Term Project Assignment

Hotel Safe

Objective

Hotel Safe is an electronics system with a CPU, a numpad, a 2-row LCD, 2 motors and an Emergency LED. It has 2 sections with individual passwords, a master password to open any section and a bait password that when entered will alert the police. It is a simplified application of an actual safe system. The objective in building this system is to apply what you have learned in this course for a real-life situation and get a better understanding of what you have learned.

You must work individually. If you get stuck, you may work together with your friends, but everyone should upload their own solutions.

Environment & Components

- Proteus
- Microcontroller (you can use multiple)
- Numpad
- 2-row LCD (at least 2x16)
- 2xMotor
- Emergency LED

Note: You are free to select models of your components (PIC, AVR, Arduino, DC motor, stepper motor etc.).

Passwords

All passwords are 4 digits [1-9].

- Master Password (can be used to open either section, change passwords or report attempts)
- Side Password 1 (can be used to open section A)

- Side Password 2 (can be used to open section B)
- Bait Password (is used to open the desired and call the police (Emergency LED))

Motors & LCD

The motors in this system represent the opening and locking mechanism of the safe. To open a section, the motor of that section must be rotated left 2 times. And to close it, the motor must be rotated right 2 times.

The LCD screen shows some physical states of the safe. There are 2 rows in the LCD screen. The first row is used to indicate the current state ("Welcome to Hotel Safe", "System Locked Enter Main Pass" or "No access, %d seconds" (%d is the countdown from 20) etc.). **The second row is used to display the entered digits from the numpad (the passwords must be shown as stars, "*"),** the processes of opening or locking sections, whether a wrong password is entered or the number of successful and unsuccessful attempts.

States and Functionality

Below is the functionality of the system. There are 3 states. In main screen, there are 4 options: Open/Lock Section A, Open/Lock Section B, Change Password and Report Previous Attempts. These options are chosen by entering the corresponding number from the numpad.

For example, in the case that 1 (Open/Lock Section A) is chosen, if the person enters the master password or the side password 1, the system will open/lock section A with the motor turning and the LCD displaying "Section A opening/locking" and then the system will go back to the Main Screen. If the person enters the bait password; the section will open in the same way, but also the Emergency LED will blink for a second. If the person enters any other password; the LCD will display "Wrong Password", Increase Successive Failure Attempts (SFA) counter, if SFA < 3 it will go back to Open/Lock Section A, if not, it will go to Master Lock Screen.

For the Change Password function, the system will expect the master password to be entered, if not, it will behave in the same way as when a wrong password is entered in Open/Lock Section A. If the master password in entered, there will be 4 choices which you can see below (i, ii, iii, iv represent the numerals 1,2,3 and 4).

When 4 (Report Previous Attempts) is chosen, the LCD will display the number of successful and unsuccessful attempts ("X successful, Y unsuccessful attempts"). Please keep in mind that total number of unsuccessful attempts **is not the same as** SFA.

The state "Master Lock Screen" is where the user can enter the master password to unlock the system (go to the Main Screen) or enter any other password to lock the password entering mechanism for 20 seconds (go to Time Lock Screen). In the state "Time Lock Screen", the system will wait 20 seconds, update the LCD according to time, and will not accept any inputs. Then it will revert back to the Master Lock Screen.

A. Main Screen (LCD: "Main Menu") -> Enter 1, 2, 3 or 4
    1. Open/Lock Section A (LCD: "Enter Pass. A")
        a. Enter Master Password or Side Password 1 -> open/lock section A (LCD: "Sect. A opening/locking") -> return Main Screen
        b. Enter Bait Password -> open/lock section A (LCD: "Sect A opening/locking") and blink Emergency LED -> return Main Screen
        c. Enter Any Other Password -> (LCD: "Wrong Password") -> Increase Successive Failure Attempts (SFA) counter -> if SFA < 3 return Open Section A, else GOTO Master Lock Screen.
    2. Open/Lock Section B

       Same as Open/Lock Section A.
    3. Change Password (LCD: "Master P. for CP")
        a. Enter Master Password -> Enter 1, 2, 3 or 4 (LCD: "CP 1M 2A 3B 4T)
            i. Change Master Password (LCD: "Enter New Pass M") -> Enter New Password -> Change the password (LCD: "Pass is changed") -> return Main Screen
            ii. Change Section A Password (LCD: "Enter New Pass A") rest is same with i.
            iii. Change Section B Password (LCD: "Enter New Pass B") rest is same with i.
            iv. Change Bait Password (LCD: "Enter New Pass T") rest is same with i.
        b. Enter Any Other Password -> (LCD: "Wrong Password") -> Increase Successive Failure Attempts (SFA) counter -> if SFA less than 3 return Change Password, else GOTO Master Lock Screen.
    4. Report Previous Attempts (LCD: "XX successful, YY unsuccessful attempts") (you may shorten this in a meaningful way) after a few seconds -> return Main Screen
B. Master Lock Screen (LCD: "System Locked MP")

a. Enter Master Password -> GOTO Main Screen
b. Enter Any Other Password -> GOTO Time Lock Screen

C. Time Lock Screen (LCD: “No access %d sec”, countdown from 20)) -> wait 20 seconds (do not accept any input) -> return Master Lock Screen

Important Notes

- Functions are chosen by entering the corresponding numbers from the numpad.
- You do not have enter button. When you type 4 digit as password or pressing a valid number in the menus, it enters automatically.
- If there is an LCD message between state changes (such as “Pass is changed”), it should be visible a few seconds.
- If there is no new LCD message in the next state, you should preserve previous one.
- SFA should be cleared after a successful attempt or 15 seconds later from the last unsuccessful attempt.
- Use timer and interrupt for clearing SFA.
- SFA and total unsuccessful attempts are different.
- Initial passwords should be -> master: 1234, section A: 2222, section B: 3333, Bait: 9999.
- Locks should be initially open.
- Motor accuracy (rotating exactly two times) affect your points.
- For bonus points, you can save the passwords and number of attempts in EEPROM registers.

Submission and Reports

You must submit all files related with your project (codes, designs files, hex files etc.).

You must also prepare a detailed report of the project, how you accomplished each part, your calculations, how the system works as a state machine and so on. There must also be a part that acts as a user manual. 3-5 pages without cover is ideal.

Submission due is 31 May 23:59. Please do not wait until last week and start as early as possible.

Good Luck