Alarm Clock Requirements

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4/14/2020
EGR 226
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1.0 Hardware Requirements

Table 1. Hardware Specifications

Component	Description	Part Number
LCD Screen	5 × 8 and 5 × 10 dot matrix possible 5v ref Drivers were available	HD44780U
Piezo Sounder	1.5 - 30V 22 X 13 mm	PKM13EPYH4002-B0
LED	36 x 5 x 5 mm 2.4 - 3.3V	FIT0242
Tactile Push Buttons	6.0 mm 4-pin push button	1825967-1

2.0 Hardware Description

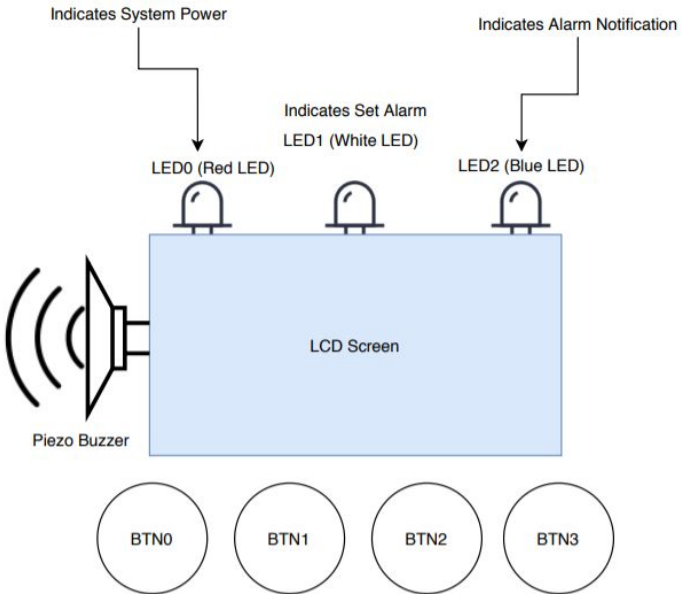

Figure 2.0

2.1 LED

Table 2.1: LED Specifications

LED name	LED color	Hardware description
LED0	Red	Indicates system power
LED1	White	Indicates set alarm
LED2	Blue	Indicates alarm notification

There will be three LEDs, one red LED (LED0), one white LED (LED1), and one Blue LED (LED2). The red led will be on to signify that the entire system is on and working. The white LED will blink with a delay of ½ second while the alarm is currently being set. Once the alarm is set, the white LED will continue to stay on until the alarm is turned off (Either before or during the period while the alarm is going off). The blue LED will be used to flash with a ½ second delay while the alarm goes off.

2.2 Button

Table 2.2: Button Specifications

Button name	Hardware description
Button 0	Opens menu Select to set hours Inputs number of presses for hours Inputs number of presses for minutes
Button 1	Chooses to set alarm time Inputs number of presses for hours Inputs number of presses for minutes
Button 2	Snoozes alarm
Button 3	Turn off alarm at any time

This alarm clock will require four buttons. The first button (Button0) will be used to put the system into “alarm setup” mode, by holding it down for 5 seconds. The second (Button1) will be pressed as many times as the amount of hours wanted by the user. To switch to change minutes, Button0 will be pressed again. Button1 would be pressed as many times as the amount of minutes wanted by the user. Button0 would then be pressed one last time to “lock in” the alarm and set it. The third button (Button2) is used

to “snooze” the alarm by ten minutes as it is going off. At any point the fourth button (Button3) may be used to disable the alarm.

2.3 LCD

The alarm clock will require an LCD screen. This screen will display the current time, if an alarm is set and what time it is set for, and any other necessary information needed about setting an alarm.

2.4 Piezo Buzzer

A form of buzzer is a crucial piece of equipment for any alarm clock. For this project we will be using a piezo buzzer. The buzzer will sound with a set frequency when the alarm is going off.

