Octave Keyboard

Daniel Chen and Vivian Hu

August 26, 2014

The goal of this project was to create a simple one octave keyboard mapped to buttons with the additional capability to autoplay "Kids" by MGMT when a switch is turned on. When the buttons corresponding to notes are pressed, the appropriate notes are played through the speaker, and LEDs which correspond to the keys light up. The LEDs can be disabled using a switch.

This project was created by Vivian Hu and Daniel Chen in Summer 2014 at Dartmouth College for the Digital Electronics (ENGS031/COSC056) course. This report goes over the implementation, design, and usage of the final product, which implements all of these features.

Contents

1 Introduction: The Problem

The problem that this project solves is the creation of a one-octave keyboard, and the ability to produce certain sounds through circuit logic. An additional issue is representing the song that will be autoplayed.

2 Design Solution

2.1 Specifications

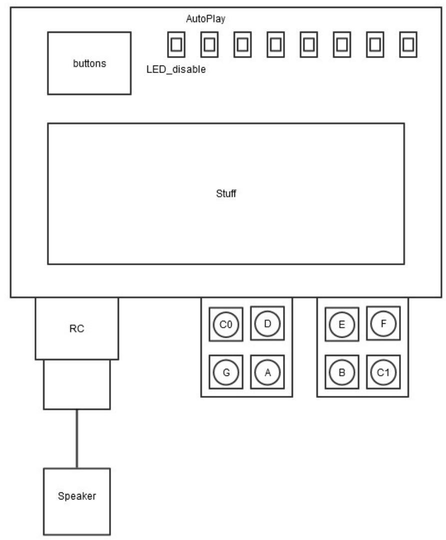
This section goes over the inputs, outputs, and functionality of the circuit.

The inputs to this circuit are:

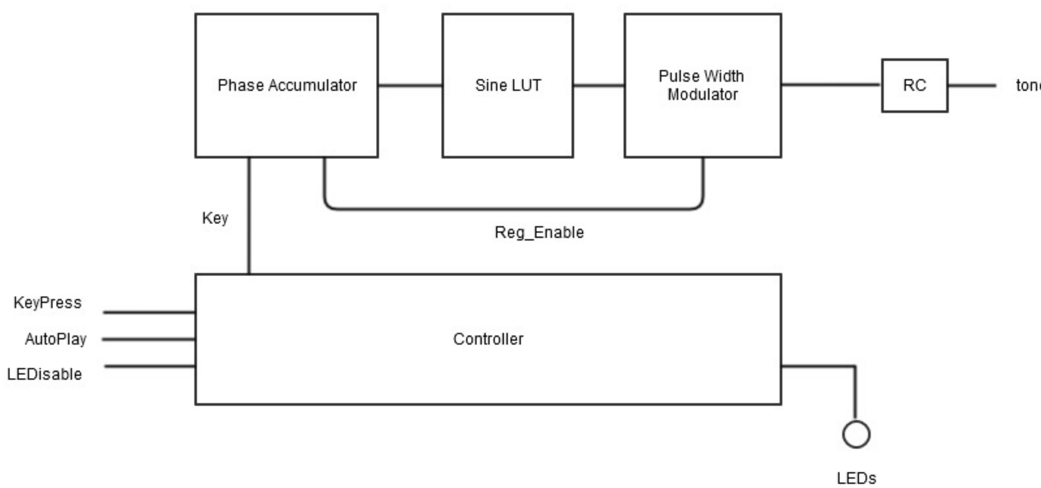
- 8 Buttons that map to the notes to play (bottom right of image to the right).
- An LED disable switch which disables LED output.
- An AutoPlay switch which enables the playing of "Kids" by MGMT.

The outputs to the circuit are:

- 8 LEDs which correspond to the notes being played.
- A speaker which outputs the notes appropriate to the song or specified by the keys.



The picutre shown below displays the datapath and control of the circuit. The controller (a finite state machine) takes in all of the inputs and outputs the LEDs. It emits a signal corresponding to the note that needs to be output (a copy of the LED output) which is the Phase Accumulator receives. The data from the Phase Accumulator transfers to the Sine LUT, which goes to the Pulse Width Modulator...



2.2 Operating Instructions

2.3 Theory of Operation

2.4 Construction and Debugging

3 Evaluation of Design

4 Conclusions and Recommendations

5 Acknowledgments

We would like to thank Eric Hansen and Dave Picard for their support and mentorship throughout not only this project but also the course. We would also like to thank the other students of Digital Electronics as well as the TAs.

5.1 Vivian's Contributions

- Design of
- The second item
- The third etc

5.2 Daniel's Contributions

- The first item
- The second item
- Git creation/management

6 References

7 Appendices

List of Figures

7.1 System level diagrams

7.1.1 Front Panel

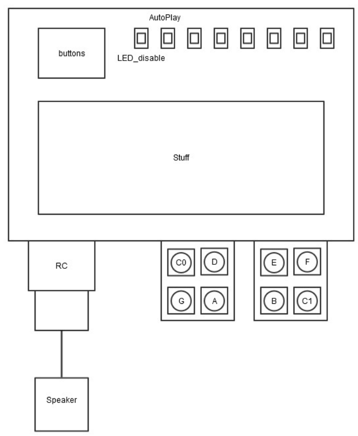


Figure 1: FPGA Diagram

7.1.2 Block Diagram

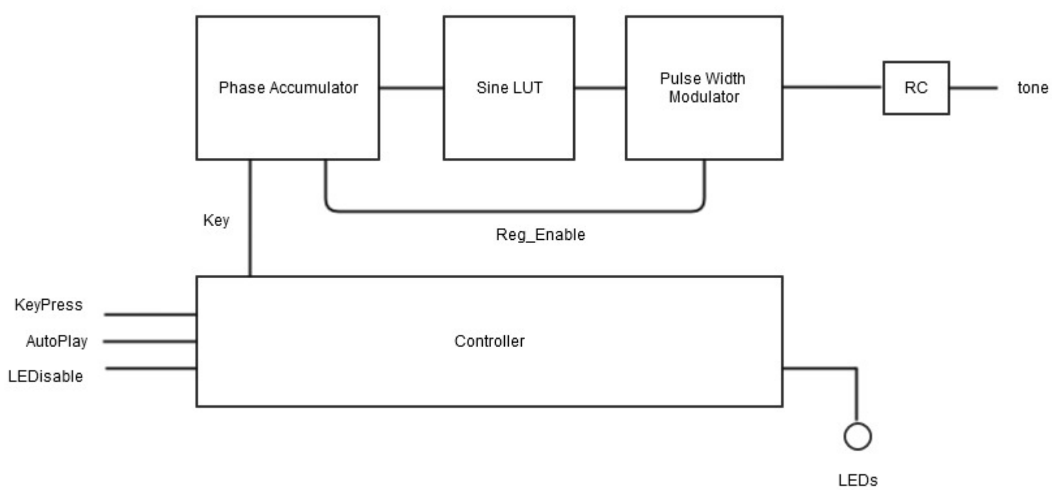


Figure 2: Block Diagram

7.1.3 Schematic Diagram

7.1.4 Package Map

7.1.5 Parts list

7.2 Programmed Logic

7.2.1 State Diagrams

7.2.2 VHDL Code

```vhdl
process
begin
  CLK <= '1'; wait for 10 NS;
  CLK <= '0'; wait for 10 NS;
end process;
```

7.2.3 Resource utilization

7.3 Memory Map

7.4 Timing Diagram