Countdown Timer

CSE321 Fall 2021: Project 2

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# Introduction

This document describes the implementation and use of a countdown timer and alarm system.

# Specifications

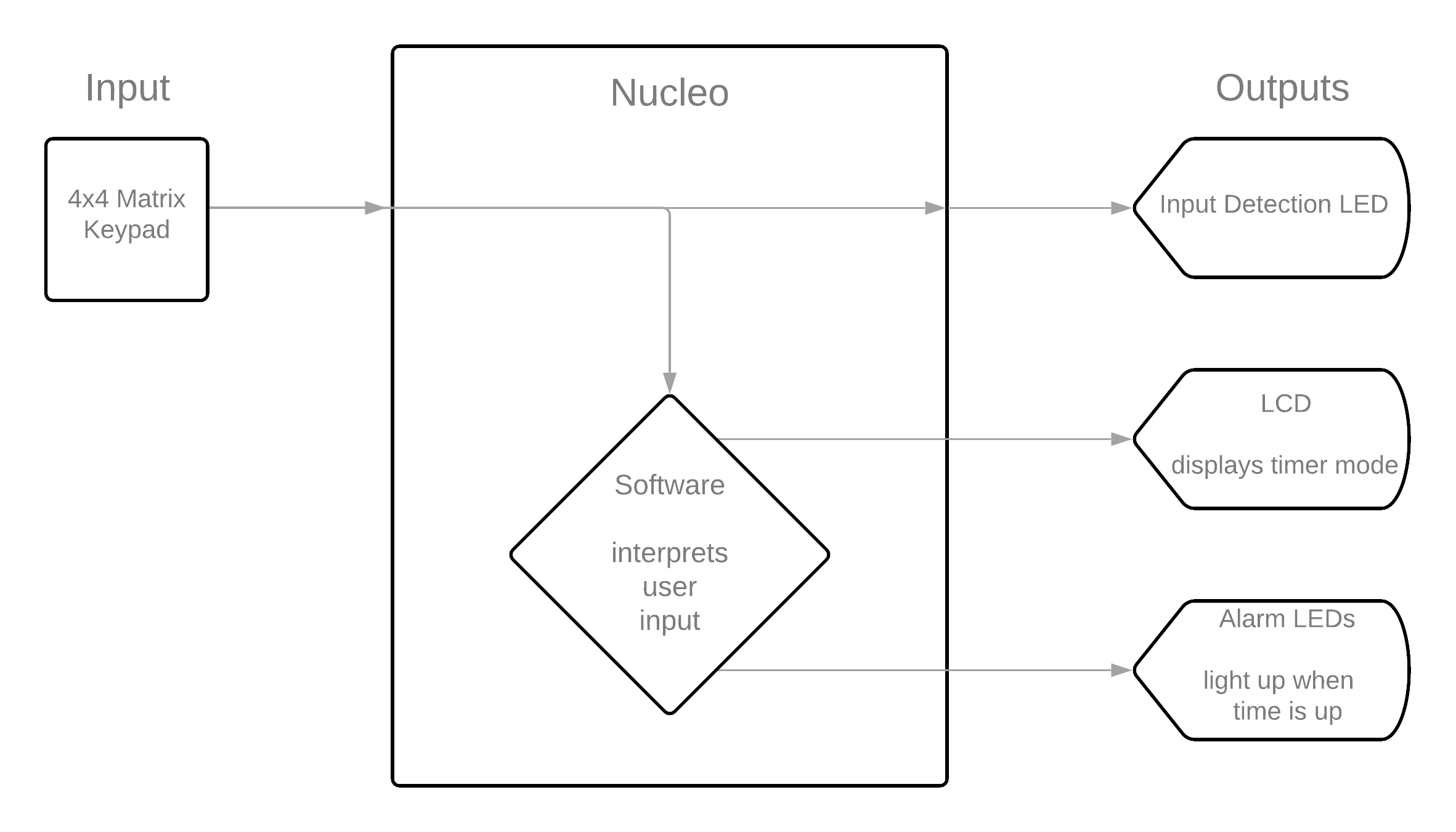
