 1) {

c = c + 3;

cout << "3 pulses inserted into the pulse block." << endl;

}

break;

case 4:

if (switch2 == 1) {

b = b / 2;

d = d / 2;

cout << "Time for b and d halved." << endl;

}

break;

default:

cout << "Invalid mode. Running in normal mode." << endl;

break;

}

}

}

int main() {

//initialize the switch inputs and parameters

int switch1, switch2, a, b, c, d, mode;

//call the input switch values to print the output modes

cout << "Enter the value of switch1 (0/1): ";

cin >> switch1;

cout << "Enter the value of switch2 (0/1): ";

cin >> switch2;

cout << "Enter the value of a: ";

cin >> a;

cout << "Enter the value of b: ";

cin >> b;

cout << "Enter the value of c: ";

cin >> c;

cout << "Enter the value of d: ";

cin >> d;

cout << "Enter the value of mode (1/2/3/4): ";

cin >> mode;

generateWaveform (switch1, switch2, a, b, c, d, mode);

return 0;

}

#include <iostream>

#include <string>

using namespace std;

//initialize the alphabet in ascending order from a to m

int number\_of\_alphabet(char alphabet) {

if (alphabet >= 'a' && alphabet <= 'm') {

return alphabet - 'a' + 1;

//initialize the alphabet in descending order from n to z

} else if (alphabet >= 'n' && alphabet <= 'z') {

return 13 - (alphabet - 'n');

} else if (alphabet >= 'A' && alphabet <= 'M') {

return alphabet - 'A' + 1;

} else {

return 13 - (alphabet - 'N');

}

}

int rem(int num, int den) {

return num % den;

}

int main() {

//get the first and last name inputs from the console

string first\_name, last\_name;

cout << "Enter your first name: ";

cin >> first\_name;

cout << "Enter your last name: ";

cin >> last\_name;

//calculate the parameter values from the first 5 values of the last name

int length = last\_name.length();

if (length < 5) {

last\_name += last\_name.substr(0, 5-length);

}

int a = number\_of\_alphabet(last\_name[0]) \* 100;

int b = number\_of\_alphabet(last\_name[1]) \* 100;

int c = number\_of\_alphabet(last\_name[2]) + 4;

int d = number\_of\_alphabet(last\_name[3]) \* 500;

int mode = rem((last\_name[4] <= 'Z' ? last\_name[4] - 'A' + 1 : last\_name[4] - 'a' + 1), 4) + 1;

//Print the parameters and modes for waveform

cout << "The parameter set for the name " << " is " << a << " μS, " << b << " μS, " << c << ", " << d << " μS, and mode " << mode << "." << endl;

return 0;

}

OUTPUT -RESULT

Shape

Description automatically generatedText

Description automatically generated

**Explanation:**

This program generates two waveform signals, **SignalA** and **SignalB**.

The waveform consists of repeated cycles, and **SignalB** should be 50 microseconds.

There are two switch inputs to generate the signals, **Switch1** and **Switch2**, and four parameters, **a**, **b**, **c**, and **d**.

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The new waveform cycle parameters are defined as follows: **a** is the width of the first pulse, the 2nd pulse is **a + 50 microseconds**, the 3rd pulse is **a + 100 microseconds**, and so on. **b** is the width of the space between pulses (all spaces are the same). **c** is the number of pulses in a block, and **d** is the space between pulse blocks.

This is a C++ program that takes the user's first and last name as input, calculates a set of parameters for the name and outputs it to the console.

The program uses the function "number\_of\_alphabet" to calculate the position of an alphabet in the English alphabet (from 1 to 26) and maps it to a number.

The program then concatenates the first 5 characters of the last name and calculates the values of the parameters a, b, c, d and mode by using the first 5 characters of the last name as input. The value of a and b are calculated as the position of the first and second characters of the last name multiplied by 100. The value of c is calculated as the position of the third character of the last name plus 4. The value of d is calculated as the position of the fourth character of the last name multiplied by 500. The value of mode is calculated as the remainder of the position of the fifth character of the last name divided by 4 plus 1.

Finally, the program outputs the values of the parameters to the console.

**FIRST NAME: GAUTAMI**

**LAST NAME: ALAGARSAMY**

**Parameters calculation : A=1,L=12,A=1,G=7 and A=1.**

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2. Parameter 'b' calculated as second letter\*100 = 12\*100 = 1200 => **b = 1200**
3. Parameter 'c' calculated as third letter+4 = 1+4=5=> **c = 5**
4. Parameter 'd' calculated as fourth letter\*500 = 7\*500 = 3500=> **d = 3500**
5. Mode is calculated as rem(fifth letter/4) + 1 = rem(1/4) + 1 = 2. Hence, we use **mode 2.**