Individual Report Project 2

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For my portion of the main project I programmed mode 2. Mode 2 included all the keyboard function as well as the additional functions that I added for my individual feature. The keyboard's main function is to play the notes G through F. To accomplish this I used switches 1-3, 5, and 7-9. This forms a 'Z' shape on the board. To add in my individual feature I used the last two switches 4 and 6. These switches can be pushed in addition to and other switch to modify the note that is played. Switch 4 would would play the sharp version of the note selected, if the sharp exists, and Switch 6 would play the same note but an octave higher. Both switch 4 and 6 can also be pressed at the same time to play the sharp version an octave higher.

Below is all the code for one of the 7 possible notes (figure 1). This is the first switch which plays a G note as long as switch 1 is pushed and neither of the modifier switches 4 and 6 are pushed. But if either of the two modifier switches are active it will result in a different note being played. The rest of the code can be seen below in figure 3.

```
if((~PINA & 0x01) && !(~PINA & 0x08) && !(~PINA & 0x10)) //normal
                {
                        USART_TxString("G, ");
                        while((~PINA & 0x01) && !(~PINA & 0x08) && !(~PINA & 0x10)){
                                NoteG(); //G note
                        }
                }
                if((~PINA & 0x01) && (~PINA & 0x08) && !(~PINA & 0x10)) //sharp
                {
                        USART_TxString("G#, ");
                        while((~PINA & 0x01) && (~PINA & 0x08) && !(~PINA & 0x10)){
                                NoteGSharp();//G# note
                        }
                }
                if((~PINA & 0x01) && !(~PINA & 0x08) && (~PINA & 0x10)) //octave
                {
                        USART_TxString("HG, ");
                        while((~PINA & 0x01) && !(~PINA & 0x08) && (~PINA & 0x10)){
                                NoteHighG();//High G note
                        }
                 }
                if((~PINA & 0x01) && (~PINA & 0x08) && (~PINA & 0x10)) //sharp octave
                {
                        USART_TxString("HG#, ");
                        while((~PINA & 0x01) && (~PINA & 0x08) && (~PINA & 0x10)){
                                NoteHighGSharp();//High G# note
                        }
                }
```

Figure 1: Code for One Note

As for the ATmega324pb I made use of all the bits in PORTA for the switches and used all the bits of PORTD for the LEDs, except for PORTD3 which had to be set to input mode in order to receive transmission through serial communication so another LED had to be used in its place. I also made use of the PORTE bits 4-5 for LEDs, switches, and for the buzzer. For the buzzer to properly play notes the built in timer was used. I also programmed seven additional notes that Tim had not already made for his songs(figure 2).

```
void NoteGSharp()
{
        LEDG();
        LEDA();
        NoteTimer(-19);
        LEDG();
        LEDA();
}

void NoteHighASharp()
{
        LEDA();
        LEDB();
        NoteTimer(-17);
        LEDA();
        LEDB();
}

void NoteHighCSharp()
{
        LEDC();
        LEDD();
        NoteTimer(-14);
        LEDC();
        LEDD();
}
```

```
void NoteHighDSharp()
{
        LEDD();
        LEDE();
        NoteTimer(-13);
        LEDD();
        LEDE();
}
void NoteHighE()
{
        LEDE();
        NoteTimer(-12);
        LEDE();
}

void NoteHighF()
{
        LEDF();
        LEDG();
        NoteTimer(-11);
        LEDF();
        LEDG();
}

void NoteHighFSharp()
{
        LEDF();
        LEDG();
        NoteTimer(-10);
        LEDF();
        LEDG();
}
```