# Features

# Applications

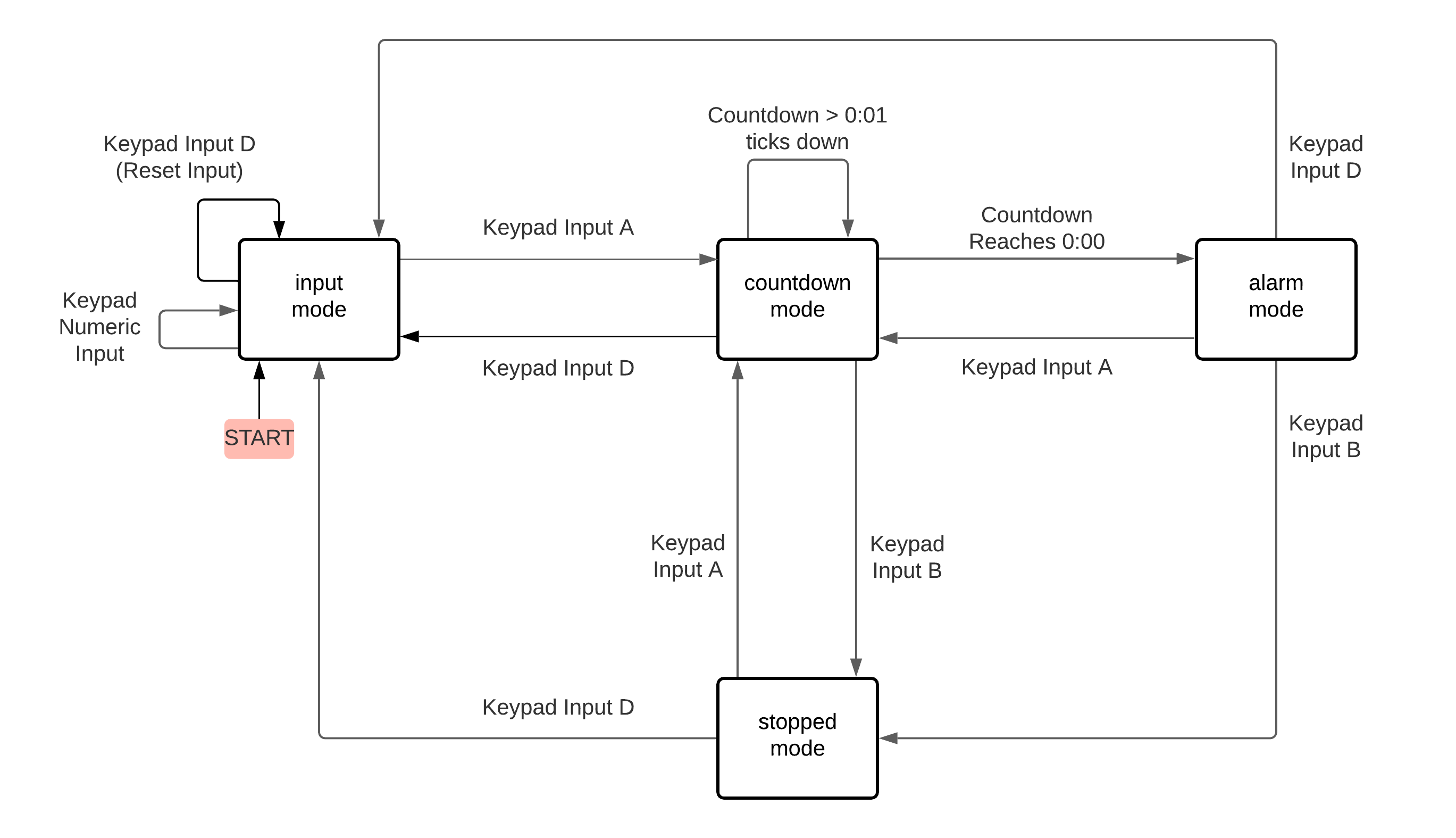
This system can be utilized in a context where a countdown with a duration of less than 10 minutes is required and where a purely visual alarm that the designated time has elapsed are sufficient. Some example use cases are provided:

