MINISTERUL EDUCAȚIEI

UNIVERSITATEA TEHNICĂ
DIN CLUJ-NAPOCA

FACULTATEA DE AUTOMATICĂ ŞI CALCULATOARE
DEPARTAMENTUL CALCULATOARE

Locker Security System
(3 hexadecimal number pin)

DSD PROJECT

Student: Palacian Bogdan-Tudor
Tianu Cosmin-Nicolae

Project supervisor: **Blaj Ileana**

2023

1.Specification

Description:

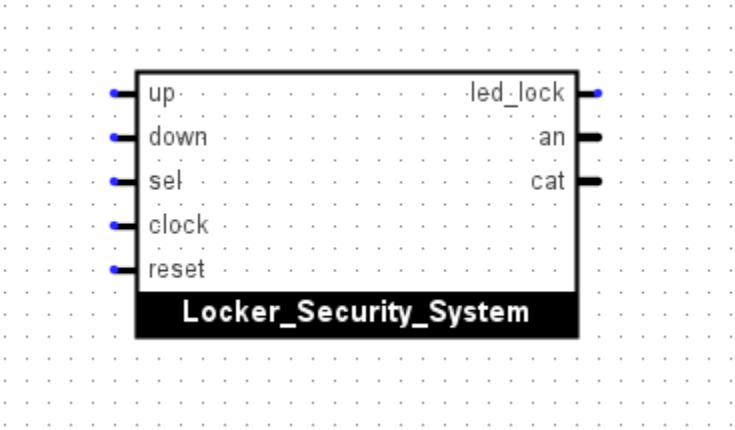
Implement an app that allows the user to add a 3 hexadecimal number PIN for locker security (as seen in lockers used in the mall, sport lockers)

Functional requirenments:

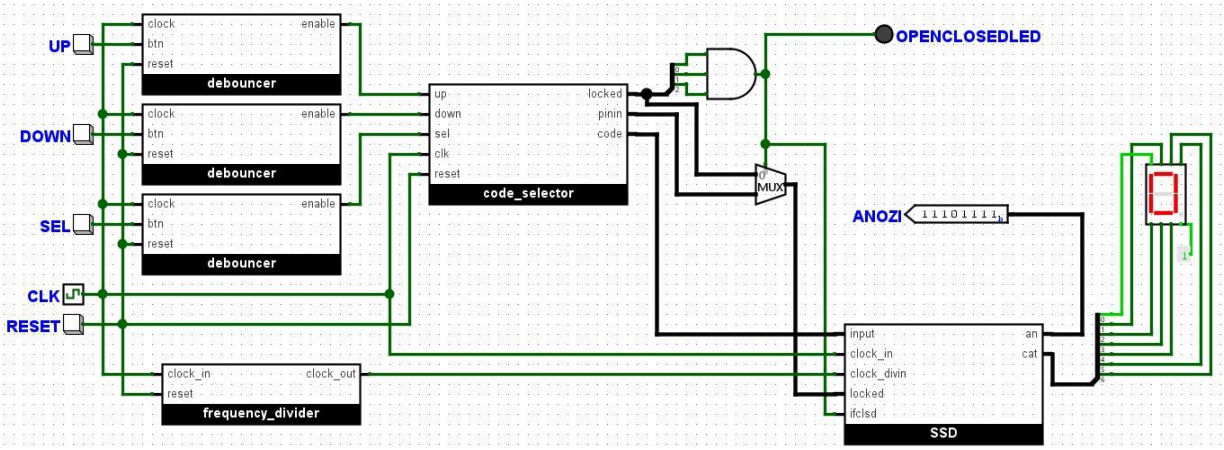
1. A LED **Open_Lock** which signals the fact that the locker is free (LED OFF) or locked (LED ON)
2. The user presses the button **Code_Select** to signal the start of PIN input. A LED **Input_Code** will turn on to signal the state.
3. The user will enter sequentially a 3-character PIN by using **UP** and **DOWN** buttons
4. The characters are 0-1-…-8-9-A-B-…-F
5. Current character is displayed on the **Seven Segment Display** (SSD)
6. To move to the entry of the next character the user will press the **Code_Select** button
7. The previously entered character will still be displayed on the SSD
8. The next character is displayed on the SSD on the next position
9. After the entry of the thirds character, when pressing the **Code_Select** button, the SSD will go off and the PIN will remain locked and the **Open_Lock** LED will be turned ON
10. The **Input_Code** led turns off
11. The existence of a **RESET** button which will reset everything (LEDs and SSD turn off)
12. The user will press the **Input_Code** button to enter the PIN for unlocking the locker
13. Steps 2-8 are gone through again
14. After the new PIN it is compared with the previous one
15. If equal the **Open_Lock** LED turns off and the SSD resets
16. If not equal go to step 12

