Computer Technology I

Lab. 6 : CyberTech Wall Display

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Area: Computer Science
Course code: 1DT301

Contents

1 Task 1

```
1  /*>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
2  ; 1DT301, Computer Technology I
3  ; Date: 2016-09-15
4  ; Author:
5  ;    Anas Kwefati
6  ;
7  ; Lab number: 6
8  ; Title: CyberTech Wall Display
9  ;
10 ; Hardware: STK600, CPU ATmega2560
11 ;
12 ; Function: Program that writes a character on the CyberTech Display.
13 ;
14 ; Input ports: none
15 ;
16 ; Output ports: CyberTech Display.
17 ;
18 ; Subroutines:
19 ; Included files: <avr/io.h>
20 ;
21 ;Other information: Display is connected to the serial port (RS232) on
       the STK600.
22 ; Communication speed is 2400bps.
23 ;Changes in program: (Description and date)
24 <<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<*/
25
26 #include <avr/io.h>
27 #include <stdio.h>
28 #include <string.h>
29 //#include <util/delay.h>
30 #define FCPU 1000000// Clock Speed
31 #define BAUD 2400 //Communication Speed Display rate 2400
32 #define MYUBBRR (FCPU/16/BAUD-1) //UBBRR = 25 -> osc = 1MHz and UBRR =
      47 -> osc = 1,843200MHz
33
34 void uart_int(void);
35 void toPutty(unsigned char data);
36
37 int main(void)
