DAWSON COLLEGE – Electronics Engineering Technology Department

Winter 2012

Embedded Systems Programming (243-41-DW)

Embedded Project

Minute Timer

Submitted by: Matthew Masi

Student Number: 1036987

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OBJECTIVES

1. Implement C programing language in hardware.
2. Design a decimal down counter with a stop, start and reset function.
3. Implement transistors to as switches to multiplex.

EQUIPMENT & COMPONENTS

- AVR Studio 4
- AVRISP MKII
- ATMEGA8A
- Breadboard
- Resistor Pack
- Dip Switch
- 7 Segment Display
- RESISTOR SIP
- Computer
- Wires
- Alligator Clips
- 2N2222N BJT
- 100Ω resistor

CIRCUIT DIAGRAMS & FIGURES

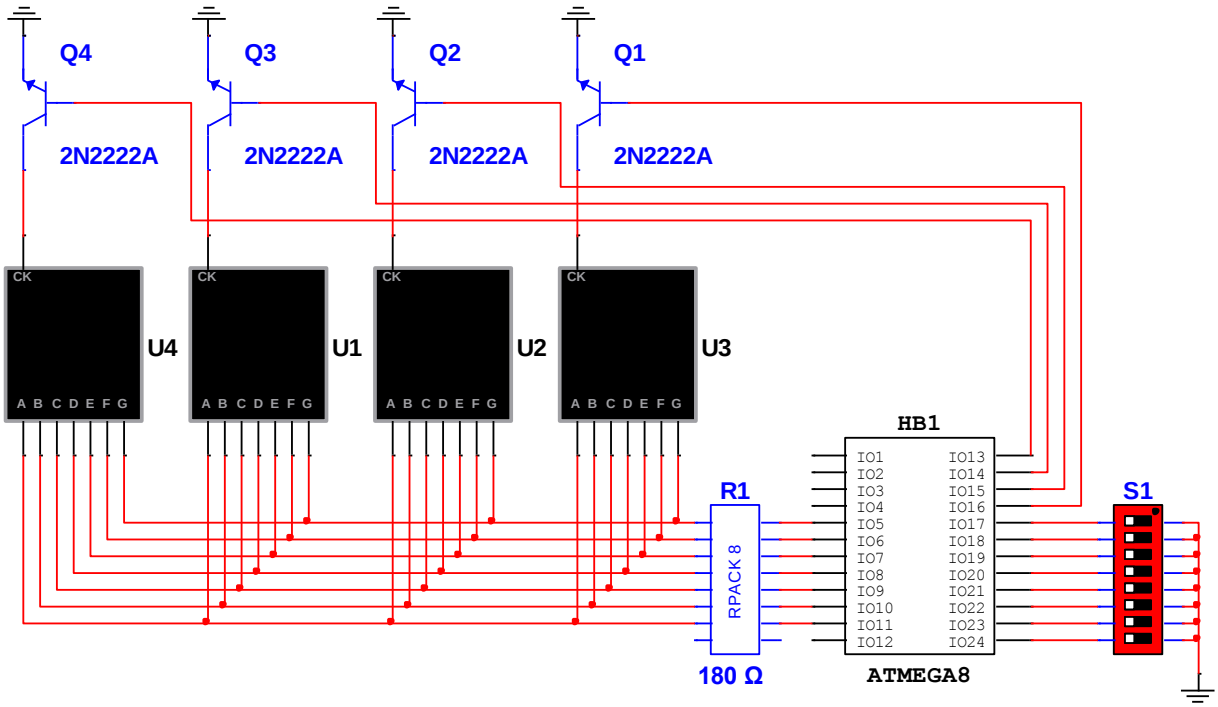

Figure 1: Timer circuit using the ATMRGA8A

MEASUREMENT & RESULTS

Switch (LSB)				Value
0	0	0	0	0
1	0	0	0	1
0	1	0	0	2
1	1	0	0	3
0	0	1	0	4
1	0	1	0	5
0	1	1	0	6
1	1	1	0	7
0	0	0	1	8
1	0	0	1	9

