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## Table of Contents

Cover Page.....	pg.2
Specifications....	pg.3
Features.....	pg.3
Applications.....	pg.3
Block Diagram.....	pg.4
Functionality Diagram.....	pg.5
BOM.....	pg.5
Schematic.....	pg.6
Test Plan.....	pg.7-8

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## PROJECT 2

### Security System Documentation

## Specifications

The system contains a matrix keyboard whose rows are outputs and columns are inputs. The systems' goal is to check if the completed user keyboard input matches the hardcoded password represented by the last four digits of my UBIT number (8632). A user keyboard input is defined as completed when there are four registered inputs. Whenever a keyboard input is received, the system will turn on an LED allowing the user to acknowledge that their input was received by the system. Two LEDs will be used as outputs, and each LED will have its' turn to turn on. Whenever a completed user keyboard input is received, the LCD will inform the user whether the passcode was correct, displaying "unlocked", or incorrect, displaying "locked, try again". If the star button is pressed on the keypad at any point, the user will be able to restart entering their password.

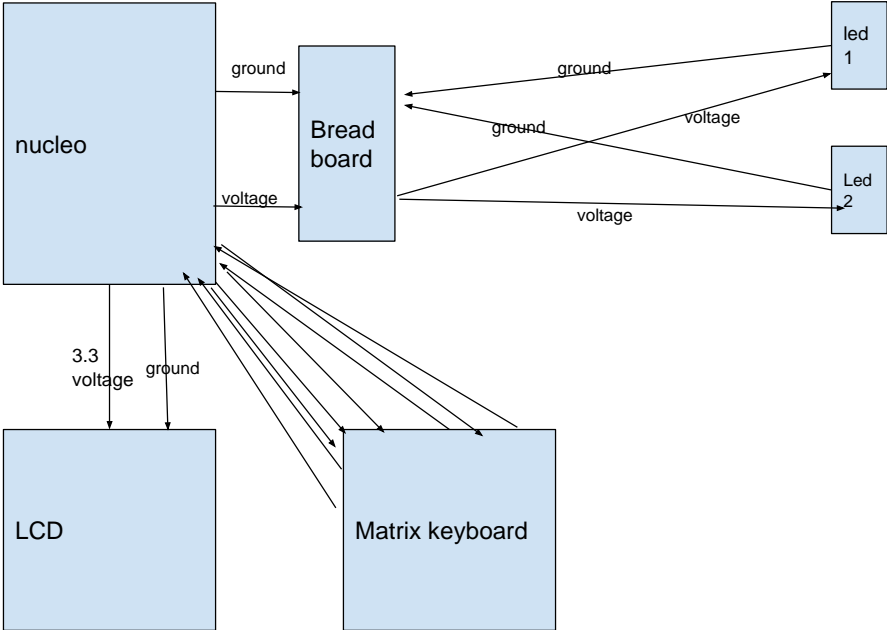
## Features

Features of this design include: a password reset capability allowing the user to reset the password they're entering at any point of the program. Another feature of this design is informing the user in the event that their password is incorrect, that they need to retry entering another password and that the system remains locked.

