

## Lab 12

### Final Project

Due Friday 5/1

#### *Collaboration Guidelines*

*This lab is intended to test your ability to work independently. You must work strictly alone. No collaboration with your classmates or anyone else is permitted.*

#### **Project Specifications**

Using the Keil development environment, develop a program that will simultaneously perform the following tasks:

##### Task1

Operate one channel of the speaker as a Theremin, as specified in Lab 10. Use Timer TIM1.

##### Task2

Operate the other channel of the speaker as a Toy Piano, as specified in Lab 9. Use Timer TIM3.

##### Task3

Display notes that are entered from the piano keyboard on the TeraTerm terminal. The display for each note should include the note number and the time (i.e., the millisecond count) when the note turns on and turns off. The display format is illustrated by the following example:

```
Note 65 On 10666
Note 65 Off 11053
Note 62 On 11357
Note 62 Off 11644
```

##### Task4

Blink the green and blue LEDs. The blink rates are independent and should range from 1 to 10 blinks per second. Control the blink rates using the TeraTerm keyboard. Press key B to increment the blue blink rate and key G to increment the green blink rate. Incrementing a blink rate of 10 should produce a blink rate of 1. The control keys are pressed between notes played on the piano, and the keystroke should be echoed. For example, if the blue blink rate is increased by 2 after the first note and the green rate increased by 3 after the second note, the display would look as follows:

```
Note 65 On 10666
Note 65 Off 11053
bb
Note 62 On 11357
Note 62 Off 11644
ggg
Note 67 On 10666
Note 67 Off 11053
```

The four tasks should appear to operate simultaneously and should not interfere with each other.

### **Demonstrations**

Demonstrate your work for the lab instructor during your scheduled lab period on Friday 5/1.

### **Program Submission**

Submit your work as follows:

- Build and run your project to be sure it is working correctly.
- Copy your entire Project directory into a directory named Lab12 followed by your name (e.g., Lab12\_YourName)
- Delete the folders ListingFiles and ObjectFiles . (These directories contain files that some email programs will not send or accept).
- Compress Lab12\_YourName into a single file with extension ZIP (e.g., Lab12\_YourName.zip),. On Windows, this is done as follows: RtClk the Project directory > SendTo > Compressed Folder.
- Test the ZIP file as follows: copy the zip file to a new location; unzip it; open the Project; build and run.
- Email the zip file to [CompE375@gmail.com](mailto:CompE375@gmail.com) before midnight on the due date, 5/1/2015.

### ***Reminders***

***1. The in-class final exam will be Tuesday 5/12, 1300-1500***

***2. At the final exam, return the following parts:***

- ***breadboard assembly***
- ***hex keypad***
- ***audio cable***
- ***Sparkfun FT232R board with header***
- ***USB cable for the Sparkfun board***
- ***photocell***

***Include other parts if you have no use for them.***

***Put all parts in an envelope. Put your name on the envelope.***