CSE 321

Real Time and Embedded Operating Systems

Project 2**, Fall 2022**

Bruno Sato

University at Buffalo
Department of Computer Science and Engineering
School of Engineering and Applied Sciences

Table of Contents

Project Overview

The main objective of this Project was to develop a lock implementation using a matrix keypad to input digits, and an LCD to display the status of the lock (locked or unlocked).

In order to implement this project, a lot of general purpose input output (GPIO) knowledge was used with an STM32L552 Nucleo. In addition, one of the requirements of the project was to properly use an Interrupt.

Constraints/Specification Requirements

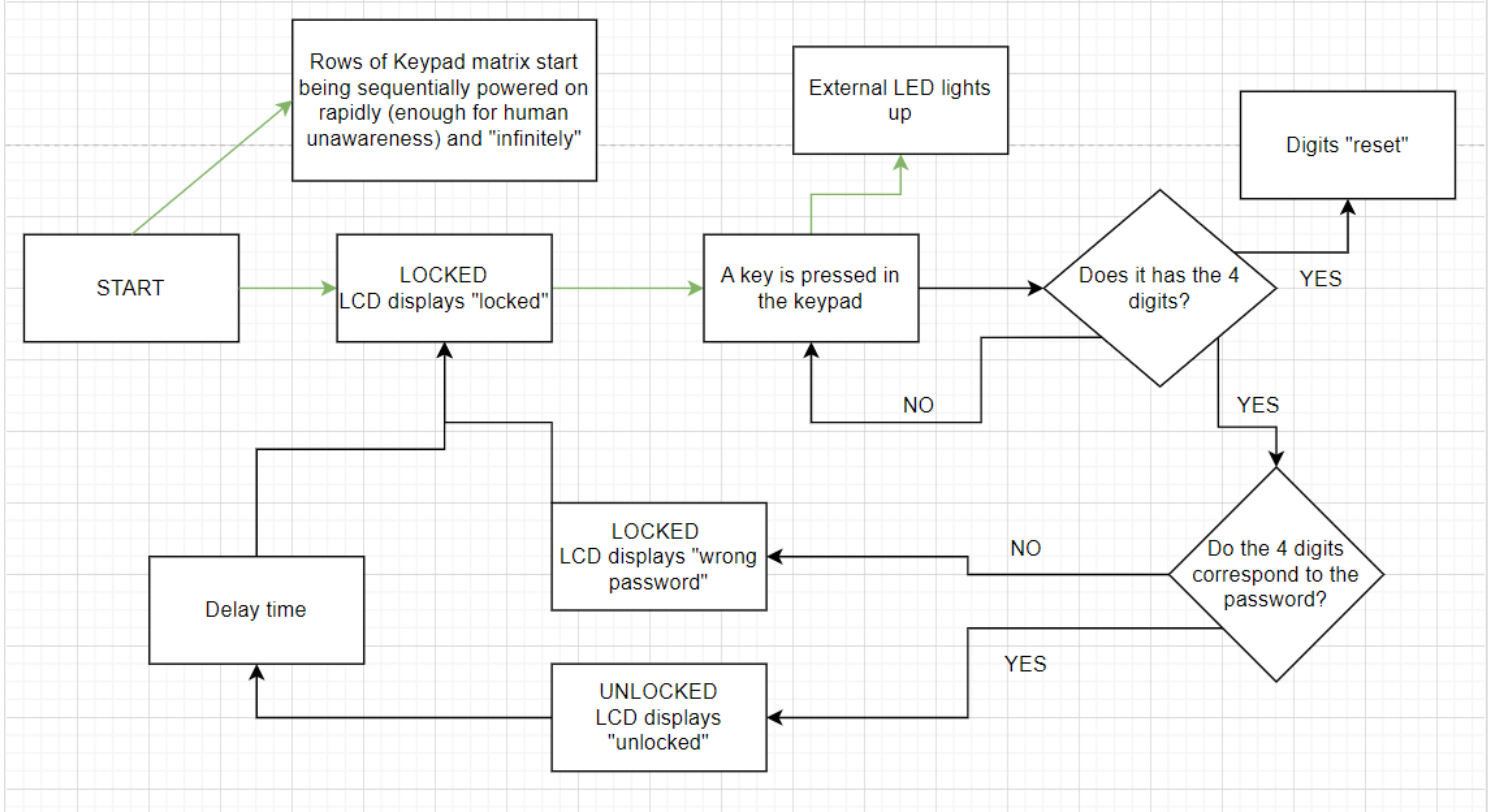
- 4 digit code = last 4 digits of your person number
- Code entered via matrix keypad
- Everytime a value is entered, an LED lights up
- When 4 values are entered it will lock or unlock
- Lock/unlock mode will display on the LCD
- Must have a response of some kind if the wrong code is entered
- Must run “forever”
- BONUS: Add in a password reset to allow user to restart entering their password at any point
  - 10 Points for inclusion in Documentation
  - 10 Points for Code
  - 10 Points for implementation