Figure 2: Additional Notes

```
// If mode is keyboard mode, play specific note for switch
        if(mode == 1)
        {
                if((~PINA & 0x01) && !(~PINA & 0x08) && !(~PINA & 0x10)) //normal
                {
                        USART_TxString("G, ");
                        while((~PINA & 0x01) && !(~PINA & 0x08) && !(~PINA & 0x10))
                        {
                                NoteG(); //G note
                        }
                }
                if((~PINA & 0x01) && (~PINA & 0x08) && !(~PINA & 0x10)) //sharp
                {
                        USART_TxString("G#, ");
                        while((~PINA & 0x01) && (~PINA & 0x08) && !(~PINA & 0x10))
                        {
                                NoteGSharp();//G# note
                        }
                }
                if((~PINA & 0x01) && !(~PINA & 0x08) && (~PINA & 0x10)) //octave
                {
                        USART_TxString("HG, ");
                        while((~PINA & 0x01) && !(~PINA & 0x08) && (~PINA & 0x10))
                        {
                                NoteHighG();//High G note
                        }
                        }
                if((~PINA & 0x01) && (~PINA & 0x08) && (~PINA & 0x10)) //sharp octave
                {
                        USART_TxString("HG#, ");
                        while((~PINA & 0x01) && (~PINA & 0x08) && (~PINA & 0x10))
                        {
                                NoteHighGSharp();//High G# note
                        }
                }
                if((~PINA & 0x02) && !(~PINA & 0x08) && !(~PINA & 0x10)) //normal
                {
                        USART_TxString("A, ");
                        while((~PINA & 0x02) && !(~PINA & 0x08) && !(~PINA & 0x10))
                        {
                                NoteA();//A note
                        }
                }
                if((~PINA & 0x02) && (~PINA & 0x08) && !(~PINA & 0x10)) //sharp
                {
                        USART_TxString("A#, ");
                        while((~PINA & 0x02) && (~PINA & 0x08) && !(~PINA & 0x10))
                        {
                                NoteASharp();//A# note
                }
            }
            if((~PINA & 0x02) && !(~PINA & 0x08) && (~PINA & 0x10)) //octave
            {
                USART_TxString("HA, ");
                while((~PINA & 0x02) && !(~PINA & 0x08) && (~PINA & 0x10))
                {
                    NoteHighA();//High A note
                }
            }
            if((~PINA & 0x02) && (~PINA & 0x08) && (~PINA & 0x10)) //sharp octave
            {
                USART_TxString("HA#, ");
                while((~PINA & 0x02) && (~PINA & 0x08) && (~PINA & 0x10))
                {
                    NoteHighASharp();//High A# note
                }
            }
            if((~PINA & 0x04) && !(~PINA & 0x08) && !(~PINA & 0x10)) //normal
            {
                USART_TxString("B, ");
                while((~PINA & 0x04) && !(~PINA & 0x08) && !(~PINA & 0x10))
                {
                    NoteB();//B note
                }
            }
            if((~PINA & 0x04) && (~PINA & 0x08) && !(~PINA & 0x10)) //sharp
            {
                USART_TxString("B, ");
                while((~PINA & 0x04) && (~PINA & 0x08) && !(~PINA & 0x10))
                {
                    NoteB();//B note
                }
            }
            if((~PINA & 0x04) && !(~PINA & 0x08) && (~PINA & 0x10)) //octave
            {
                USART_TxString("HB, ");
                while((~PINA & 0x04) && !(~PINA & 0x08) && (~PINA & 0x10))
                {
                    NoteHighB();//High B note
                }
            }
            if((~PINA & 0x04) && (~PINA & 0x08) && (~PINA & 0x10)) //sharp octave
            {
                USART_TxString("HB, ");
                while((~PINA & 0x04) && (~PINA & 0x08) && (~PINA & 0x10))
                {
                    NoteHighB();//High B note
                }
            }
            if((~PINE & 0x40) && !(~PINA & 0x08) && !(~PINA & 0x10)) //normal
            {
                USART_TxString("C, ");