2.Design

2.1 Black box



2.2Detail diagram

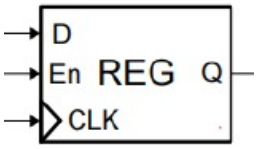


3.Structure and functionality

3.1 Resources

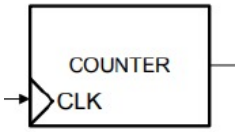
3.1.1 D Flip-Flop

Normal D Flip-Flop used for the implementation of the counters and debouncers. It delays the data input by one clock cycle



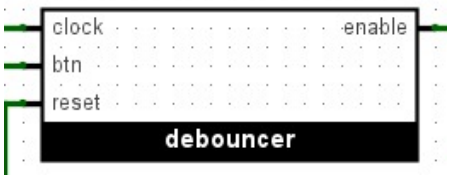
3.1.2 Counter

Counter used by the debouncers and frequency divider.



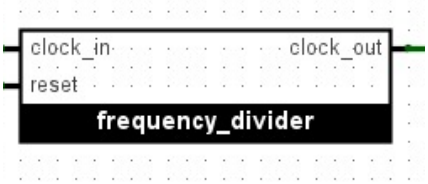
3.1.3 Debouncer

The debouncer is needed for the correct functioning of the physical buttons. The debouncer makes sure that only 1 button press is registered at a time



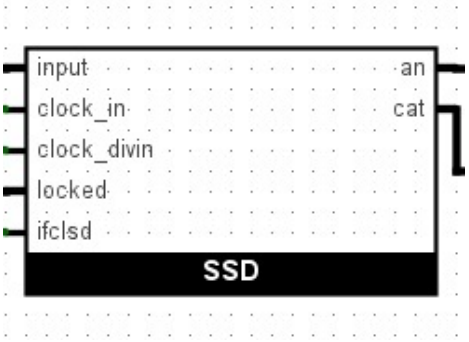
3.1.4 Frequency Divider

The frequency divider is used to divide the frequency of the board in such a way that the user can observe the changes on the SSD. This is used to implement the flashing numbers on the SSD



3.1.5 SSD

Standard SSD control. Ifclsd signal makes the numbers blink



3.2 Flowchart/fsm

Not applicable

4.Utility and results

4.1 Utility

The Security System allows for easy locking any locker that it is implemented on. It is easy to use and the steps are straightforward so even elderly users will have no problems figuring out what they need to do in order to secure their belongings.

4.2 Results

4.2.1 Open Locker

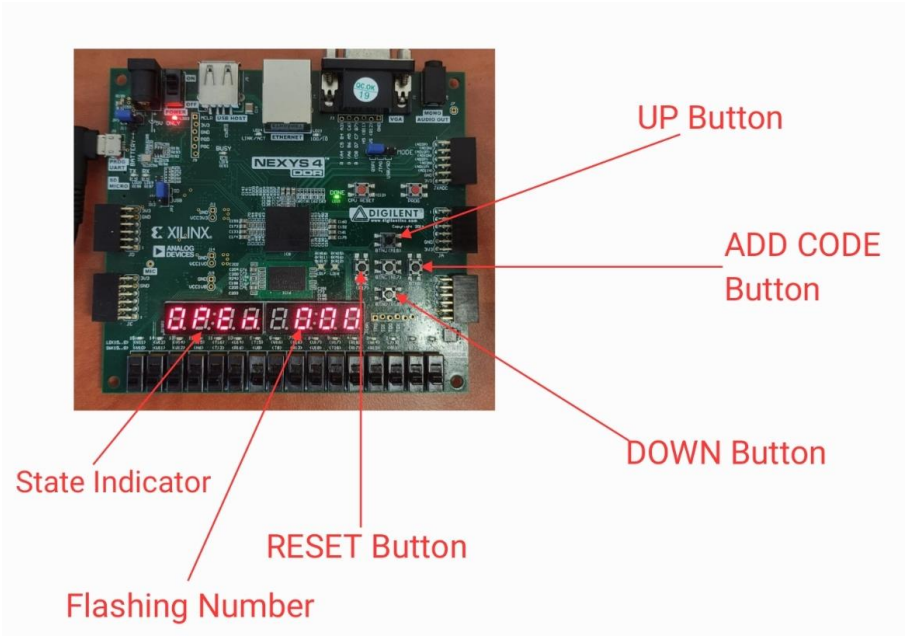
In this part the locker is empty and the display shows OPEN. The user will put their belongings in the locker and will proceed with Code Entry.

