

# The Last Music Trainer

## Embedded System Design, Lab 4

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# 1 Objectives and Problem Descriptions

## 1.1 Beginner Music Trainer

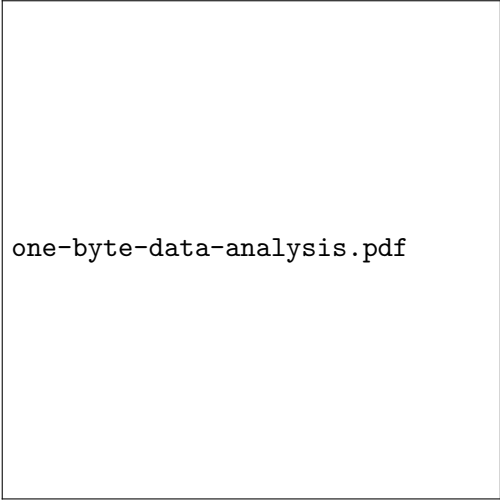
The objective of this lab is to develop microcontroller-based, beginner music trainer with the following features:

1. Be capable of playing simple songs using PBasic's `FREQOUT Pin, Duration, Freq1 {, Freq2}` command. This including the ability to
  - a. play any piano tone in the 4<sup>th</sup>–7<sup>th</sup> octave {C, C#, D, D#, E, F, F#, G, G#, A, A#, B};
  - b. change the base tempo's whole note duration;
  - c. play each note for {1, 1/2, 1/4, 1/8, 1/16, 1/32} of the base tempo;
  - d. play each note for  $1\frac{1}{2} * \{1, 1/2, 1/4, 1/8, 1/16, 1/32\}$  (dotted notes) of the base tempo; and
  - e. play two tones simultaneously over the same duration.
2. allow user to select from a menu of 5 Ring Tone Text Transfer Language (RTTTL) songs, using a pushbutton switch—each push causes an advance to the next song.
3. allow user to increase the base tempo by a factor of 1–4 using a potentiometer rotary knob.
4. display the current note being played on a 7-segment display, using the decimal point to indicate sharp notes. Furthermore, display the note's octave with individual LEDs.
5. play each song in an infinite loop if user does not advance to the next song.

## 2 Procedure

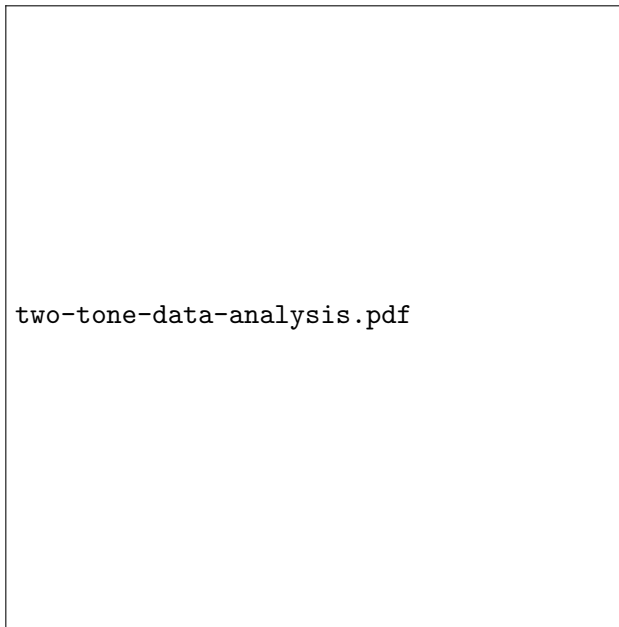
### 2.1 Circuit Design

### 2.2 Data Design



one-byte-data-analysis.pdf

Table 1: Single Byte Data Lookup Table



two-tone-data-analysis.pdf

### **2.3 Data Generation from RTTTL Files**

### **2.4 Implementation Flowchart**

## **3 Expected Results**

### **3.1 Why is this a section?**

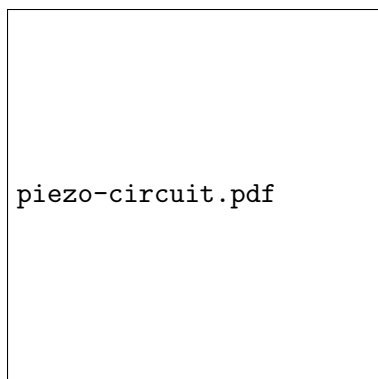
I expected my microcontroller and circuit to behave as described in section 1.1. Not going to waste paper by copying the specifications here...

## **4 Experiment and Design Revisions**

## **5 Observations**

## **6 Discussion**

## **7 Exercises**



(a) Piezo Circuit

pushbutton-circuit.pdf

(b) Pushbutton Switch Circuit

potentiometer-circuit.pdf

(c) Potentiometer RC Circiut

LED-display-circuit.pdf

(d) LED Display Circuit

Figure 1: Hardware for4The Last Music Trainer

## 8 Implementation Code