3.0 Hardware Reference Schematic

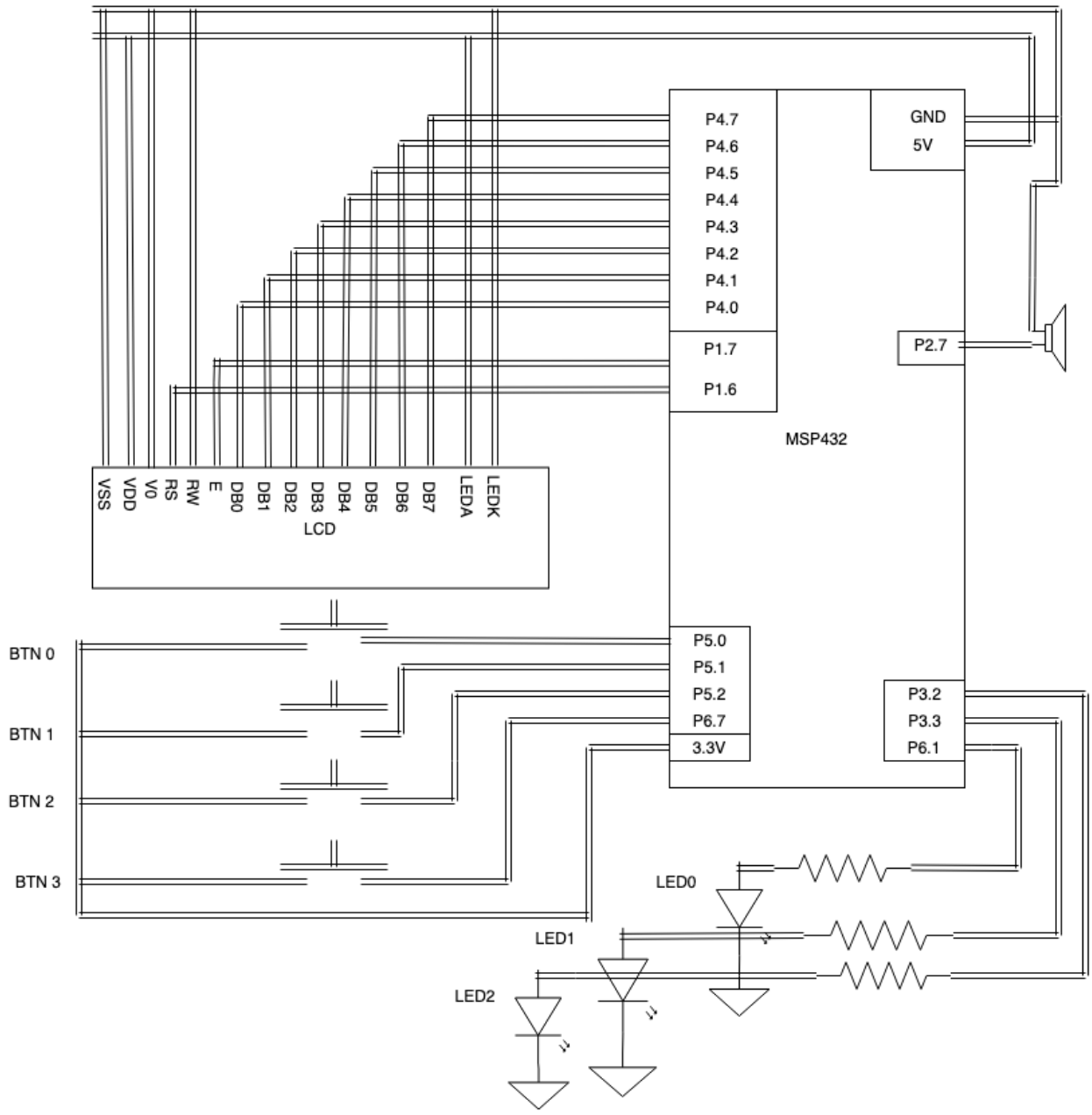

Figure 3.0

4.0 Software Requirements

The system should display the current time and date on the LCD screen as well as a power on LED light to signify operations. The user should be able to enter in the desired time of an alarm. The system will have an LED to signify an alarm is set as well as the letter A displayed in the bottom of the LCD screen. At the specified time the buzzer will sound along with flashing an LED light. The user has the option to shut off the alarm or snooze the alarm and delay it for 10 minutes or shut off the alarm completely.