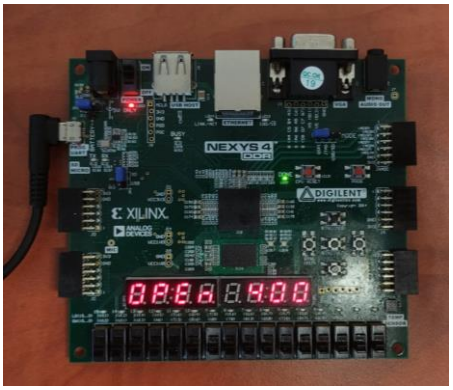
4.2.2

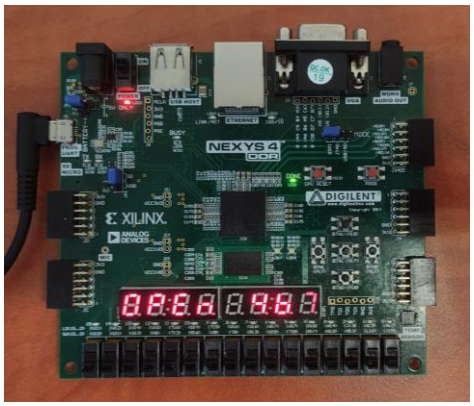
This part will describe the steps for Code Entry. A 3 hexadecimal number code/PIN will be given in order to secure the locker. Each entry will be done separately. The number to be given will flash On and Off. The user will use 2 buttons that will go through the hexadecimal numbers (1 button for up – from 1 to 2, and one number for down – from A to 9). When the user is ready to register the number he will press another button Add_Code.

After 3 inputs the system will go into the Locked state and will await for the password to be given in the same manner. If the password matches the PIN the locker will go in the Open state and a new PIN will be awaited. If the password does not match the PIN the system will stay locked and wait for a new password. In case the user forgets the PIN a RESET button is implemented that will always open the locker.

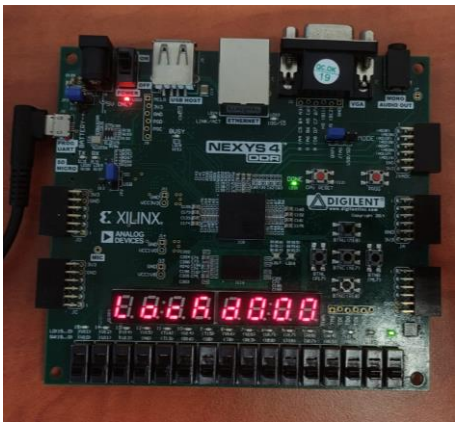
PIN entry:

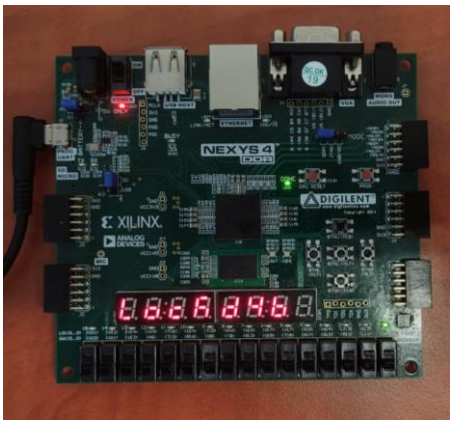

UP Button
ADD CODE Button
DOWN Button
State Indicator
RESET Button
Flashing Number





Password entry:





5.Further development

Implementation of a hexadecimal keyboard for code entry

Implementation of a digital display for better display of Open and Locked states as well as grapchics guiding the user trough the usage steps of the Security System

Implementation of RFID tags (more expensive but more secure)

Changing the RESET button to a master key used to unlock locker if the user forgets the password

Haptic Feedback for pressed keys

Implementation of a system that allows blind users to acces the functions of the locker(for example Braille on the keys of the Hexadecimal Keyboard or a speaker reading the number input and states when the system is in Accesibility mode)

A new BROKEN state could be implemented to show that the system needs maintenance.

6.Technical justifications for the design

We chose this implementation because the usage of the implemented design is very easy and straightforward. Debouncers are needed for correct functioning of the buttons and for avoiding future problems caused by the wearing of the device. We implemented a flashing number to make it clear to the user what number will be given. The OPEN and LOCKED display on the SSD makes it easier for users to find an empty locker.