38 {
39     uart_int();
40
41     char* txt = "\rAO0001Hi How are you ? :)";
42     int checksum =0;
43     //We make sure that everything is in it
44     for(int i =0; i<strlen(txt);i++){
45         checksum += txt[i];
46     }
47
48     checksum\%=256;
49
50     char toDisplay [strlen(txt)+3];
51     sprintf(toDisplay, "\%s\%02X\n", txt, checksum); //\%02x means
     print at least 2 digits, prepends it with 0's if there's less.
52     //\%02x is used to convert one character to a hexadecimal string
53
54     for (int i = 0; i<strlen(txt)+3;i++){
```

```
55          toPutty(toDisplay[i]);
56      }
57
58      txt = "\rZD0013C\n";
59      for(int i = 0; i<strlen(txt);i++){
60          toPutty(txt[i]);
61      }
62
63      return 0;
64  }
65
66  //INITALIZATION OF THE DISPLAY
67
68  void toPutty(unsigned char data){
69      //WAIT FOR DATA TO BE RECEIVED
70      while(!(UCSR1A & (1<<UDRE1)));
71      UDR1 = data;
72  }
73
74  void uart_int(void) {
75      UBRR1L = MYUBBRR; //25 because we are setting the board at 1MHz
76      /*Enable receiver and transmitter*/
77      UCSR1B = (1<<RXEN1|1<<TXEN1); // Receive Enable (RXEN) bit //
          Transmit Enable (TXEN) bit
78  }
```
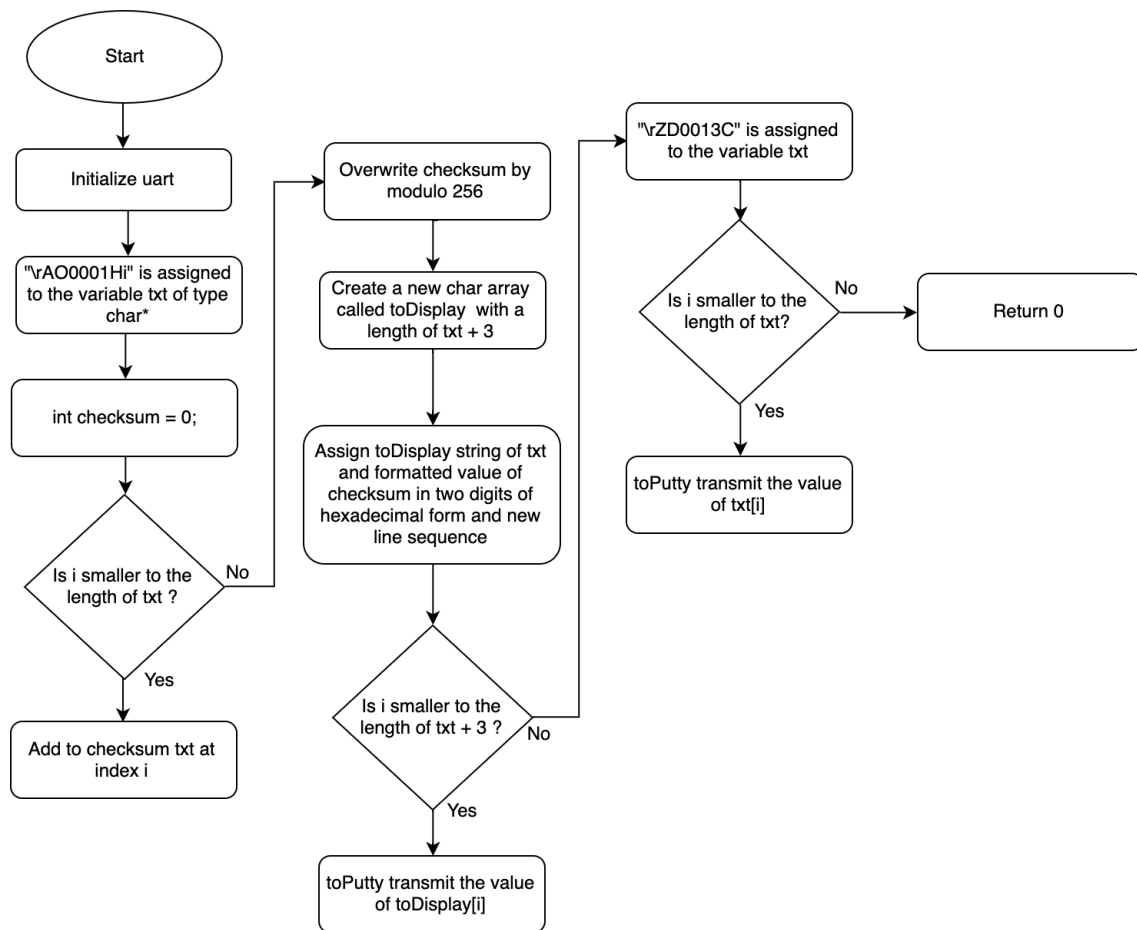
Figure 1: Task 1 flowchart