Features and Applications

- 4x4 Matrix Keypad
- 1802 LCD
- Interrupt

Block Diagram

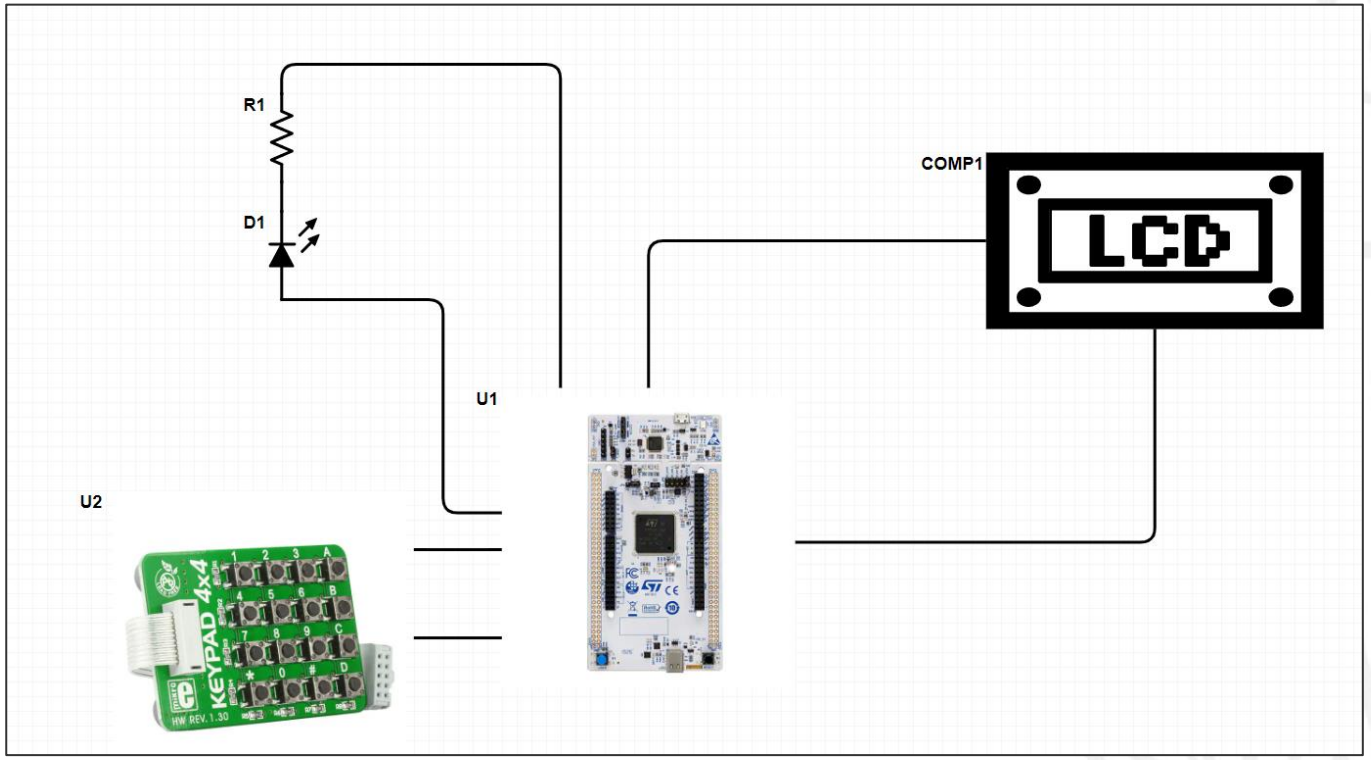
The green arrows represent steps that have been completed in time.



Bill of Materials

- LCD (1802)
- Nucleo
- Keypad
- Solderless Breadboard
- Jumper wires
- LEDs

Schematic



Test Plan

The only Test Plan implemented was for the blinking LED implementation. Every time a key was pressed in the keypad, an external LED should light up.

In order to test if the hardware arrangement and coding was accurate, it was first designed that the LED would light up based on a pushbutton (PC13) from the Nucleo; therefore, whenever there were additions to the code and hardware design, there would be a test case (pushbutton) to make sure the LED and the Nucleo were working properly.

Results

The results were not satisfactory considering the fact that the final version of the project did not have the full functionality originally desired.

However, the project had the full implementation of the LED part of the project; had a functioning LCD, and functioning keypad.

The project could not properly associate the keys pressed as the digits of a password: it did not which key it was or how many had been pressed.

The project could not change the state of the lock: it did not have any unlock implementation.

Recommendations for Improvement

- The biggest suggestion is to start making progress on the project early.
- In addition, there should be more effort put into planning the details of the coding and hardware implementations
- Take advantage of recitation times and/or Office hours: Come to recitation with questions prepared.