* Using this timer as an indicator to not interact with something in proximity of the timer until the time has elapsed.
  + E.g. A chemical reaction takes five minutes to be considered safe to interact with. The timer can be run for five minutes, and the times up screen can act as an indicator that it is safe to proceed with appropriate use of the chemical.
* Using the active alarm LEDs when the timer duration has expired to be informed that what the timer was associated with is ready to be checked up on.
  + E.g. A subroutine without a user interface takes eight minutes to complete. After beginning the subroutine, begin the timer. Once the Alarm LEDs are active, this indicates that the subroutine should be done, and subsequent work with the system can proceed.
* Repeat use of the timer with short durations can be used to assist in managing time spent on each individual step of a task.
  + E.g. A two-hour open-resource exam is given such that an average of only 90 seconds can be spent on each individual question. Starting the timer at the beginning of each question can indicate when average time has elapsed and it is recommended to move on.

# Block Diagram



# Functionality Diagram



# Bill of Materials

The following will be required to create the timer:

* NUCLEO L4R5ZI microcontroller
* 4x4 matrix keypad (8-pin)
* JHD1804 LCD
* Solderless breadboard
* USB 2.0 A to USB 2.0 Micro B cable
* Four (4) LEDs
* Eight (8) 1kΩ resistors
* Jumper wires (recommended to have at least 14)
* Mbed Studio (<https://os.mbed.com/studio/>)

# Schematic

The following set of schematics describes the set of electrical connections between the NUCLEO and peripheral devices required to create the timer.

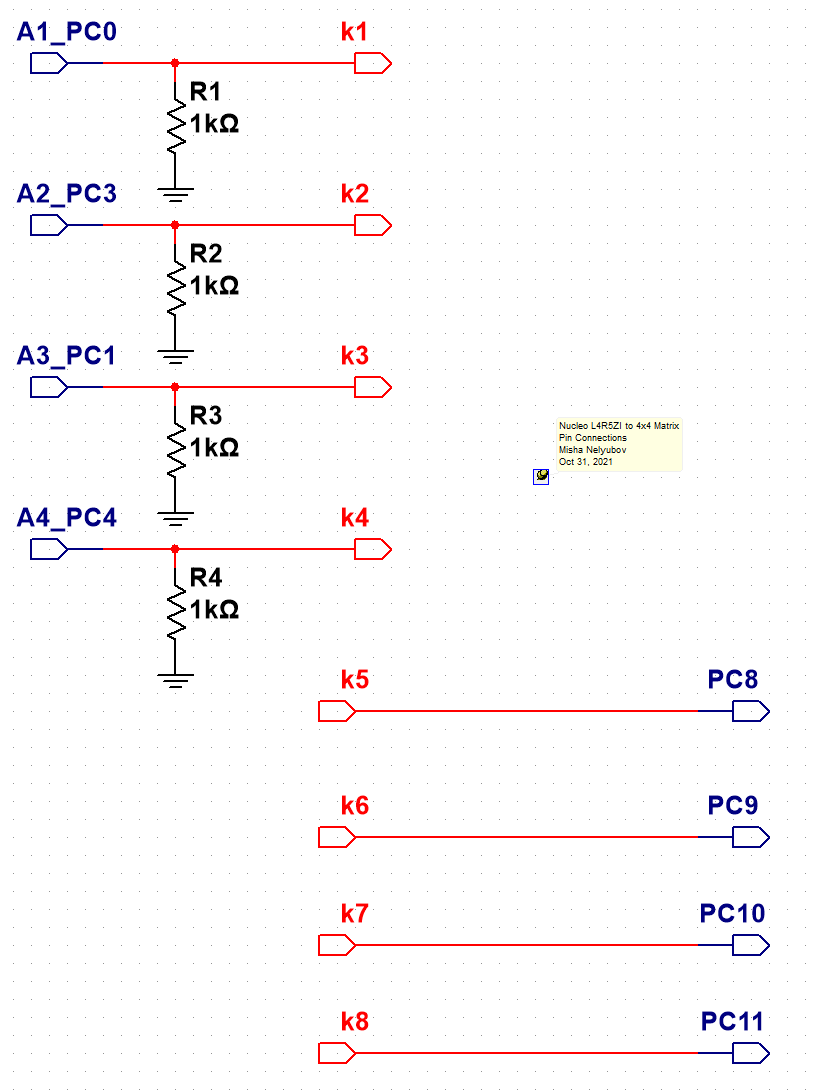


Figure 1. The eight pin connections between the NUCLEO microcontroller and 4x4 matrix keypad. Connectors k1-k8 represent pins 1-8 of the matrix keypad.