Table 1: Lower 4 switch display

Switch (MSB)				Function
1	0	0	0	LED 1
1	1	0	0	LED 2
1	1	1	0	LED 3
1	1	1	1	LED 4
0	0	0	1	start
0	0	1	1	stop
0	1	1	1	reset

Table 2: Upper 4 switch functions

CODE

```
#include <avr/io.h>
#include <avr/interrupt.h>
#include <util/delay.h>
#define F_CPU 16000000UL

int main(void)
{
	int a, b, c, d, i, j, x = 0, set =0, sel= 0, u;
	int num[10] = {125, 96, 62, 122, 99, 91, 95, 112, 127, 123};
	int buff1 =0, buff2 =0, buff3 =0, buff4 =0;

      DDRB = 0x00;
      DDRC = 0xFF;
      DDRD = 0xFF;

      set = PINB & 0x0f;
      sel = PINB & 0xf0;

while(1)
{
      while(sel != 0x80)
      {
      for(u =0; u<2; u++)
      {
            set = PINB & 0x0f;
            sel = PINB & 0xf0;

            PORTC = 1;
            if(sel== 0x10)
            {
                  PORTD = num[set];
                  buff1 = set;
            }
```

```
        _delay_ms(1);
        PORTD = num[buff2];
        PORTC = 2;
        if(sel== 0x30)
        {
              PORTD = num[set];
              buff2 = set;
        }
        _delay_ms(1);
        PORTD = num[buff3];
        PORTC = 4;
        if(sel== 0x70)
        {
              PORTD = num[set];
              buff3 = set;
        }
        _delay_ms(1);
        PORTD = num[buff4];
        PORTC = 8;
        if(sel== 0xF0)
        {
              PORTD = num[set];
              buff4 = set;
        }
        _delay_ms(1);
        PORTD = num[buff1];
}
}

        for(a=buff4; a>=0; a--)
              {
              sel = PINB & 0xf0;
              if(sel== 0xC0)
                    a++;
                    if(sel == 0xE0)
                          break;
                    for(b=buff3; b>=0; b--)
                    {
                    sel = PINB & 0xf0;
                    if(sel== 0xC0)
                          b++;
                          if(sel == 0xE0)
                                break;
                          for(c=buff2; c>=0; c--)
                          {
                          sel = PINB & 0xf0;
                          if(sel== 0xC0)
                                c++;
                                if(sel == 0xE0)
```

```
                                    break;
                              for(d=buff1; d>=0; d--)
                              {
                              sel = PINB & 0xf0;
                              if(sel== 0xC0)
                                    d++;
                                    if(sel == 0xE0)
                                          break;
                                    for(i =0; i<249; i++)
                                    {
                                    sel = PINB & 0xf0;
                                    if(sel== 0xC0)
                                          i++;
                                          if(sel == 0xE0)
                                                break;
                                    PORTC = 1;
                                    PORTD = num[d];
                                    _delay_ms(1);

                                    PORTC = 2;
                                    PORTD = num[c];
                                    _delay_ms(1);

                                    PORTC = 4;
                                    PORTD = num[b];
                                    _delay_ms(1);

                                    PORTC = 8;
                                    PORTD = num[a];
                                    _delay_ms(1);
                                          buff1 = 9;
                                          buff2 = 5;
                                          buff3 = 9;
                                          buff4 = 5;
                                    }
                              }

                        }
                  }
            }
            buff1 = 0;
            buff2 = 0;
            buff3 = 0;
            buff4 = 0;
      }

}
```

CONCLUSION

A decimal counter was designed and implemented on the ATMEGA8A chip using C programming language. Many hardware components were used together with the programing such as the transistors. The transistor collector was connected to the seven segment ground pin and the emitter was connected to ground. Output C was programmed to send a pulse to the base of the transistor when it had to display the value. With the fast internal speed reading the code, multiplexing was achieved with some code.