EE212-Microprocessors Off-Lab Assignment 4

Fall 2023

1   Introduction

In this lab, you will implement a simple security system that takes an identification number and a password. Furthermore, this security system will have an administrator mode that can delete existing users or add new ones. You will use keypad and 16x2 LCD modules with Freedom Board. Thus, it is important to enable keypad and LCD modules before starting to implement a security system. Following functionalities of your implementation will be the basis for grading.

2   Implementation

2.1   Required Functionalities

- Entering a password and an ID.

- Checking the ID and password if they match with a user on the system.

- For normal users, two possible action. Granting or denying access.

- For administrator, 4 possible action. Granting or denying access, deleting a user and, adding a new user.

- There is one administrator user and it can't be deleted by administrator itself.

- In administrator mode, there are 3 possible actions. Access, add user, delete user. To choose between those actions, you will use 'A', 'B', 'C' or 'D' keys in keypad.

- Print indicating texts on LCD to guide users. For example, you can as for ID of a user by printing **Enter ID:**. Similarly, for administrator mode, you can print **Enter an Action: Pass, Del, Add**.

- '#' key on keypad will be used as an enter key.

- Password and ID has to be more than one digit.

2.2 Implementation Steps

1. Check **this link** for keil installation. For the following labs, you will use this IDE to write and debug programs in C language.

2. Run demo code in this **link**. This code also contains LCD connections to the Freedom Board.

3. Connect LCD and keypad to the board. Pin connections are provided within the code.

4. LCD requires extra supply. Connect the voltage supply (5V-2A Adapter, or you can use the power supply in lab) to the LCD (**NOT TO THE BOARD**). Connect only the **GND** of the power supply to a **GND** pin on the board. Check [1] for more details on LCD display.

5. Make sure that demo code works properly on your setup.

6. Follow the pseudocode given at next part if you like. You can follow different approach when designing your algorithm. However, it is a must to make it work correctly.

3   Assumptions

- Maximum number of users is 5. If this capacity is reached, a warning message should be printed on LCD.

- All messages will be printed for 1 second. After that, the program will continue running.

- ID and password are two unsigned integers (32-bit uint), ranging between 0 and 4,294,967,295.

- Print ID and password on LCD. If you want, you can hide password with '*' character for each digit of password. However, ID should be printed on LCD as it is entered from keypad.

- For deleting a user, ID is sufficient. However, when adding a new user ID and password of new user are required.

- Example Display for ID Entering Step:
  LCD ROW1: Enter ID:
  LCD ROW2:22222222

- Example Display for Password Entering Step:
  LCD ROW1: Enter Password:
  LCD ROW2:1234
  or
  LCD ROW2:****

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4 Pseudocode

```
/* Main Function Structure
Get an id
Get a password
Check if true and valid
valid:User ID is valid or not. An old user may attempt to enter
If false
  Print Wrong Password
If true
  Check if it is admin
    If admin, grant 3 options
    Check Keys
      Key is A
        Print 'Access Granted'
      Key is B
        Check Capacity
        If exceeded
          Print 'Capacity is Reached'
        Else
          Print 'User ID To Be Added'
          Get ID
          Print 'Password for New User'
          Get Password
          Add User
      Key is C
        Print 'User ID To Be Deleted'
        Get ID
        Delete User
      Other Key
        Print 'Wrong Key'
    Else
        Print 'Access Granted'
Repeat Forever
```

References

[1] *In-Depth Tutorial to Interface 16x2 Character LCD Module with Arduino*. [Online; accessed 12. Apr. 2022]. Dec. 2020. URL: `https://lastminuteengineers.com/arduino-1602-character-lcd-tutorial`.