Figure 2. The four pin connections between the NUCLEO microcontroller and LCD.

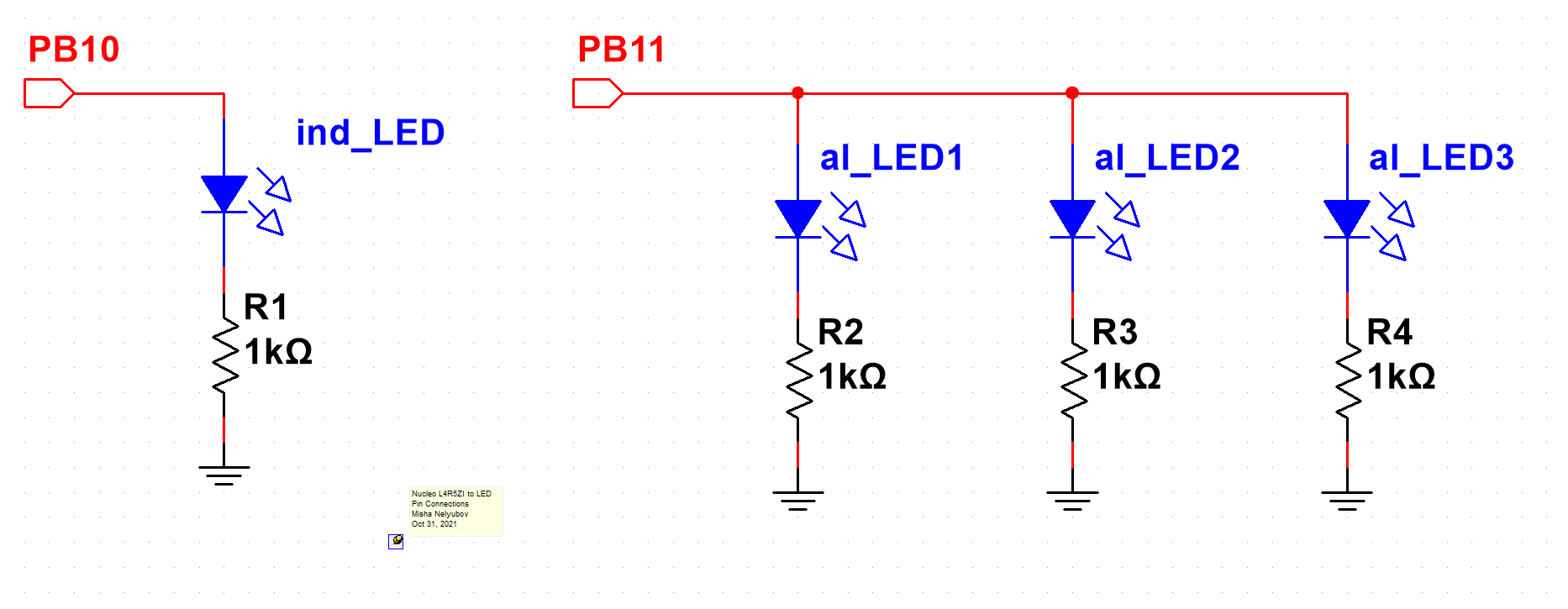


Figure 3. The two pin connections between the NUCLEO microcontroller and the indicator and alarm LEDs.

# Test Plan

# Results

# Recommendations for Improvement

The timer currently suffers from several constraints. The following recommendations are given for consideration in future revisions:

1. Increase the maximum duration of the timer to be greater than 9 minutes and 59 seconds, thus allowing the system to be used for longer-duration applications.
2. Add a paused mode between the countdown and stopped modes where the time being counted down is paused, but not cleared. From this mode, allow the countdown to be resumed from its paused value by pressing A or fully cleared back to the stopped mode by pressing B again.
3. Add an audio output component for the alarm so that users in proximity of the system can be alerted to the remaining time reaching zero without the need to be looking at the system to recognize that this is the case.