EE337 Microprocessors Laboratory
Wadhwani Electronics Laboratory
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Problem set: 8 part-2 Date: March 19 , 2025

PIANO using UART

1. [15 points] In this lab you will understand and use a program for communicating between Pt-51 and a computer using UART. This program will take inputs from the computer's keyboard that can be used in programs running on the kit to perform appropriate operations. You have already designed a tone generator in **lab6**. You will use that tone generator to generate 8 tones (sa_low, re, ga, ma, pa, dha, ni, sa_high) by taking inputs from the computer's keyboard.

   In this experiment you will design a PIANO which will play sargam on the speaker connected to the Pt-51 using the inputs from the keyboard of your computer.

   - You will use the tone generator used in LAB6 to generate tones sa_low, re, ga, ma, pa, dha, ni, sa_high.
   - In LAB8 part-1 you have used UART protocol to communicate between pt-51 and your laptop using Real-Term software. You will use that code as a reference while designing the PIANO.
   - You will have to take inputs from UART by using the appropriate function from the serial.h file. (You have already used this in LAB8 part-1)
   - Based on the key (single key) pressed from the keyboard, you will play the corresponding tone on the speaker using the tone generator you designed in LAB6.
   - E.g. You can use the following keys of your laptop to generate tones.
     - s to play sa_low
     - r to play re
     - g to play ga
     - m to play ma
     - p to play pa
     - d to play dha
     - n to play ni
     - a to play sa_high
     - q for silence

     * You are free to use keys of your choice to play the sounds.
   - Once any key is pressed, that sound will start to play. It will continue to play even when you release the key. Until you press the next key, the same sound will play. Upon pressing the next key, a new sound should play
   - You will also have to display the tone getting played on LCD.

You will have to

- Create a main.c for this experiment. You may use the template file given for the LAB8 part-1 with appropriate modifications.
- Use serial.h file provided to you.
- Use tone generation code from LAB6
- Use LCD.h file provided to you

(Hints)

While designing this experiment you will have to handle two interrupts, one for the timer0 which generates tone, and the other for Serial peripheral UART. Make sure you have all the necessary knowledge of interrupt, registers used while working with interrupts and timers.

- To learn about timers, refer to the following document: 8051 Timers
- To learn about interrupts, refer to the following document: 8051 Interrupts

2. [5 points] Show the above experiment using another Serial terminal software "Teraterm". Play the following notes for the song "Happy Birthday To You" -
Sa, Sa, Re, Sa, Ma, Ga;
Sa, Sa, Re, Sa, Pa, Ma;
Sa, Sa, Sa_high, Dha, Ma, Ga, Re;
Dha, Dha, Dha, Ma, Pa, Ma;

TA Checkpoints

- 1. Check whether students have used two Interrupts.
- 2. Ask students to explain how they have used two interrupts with their priorities.