                while((~PINE & 0x40) && !(~PINA & 0x08) && !(~PINA & 0x10))
                {
                    NoteC();//C note
                }
            }
            if((~PINE & 0x40) && (~PINA & 0x08) && !(~PINA & 0x10)) //sharp
            {
                USART_TxString("C#, ");
                while((~PINE & 0x40) && (~PINA & 0x08) && !(~PINA & 0x10))
                {
                    NoteCSharp();//C# note
                }
            }
            if((~PINE & 0x40) && !(~PINA & 0x08) && (~PINA & 0x10)) //octave
            {
                USART_TxString("HC, ");
                while((~PINE & 0x40) && !(~PINA & 0x08) && (~PINA & 0x10))
                {
                    NoteHighC();//High C note
                }
            }
            if((~PINE & 0x40) && (~PINA & 0x08) && (~PINA & 0x10)) //sharp octave
            {
                USART_TxString("HC#, ");
                while((~PINE & 0x40) && (~PINA & 0x08) && (~PINA & 0x10))
                {
                    NoteHighCSharp();//High C# note
                }
            }
            if((~PINA & 0x20) && !(~PINA & 0x08) && !(~PINA & 0x10)) //normal
            {
                USART_TxString("D, ");
                while((~PINA & 0x20) && !(~PINA & 0x08) && !(~PINA & 0x10))
                {
                    NoteD();//D note
                }
            }
            if((~PINA & 0x20) && (~PINA & 0x08) && !(~PINA & 0x10)) //sharp
            {
                USART_TxString("D#, ");
                while((~PINA & 0x20) && (~PINA & 0x08) && !(~PINA & 0x10))
                {
                    NoteDSharp(); //D# note
                }
            }
```

```
			if((~PINA & 0x20) && !(~PINA & 0x08) && (~PINA & 0x10)) //octave
			{
				USART_TxString("HD, ");
				while((~PINA & 0x20) && !(~PINA & 0x08) && (~PINA & 0x10))
				{
					NoteHighD();//High D note
				}
			}
			if((~PINA & 0x20) && (~PINA & 0x08) && (~PINA & 0x10)) //sharp octave
			{
				USART_TxString("HD#, ");
				while((~PINA & 0x20) && (~PINA & 0x08) && (~PINA & 0x10))
				{
					NoteHighDSharp();//High D# note
				}
			}
			if((~PINA & 0x40) && !(~PINA & 0x08) && !(~PINA & 0x10)) //normal
			{
				USART_TxString("E, ");
				while((~PINA & 0x40) && !(~PINA & 0x08) && !(~PINA & 0x10))
				{
					NoteE();//E note
				}
			}
			if((~PINA & 0x40) && (~PINA & 0x08) && !(~PINA & 0x10)) //sharp
			{
				USART_TxString("E, ");
				while((~PINA & 0x40) && (~PINA & 0x08) && !(~PINA & 0x10))
				{
					NoteE();//E note
				}
			}
			if((~PINA & 0x40) && !(~PINA & 0x08) && (~PINA & 0x10)) //octave
			{
				USART_TxString("HE, ");
				while((~PINA & 0x40) && !(~PINA & 0x08) && (~PINA & 0x10))
				{
					NoteHighE();//High E note
				}
			}
			if((~PINA & 0x40) && (~PINA & 0x08) && (~PINA & 0x10)) //sharp octave
			{
				USART_TxString("HE, ");
				while((~PINA & 0x40) && (~PINA & 0x08) && (~PINA & 0x10))
				{
					NoteHighE();//High E note
				}
			}
			if((~PINA & 0x80) && !(~PINA & 0x08) && !(~PINA & 0x10)) //normal
```

```
            {
                USART_TxString("F, ");
                while((~PINA & 0x80) && !(~PINA & 0x08) && !(~PINA & 0x10))
                {
                    NoteF();//F note
                }
            }
            if((~PINA & 0x80) && (~PINA & 0x08) && !(~PINA & 0x10)) //sharp
            {
                USART_TxString("F#, ");
                while((~PINA & 0x80) && (~PINA & 0x08) && !(~PINA & 0x10))
                {
                    NoteFSharp();//F# note
                }
            }
            if((~PINA & 0x80) && !(~PINA & 0x08) && (~PINA & 0x10)) //octave
            {
                USART_TxString("HF, ");
                while((~PINA & 0x80) && !(~PINA & 0x08) && (~PINA & 0x10))
                {
                    NoteHighF();//High F note
                }
            }
            if((~PINA & 0x80) && (~PINA & 0x08) && (~PINA & 0x10)) //sharp octave
            {
                USART_TxString("HF#, ");
                while((~PINA & 0x80) && (~PINA & 0x08) && (~PINA & 0x10))
                {
                    NoteHighFSharp();//High F# note
                }
            }
        }
    }
}
```

Figure 3: Keyboard Code