4.1 Button Software Requirements

Feature	Use Case	Test Case
1	As a user I want to be able to set an alarm for a certain time of day.	B-1, B-2, LED-1, LED-4,
2	Press and hold Button0 for 5 seconds to activate the set time case	B-3, B-4
3	Button1 changes hours on alarm	B-5, LCD-2,
4	After entering the desired time in hours press Button0 to change the enter in minutes	B-6
5	Button1 changes minutes on alarm	B-7, LCD-3,
6	After the desired time in minutes is entered	B-8, B-9, LED-2, LCD-4, P-3,

	in press button0 to lock in the final time	
7	While the alarm is going off, Button2, is used to “snooze” and delay the alarm by 10 minutes	B-10,
8	At any point, I want the user to be able to turn off the alarm by pressing Button3. (Both before and when the alarm is going off)	B-11, B-12, LED-3, LCD-5,

4.2 LED Software Requirements

Feature	Use Case	Test Case
1	Led0 will turn on in order to signal that the system is on	B-1, B-2, LED-1, LED-4, LCD-1,
2	I want to indicate that no alarms are set by LED1 being off	LED-2, LED-3, LCD-5,
3	I want to indicate that an alarm is set by LED1 being on	B-9, LED-2, LCD-4, P-3
4	LED Flashes when the alarm is going off	LED-3, P-1, P-2,

4.3 LCD Software Requirements

Feature	Use Case	Test Case
1	On power up LCD should display the current date and time.	B-1, B-2, LED-4, LCD-1,
2	LCD should display blinking time to user as user sets time	B-3, B-6, B-8,B-9, LCD-2, LCD-3,
3	LCD should display alarm if one is set	B-9, LED-2, LCD-4, LCD-5, P-3

4.4 Piezo Buzzer Software Requirements

Feature	Use Case	Test Case
1	Trigger the buzzer to go off at a specific time	LED-2, P-1,P-2
2	Buzzer beeps to signal alarm is set	LED-2, P-3, B-8
3	Buzzer should sound at 10kHz for all functions	B-10, B-12, LED-3,
4	Buzzer goes stops when alarm is shut off.	B-10, B-12, LED-3, LCD-5, P-4

5.0 Testing

5.1 Button Testing

Test Case	Description
B-1	When I power on the system I see the correct date and time
B-2	As a user I want to set the time, power cycle the device, and see the correct time displayed on startup.
B-3	Holding Button0 for 5 seconds should bring up the numbers to enter in the time and date on the alarm.
B-4	Test to ensure that the interrupt is set up so that whenever the button is pressed it opens the enter time screen
B-5	The system should count how many times Button1 is pressed in order to obtain hours wanted by user
B-6	Test to see if the press of Button0 locks in the change in hours
B-7	The system should count how many times Button1 is pressed in order to obtain minutes wanted by user
B-8	Make sure Button0 locks in the time in minutes for the alarm
B-9	Test to see if Button0 stops the numbers from flashing
B-10	While alarm is going off, Button2 should be able to “snooze” and delay the alarm by 10 minutes
B-11	While alarm is still set, Button3 should be able to turn off the alarm

B-12	While alarm is going off, Button3 should be able to turn off the alarm

5.2 LED Testing

Test Case	Description
LED-1	LED0 is on when system powers up
LED-2	Set an alarm, and make sure LED1 comes on
LED-3	Once the alarm is turned off, LED1 needs to be turned off
LED-4	LED0 remains on through all other operations

5.3 LCD Testing

Test Case	Description
LCD-1	After prompting the user for a time of day, I want the LCD screen to display the time chosen.
LCD-2	When the time in hours is being entered, the numbers representing the hours need to be flashing
LCD-3	When the time in minutes is being entered, the numbers representing the minutes need to be flashing
LCD-4	Once the alarm is fully set, the LCD screen should revert to the home screen, while also displaying the current alarm set
LCD-5	Whenever the alarm is shut off, the LCD screen should stop displaying that an alarm is set

5.4 Piezo BuzzerTesting

Test Case	Description
P-1	I want the buzzer to sound at the time chosen by the user. (Min. 3 tests at different times)
P-2	The buzzer should go off at a specific time
P-3	Test the buzzer beeps once when the alarm is set.
P-4	Buzzer sounds at a specified frequency (test 2 times to insure accuracy)