2 Task 2

```
1  /*>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
2  ; 1DT301, Computer Technology I
3  ; Date: 2016-09-15
4  ; Author:
5  ;    Anas Kwefati
6  ;
7  ; Lab number: 6
8  ; Title: CyberTech Wall Display
9  ;
10 ; Hardware: STK600, CPU ATmega2560
11 ;
12 ; Function: Program that writes characters on all text lines on the
       CyberTech Display.
13 ; The program will write to all 3 rows.
14 ;
15 ; Input ports: none
16 ;
17 ; Output ports: CyberTech Display.
18 ;
19 ; Subroutines:
20 ; Included files: <avr/io.h>
21 ;
22 ;Other information: Display is connected to the serial port (RS232) on
       the STK600.
```

3

```
23   ; Communication speed is 2400bps.
24   ;Changes in program: (Description and date)
25   <<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<*/
26
27   #include <avr/io.h>
28   #include <stdio.h>
29   #include <string.h>
30   //#include <util/delay.h>
31   #define FCPU 1000000// Clock Speed
32   #define BAUD 2400 //Communication Speed Display rate 2400
33   #define MYUBBRR (FCPU/16/BAUD-1) //UBBRR = 25 -> osc = 1MHz and UBRR =
        47 -> osc = 1,843200MHz
34
35   void uart_int(void);
36   void toPutty(unsigned char data);
37   void toDisplayOnLCD(char* stringChar);
38
39   int main(void)
40   {
41     uart_int();
42
43     char* txt = "\rAO0001First Line            Second Line";
44
45     toDisplayOnLCD(txt);
46
47
48
49     txt = "\rBO0001Third Line";
50     toDisplayOnLCD(txt);
51
52     txt = "\rZD0013C\n";
53     toDisplayOnLCD(txt);
54
55     return 0;
56   }
57
58
59   //METHOD TO DISPLAY ON THE SCREEN
60   void toDisplayOnLCD(char* stringChar){
61
62     int checksum = 0;
63       //We make sure that everything is in it
64       for(int i =0; i<strlen(stringChar);i++){
65         checksum += stringChar[i];
66       }
67
68     checksum\%=256;
69
70     char toDisplay [strlen(stringChar)+3];
71     sprintf(toDisplay, "\%s\%02X\n", stringChar, checksum); //\%02x
         means print at least 2 digits, prepends it with 0's if there's less
         .
72     //\%02x is used to convert one character to a hexadecimal string
73
74     for (int i = 0; i<strlen(stringChar)+3;i++){
75       toPutty(toDisplay[i]);
76     }
77   }
78
```

4

```c
// INITIALIZATION OF THE DISPLAY

void toPutty(unsigned char data){
  //WAIT FOR DATA TO BE RECEIVED
  while (!(UCSR1A & (1<<UDRE1)));
  UDR1 = data;
}

void uart_int(void) {
  UBRR1L = MYUBBRR; //25 because we are setting the board at 1MHz
  /*Enable receiver and transmitter*/
  UCSR1B = (1<<RXEN1|1<<TXEN1); // Receive Enable (RXEN) bit //
    Transmit Enable (TXEN) bit
}
```

Start

Initialize uart

"\rAO0001First Line
　　　Second Line" is
assigned to the variable txt
of type char*

toDisplayOnLCD(txt)

"\rBO0001Third Line" is
assigned to the variable txt

toDisplayOnLCD(txt)

"\rZD0013C" is assigned to
the variable txt

toDisplayOnLCD(txt)

Return 0

void toDisplayOnLCD(char*stringChar)

int checksum = 0;

Is i smaller to the length
of stringChar ? — No

Yes

Add to checksum
stringChar at index i

Overwrite checksum by
modulo 256

Create a new char array
called toDisplay with a
length of stringChar + 3

Assign toDisplay string of
stringChar and formatted
value of checksum in two
digits of hexadecimal form and
new line sequence

Is i smaller to the length
of stringChar + 3 ? — No — Done

Yes

toPutty transmit the value
of toDisplay[i]

