Piano Hero

Mock Design Review

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1. Block diagram

Figure 1: Block Diagram of the system
2. One circuit schematic

Each key will have 8 LEDs corresponding to it which will be driven with the Serial Input Parallel Output (SIPO) chip SN54HC595\(^1\).

Figure 2: Schematic of LED array for one key
3. One calculation

The 8-bit SIPO shift register that we will use to run the LED array can output a maximum of 35 mA per output and 70 mA total for all outputs combined. Using the typical forward voltage drop of a red LED\textsuperscript{[2]}, we can find the minimum resistance allowed per output.

\[ I_{\text{max}} = \frac{70 \, mA}{8} = 8.75 \, mA \]

Giving us a minimum resistance of:

\[ R = \frac{(V_{\text{IN}} - V_{fa})}{I_{\text{max}}} = \frac{(5V - 2.1V)/8.75mA}{332 \, \Omega} \approx 332 \, \Omega \]

The next highest standard resistance value is 360 \, \Omega giving us a current of:

\[ I = \frac{(V_{\text{IN}} - V_{fa})}{R} = \frac{(5V - 2.1V)/360}{360} = 8.06 \, mA \]
4. One plot (simulation or experiment)
5. One block description

The LED array will have a column of LEDs above each key that will allow the user to anticipate the next key needed with the top LEDs and what key currently needs to be pressed by the bottommost LED. For quick notes this will mean only one LED in the column will be lit at a time but for longer notes multiple LEDs will be lit.

6. Requirements and verifications for one module from the block diagram

LCD Screen:

LCD Screen is used for displaying current information loaded from the microcontroller. The requirement for the LCD screen is rather simple – it needs to be properly connected to the microcontroller with the harness included, and display test content from the microcontroller without any fuzziness or distortion. The way we test the LCD screen is we use our microcontroller to load some test pictures to display on the LCD. With help of human eyes, we make sure everything is properly displayed including figure, color and position.

7. Safety statement

For our design, we will not only follow the general lab safety guidelines shown in drs.illinois.edu, but also follow our our own safety rules listed below:

a. understand how the equipment/component works before we start using it
b. always follow the operational manuals when in doubt
c. trust our instinct – when something feels not right, it’s probably not right
d. look for and replace frayed components in our working area
e. never work alone in the lab
8. Citations