6.0 Software Flow Diagram

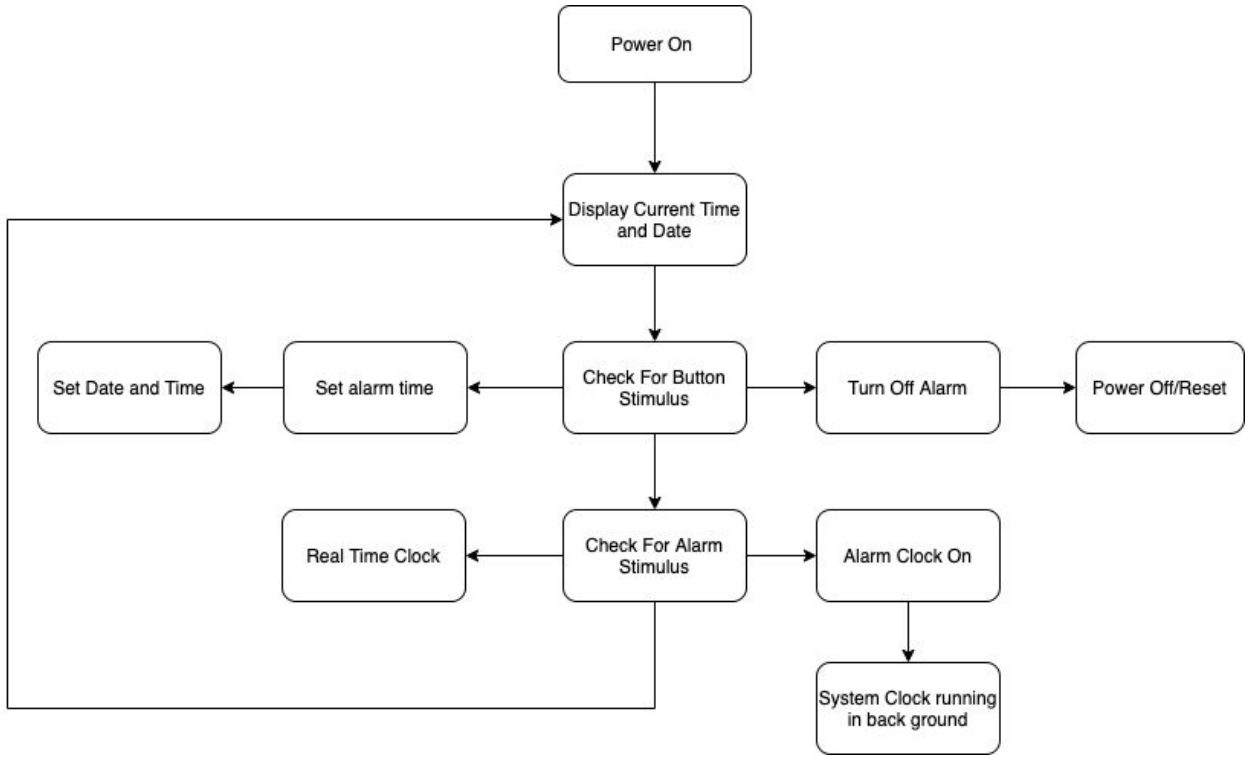

Figure 6.0 Top Level System Diagram

This represents the top level software flow for our alarm clock. It provides a basic overview of how the system operates in its various states. For more detailed measures see the following figures below.