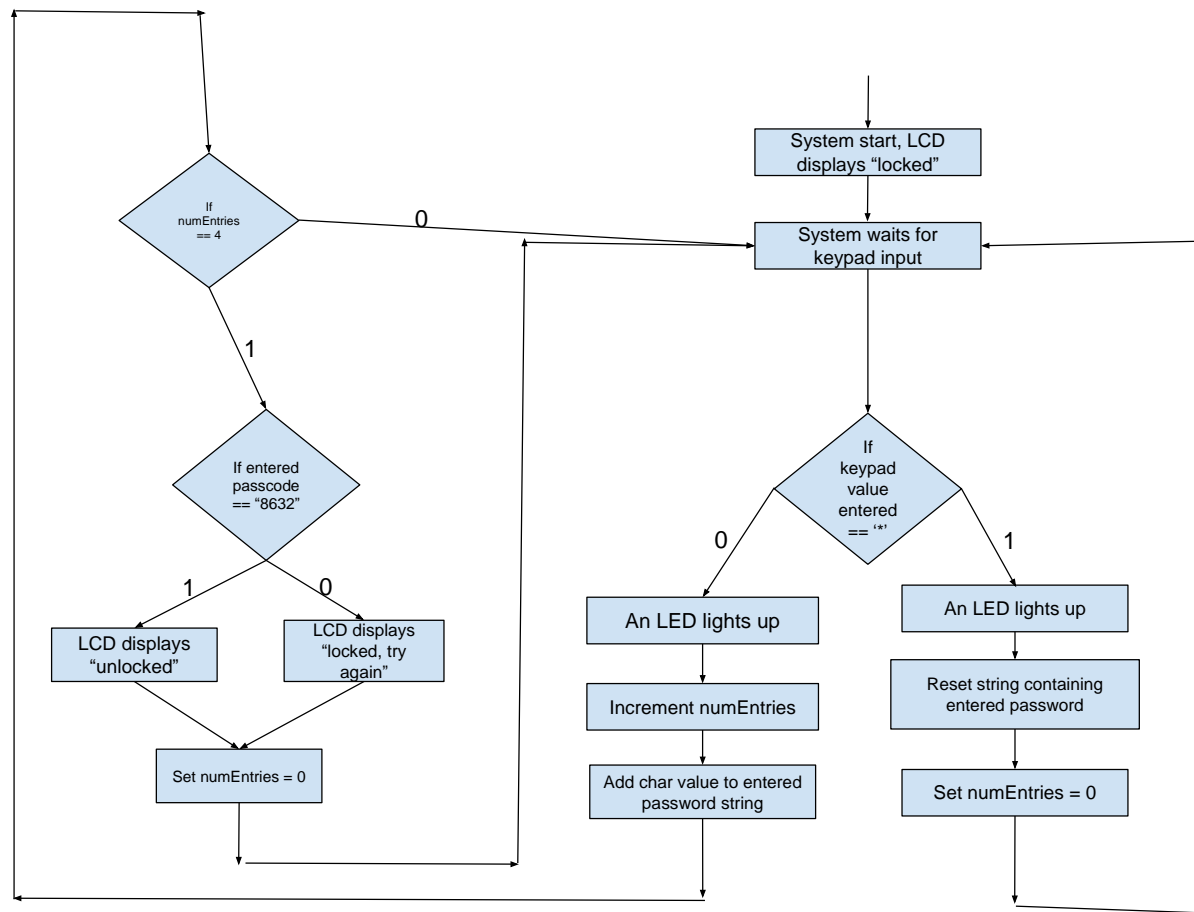
## Applications

This design can be used in an electronic safe for when a user wants to store their valuables into a container. This design can also be used for a home security system, adding on to an already existing system where this design when the correct input unlocks the system, allows the security alarm system to disengage.

Block Diagram



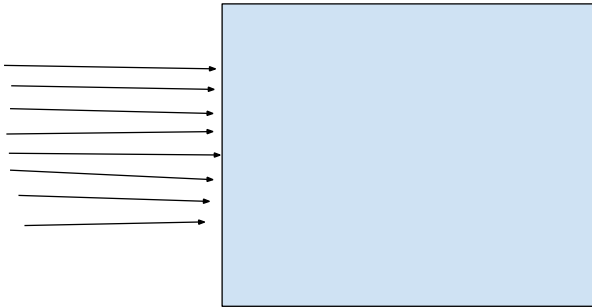
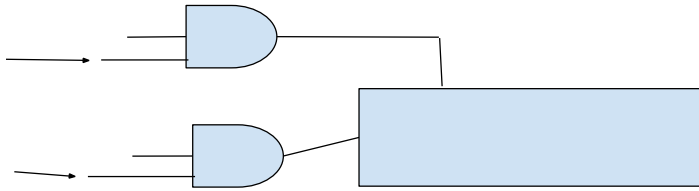
## Functionality Diagram (ASM)



## BOM (Bill of Materials)

- Ten medium-long length male-male jumper cables
- Four short-medium length male-male jumper cables
- One long length male-male jumper cables
- Two resistors
- Two LEDs
- One Grove LCD 1802
- One four-by-four Matrix-Keyboard
- One solderless breadboard
- One Nucleo-L4R5ZI

# Schematic



## Test Plan

### Before Construction

While building hardware set up, ensure that code pulled has all necessary files (lcd1802.h, lcd1802.cpp, mbed\_app.json, main.cpp). Build code in IDE to ensure no errors. Refer to BOM and double check that all materials to build system are present.

### During Construction

Begin set up by plugging in lcd to nucleo l4r5zi. Plug board into computer and run code. Ensure that lcd states "locked". This verifies that the lcd is plugged into the correct pins on the board. Then, plug in matrix keyboard to appropriate pin positions. Run code again and ensure that values pressed in matrix keyboard are recognized and printed to the serial monitor on the IDE. Ensure that values pressed are corresponding to the correct print statements in the serial monitor (pressing 1 should print "1", pressing A should print "A", etc.). Set up LEDs onto bread board, and rebuild program. Ensure that program is built, when built press buttons on keypad. If a LED lights up every time a keypad is pressed, then hardware components functional.

### After construction

Connect system to computer and build program. Clear build, run program. Ensure that program builds with no errors.

#### Testing Matrix Keypad

Press a singular button on the keypad. If the serial monitor outputs the value that you have pressed on the keypad, then test pass. Continue to press random buttons sequentially, checking the serial monitor to see if the input has been received. If the input has not been received, refrain from pressing your button of choice and wait two seconds. Press the button again and check if the value printed to the serial monitor is equal to the value pressed on the keypad. Repeat this process until all buttons on the keypad have been tested.

#### Testing LCD

If lcd displays "locked", test pass. First press four test values of keys within the first column in any order excluding "\*". If lcd prints: "locked, try again", test pass. Then, press three

test values of keys within the first column in any order. For the fourth value, press “\*”. If lcd displays: “reset entries”, test pass. Next, press 8-6-3-2. If LCD displays “unlocked”, test pass. Press four random values in any column and row without making the combination “8632”, and if lcd displays “locked, try again”, test pass.

#### Testing LED

Press every button on the matrix keyboard in a random order. Check the serial monitor and if the LED switches each time a value is recognized by the system, test pass. Make sure to give time in between each press to ensure that entry from keypad is recognized by system.