Figure 2: Task 2 flowchart

3 Task 3

```
1  /*>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
2  ; 1DT301, Computer Technology I
3  ; Date: 2016-09-15
4  ; Author:
5  ;    Anas Kwefati
6  ;
7  ; Lab number: 6
8  ; Title: CyberTech Wall Display
9  ;
10 ; Hardware: STK600, CPU ATmega2560
11 ;
12 ; Function: Program that changes text strings on the display.
13 ;
14 ; Input ports: none
15 ;
16 ; Output ports: CyberTech Display.
17 ;
18 ; Subroutines:
19 ; Included files: <avr/io.h> and <util/delay.h>
```

```
20  ;
21  ;Other information: Display is connected to the serial port (RS232) on
       the STK600.
22  ; Communication speed is 2400bps.
23  ;Changes in program: (Description and date)
24  <<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<*/
25  #include <avr/io.h>
26  #include <stdio.h>
27  #include <string.h>
28  #include <stdlib.h>
29
30  #define F_CPU 1000000// Clock Speed
31  #include <util/delay.h>
32  #define BAUD 2400 //Communication Speed Display rate 2400
33  #define MYUBBRR (F_CPU/16/BAUD-1) //UBBRR = 25 -> osc = 1MHz and UBRR =
       47 -> osc = 1,843200MHz
34
35  void uart_int(void);
36  void toPutty(unsigned char data);
37  void toDisplayOnLCD(char* stringChar);
38
39  int main(void)
40  {
41    uart_int();
42
43
44    char* data = "abc";
45    char *txt = "\rAO0001";
46
47    for(int i =0;i<strlen(data);i++){
48      //The idea is to take char by char and add it one by one to str2
49      char c = data[i];
50      size_t len = strlen(txt); //take the length of txt
51      char *str2 = malloc(len + 1 + 1); //give a length of len and
      allocate a bit more memory with malloc in case
52      strcpy(str2, txt); // copy txt to str2
53      str2[len] = c;  //create an array of str2 with a length of len for
      the char c
54      str2[len + 1] = '\0'; // we add 1 to len and add the end char \0
55      toDisplayOnLCD(str2); //call display
56      free(str2); //free str2 deallocate the space used by malloc()
57
58      str2 = "\rZD0013C";
59      toDisplayOnLCD(str2);
60      _delay_ms(5000); //wait 5s
61    }
62
63
64    return 0;
65  }
66
67
68
69  //METHOD TO DISPLAY ON THE SCREEN
70  void toDisplayOnLCD(char* stringChar){
71
72    int checksum = 0;
73      //We make sure that everything is in it
74      for(int i =0; i<strlen(stringChar);i++){
```

```
75        checksum += stringChar[i];
76    }
77
78    checksum\%=256;
79
80    char toDisplay [strlen(stringChar)+3];
81    sprintf(toDisplay, "\%s\%02X\n", stringChar, checksum); //\%02x
        means print at least 2 digits, prepends it with 0's if there's less
        .
82    //\%02x is used to convert one character to a hexadecimal string
83
84    for (int i = 0; i<strlen(stringChar)+3;i++){
85        toPutty(toDisplay[i]);
86    }
87 }
88
89 //INITIALIZATION OF THE DISPLAY
90
91 void toPutty(unsigned char data){
92    //WAIT FOR DATA TO BE RECEIVED
93    while (!(UCSR1A & (1<<UDRE1)));
94    UDR1 = data;
95 }
96
97 void uart_int(void) {
98    UBRR1L = MYUBBRR; //25 because we are setting the board at 1MHz
99    /*Enable receiver and transmitter*/
100   UCSR1B = (1<<RXEN1|1<<TXEN1); // Receive Enable (RXEN) bit //
        Transmit Enable (TXEN) bit
101 }
```

8

Figure 3: Task 3 flowchart

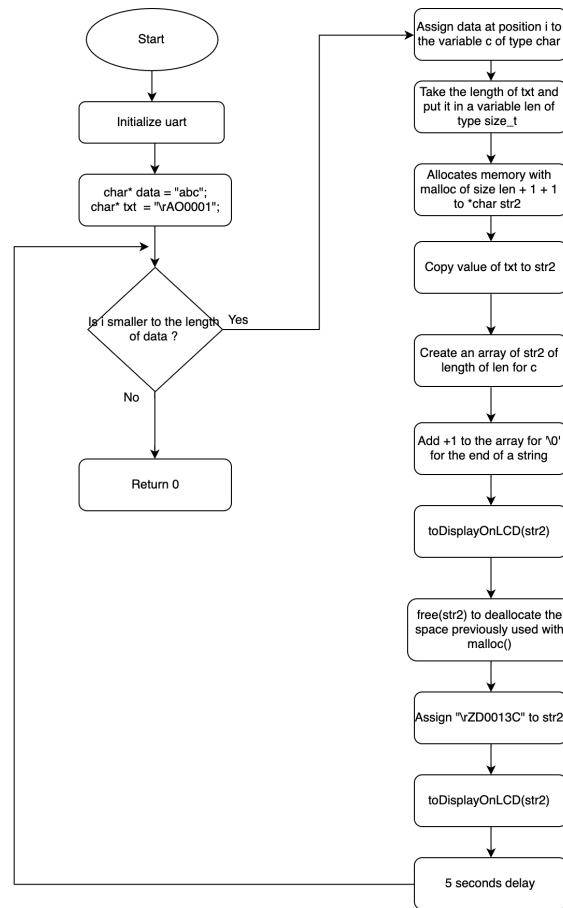# 4 Task 4

Figure 4: Task 4 flowchart

5 Task 5

Figure 5: Task 5 flowchart