6.1 Alarm Time Setup Software Flow

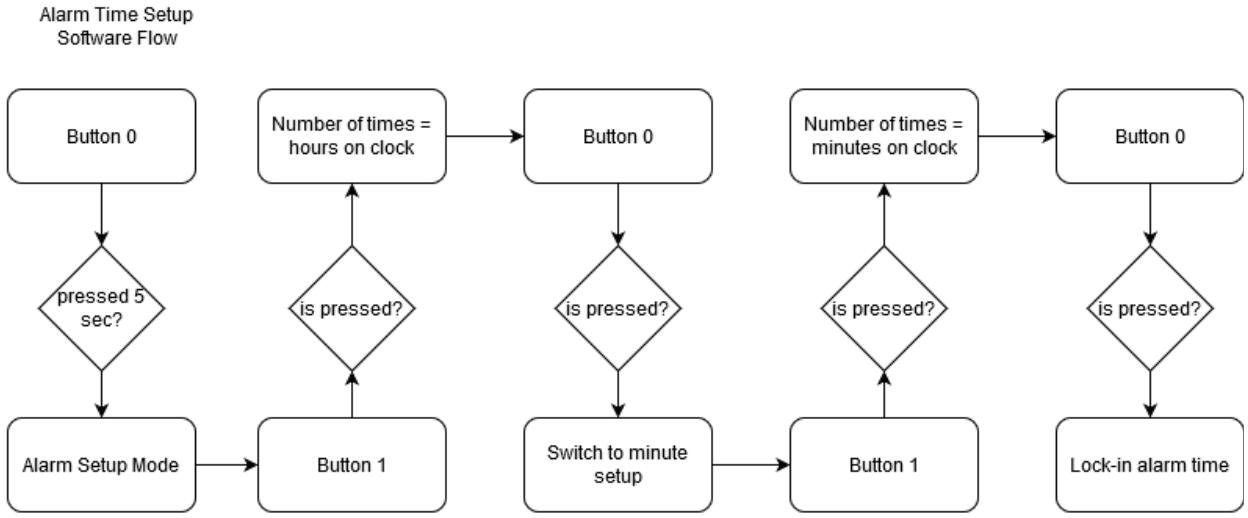

Figure 6.1-a

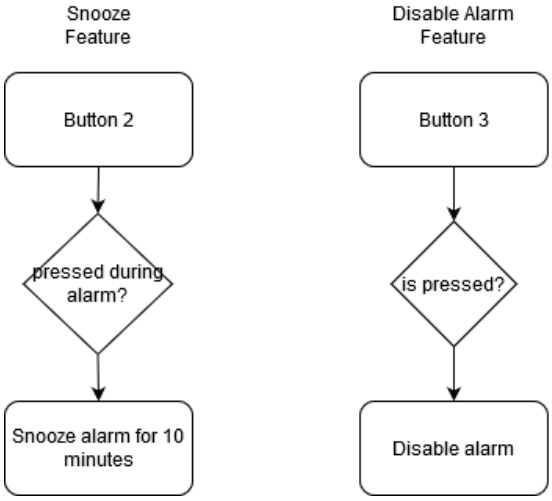

Figure 6.1-b

6.2 LED Software Flow

