

# *Final Project: Preliminary Report*

## Digital Design Lab

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### I. INTRODUCTION

This project's focus is to develop a prototype for a digital clock. This prototype will be able to keep track of the current time as well as display the time on a 20x4 character LCD board. With the use of a small speaker, sound elements will be added. These sound elements will include an alarm clock with a melody alarm and chimes at 00, 15, 30, and 45 minutes past the hour, as well as tolling the hour on the hour.

Below is a summary of the features that are currently planned to be included.

Points	Function	Description / Minimum Requirements
1	Time of Day	Keep track the current time and be able to display it as decimal hours, minutes, and seconds.
1	Alarm Clock	When the current time matches a user specified time, generate an alarm
1	Countdown Timer	After a user specified amount of time elapses, generate an alarm. Must support at least 1-99 minutes.
1	Chimes	Play the appropriate sections of Westminster chimes at 00, 15, 30, and 45 minutes past the hour, as well as tolling the hour on the hour
0.5	Melody Alarm	Play a simple melody for the alarm condition (at least 8 notes and 4 frequencies)
0.5	Character LCD	Use an LCD module with an HD44780 (or compatible) Controller
0.5	Serially interfaced switches	Use SPI or I2C interface to read at least 4 switches
<b>5.5</b>		

Table 1: Summary of selected features

### II. DESIGN ANALYSIS AND SCHEMATIC

This project incorporates various design elements from the different labs this semester. Data will be communicated from the LPC1769 to the LCD display via the MCP23017 expander part. However, as the LCD display that was in stock is a 5V logic and the LPC1769 is 3.3V, the I2C is passed through a level shifter to convert the logic levels. The expander then outputs to the LCD display and takes in input from the four buttons. These buttons will be used to set the time and alarms as well as starting the countdown timer. An audio amplifier circuit is used for the speaker to produce alarm and chime sounds. This circuit uses standard values for its design. 10k resistors are used throughout the design as pullup resistors.

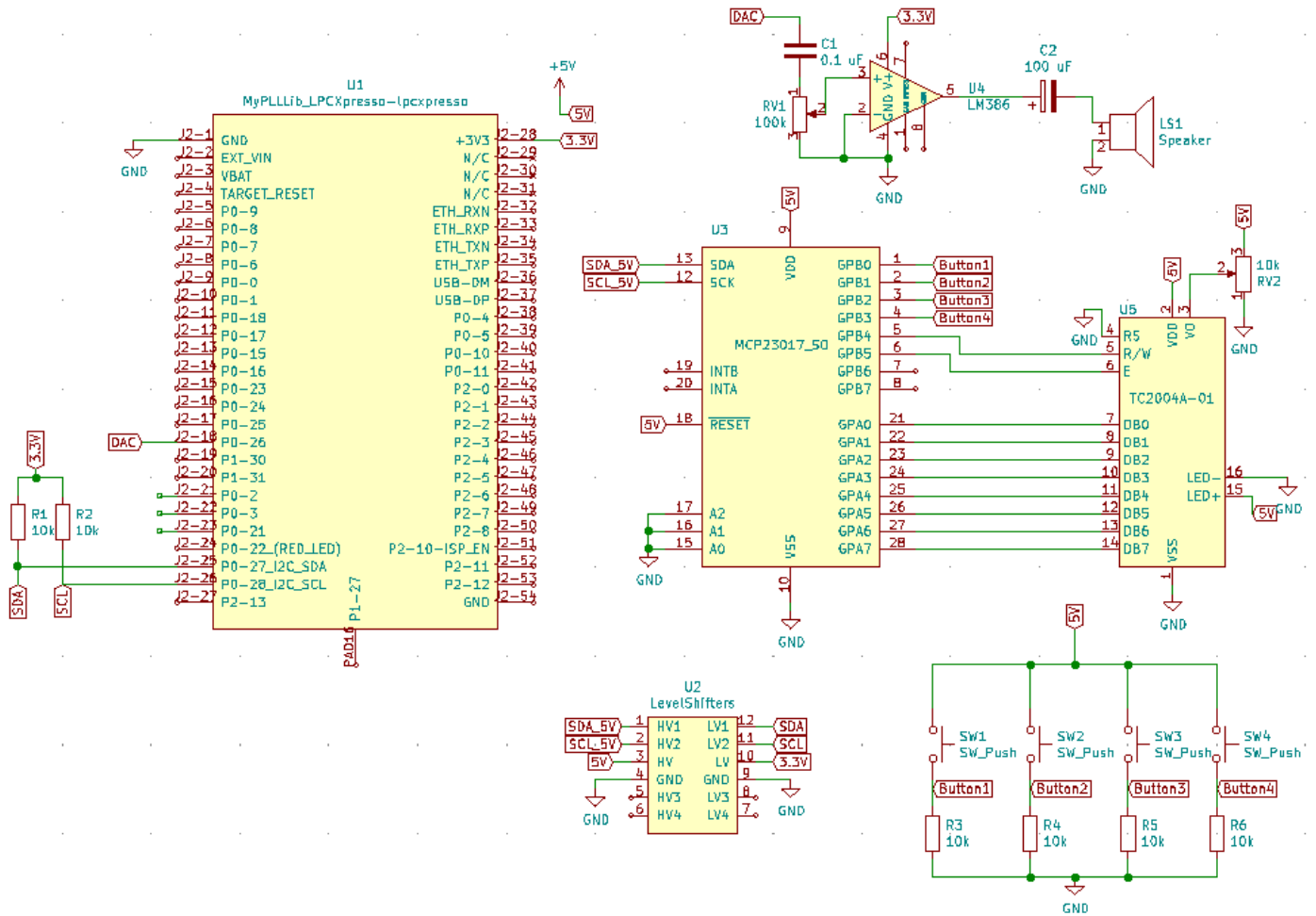


Figure 1: Initial Schematic

### III. CODE OUTLINE

The code for the final project will draw on various elements implemented throughout the semester in the labs. The code will be organized in various portions to keep track of elapsed time, to display the time on the LCD, and to create sounds for chimes and alarms. The LCD display will be interfaced with by using I2C and inputs from the buttons will be used to set alarms and other user input. As various chimes and frequencies will be produced, the clock will be changed to 100MHz and interrupts will be used to create the sounds.