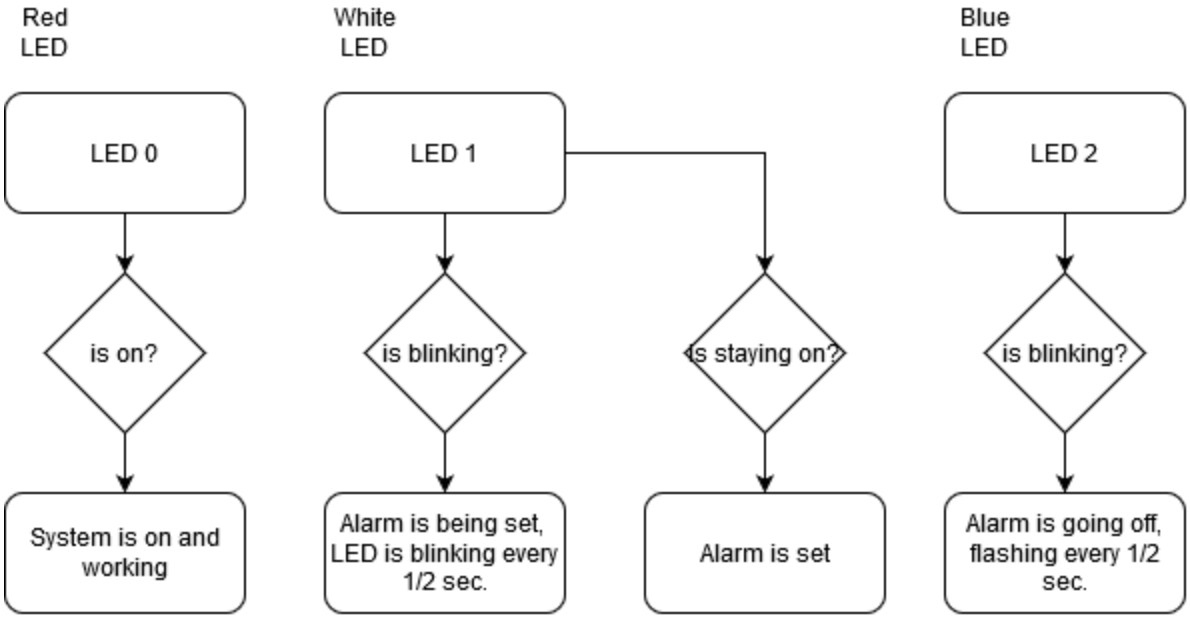

Figure 6.2

6.3 Piezzo Software Flow

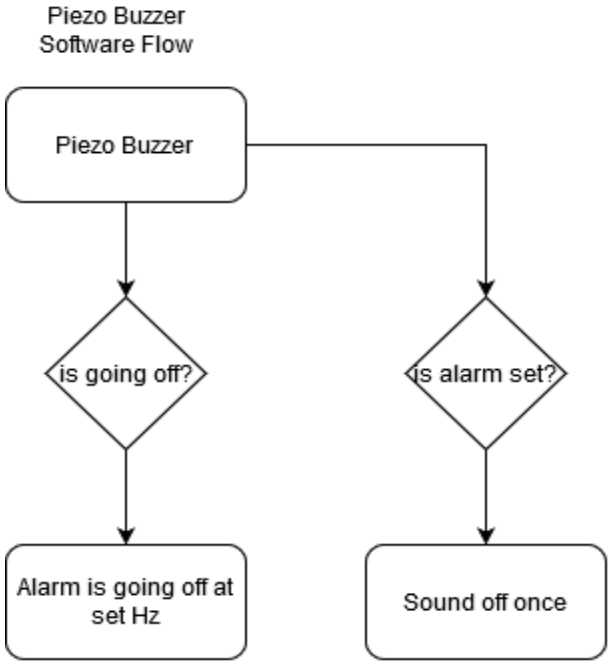

Figure 6.3

6.4 LCD Software Flow

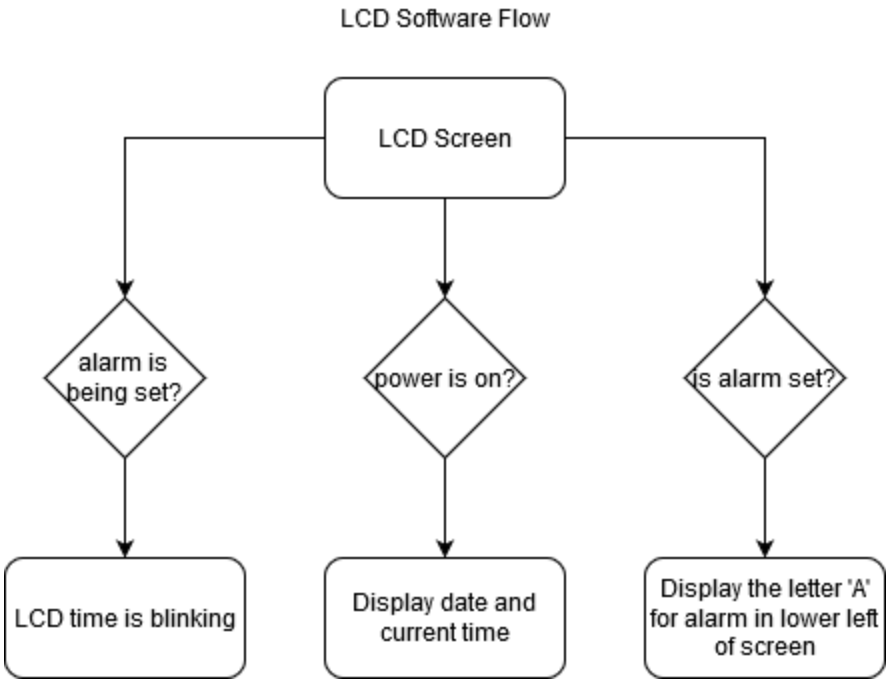

Figure 6.4