

## ECE2216 Group Assignment

### Objectives

- Gain experience in assembly language programming with MCS-51 instruction set.
- Apply the interfacing techniques learnt through ECE2216.
- Learn the fundamental of microcontroller system simulation.
- Appreciate the importance of coordinated teamwork and project management.

### Summary

- Group assignment (2 to 3 students per group)
- Date released: **20 July 2020**
- Date of submission: **28 September 2020**
- Assessment marks: 30%

Each group should submit the **group list** (name, student ID and email of each group member) via the following Google form latest by **30 July 2020**.

<https://forms.gle/2nvuh8evJxSuhkZE9>

### Description

Electronic locks are locking devices which are usually associated to access control system. They may use magnets, solenoids, or motors to engage the lock via supplying or removing of electric current. There are various authentication methods used with electronic locks, such as using numerical codes (passcode), smart card, biometric, RFID etc.

In this assignment, the students are required to implement and simulate an electronic lock system using the Edsim51 simulator, which is based on the 8051 microcontroller. The system allows the user to enter a 4-digit passcode via a keypad as the mean for authentication (as shown in Figure 1). Thus, it will make use of the keypad, the LCD display module, the motor and its sensor and a switch (SW0) of the simulator.



Figure 1: An electronic lock with keypad.

Basically, the system has four modes of operation as described below:

- i. Initialization Mode
- ii. Passcode Changing Mode
- iii. Authentication Mode

### Initialization Mode

The system will go into this mode upon power on or system reset, which consists of performing the following sequential steps:

- i. Rotate the motor counter-clockwise to the initial position (indicated by the motor sensor).
- ii. If the door is currently closed (SW0=1), close the lock by rotating the motor clockwise for 1 rotation. Otherwise, just proceed to the next step.
- iii. Wait for the user to press a key.
- iv. If the key pressed is '\*', go to the 'Passcode Changing Mode'.
- v. If the key pressed is '#', go to the 'Authentication Mode'.
- vi. Go back to step (iii) if any other key is pressed.

### Passcode Changing Mode

The following steps are carried out sequentially in this mode:

- i. Prompt the user to enter the current passcode (a default passcode should be used after power on or system reset).
- ii. If an invalid passcode has been entered, go back to step (iii) of the 'Initialization Mode'.
- iii. If a valid passcode has been entered, prompt the user to key in a new 4-digit passcode.
- iv. Prompt the user to enter the new passcode again for confirmation.
- v. Go back to step (iii) of the 'Initialization Mode'.

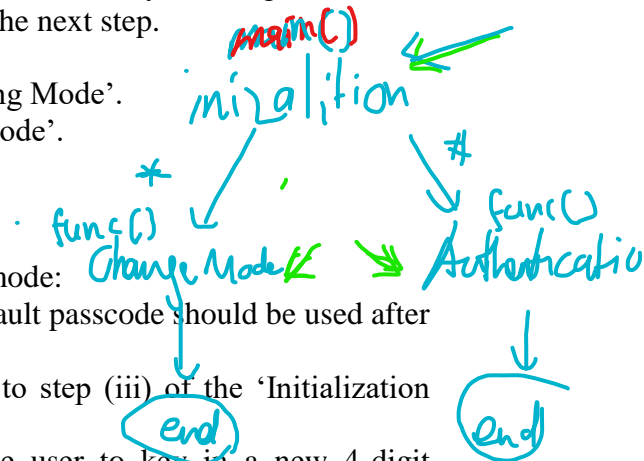
### Authentication Mode

The following steps are carried out sequentially in this mode:

- i. Prompt the user to key in the current passcode (a default passcode should be used after power on or system reset).
- ii. If an invalid passcode has been entered, go back to step (iii) of the 'Initialization Mode'.
- iii. If a valid passcode has been entered, open the lock by rotating the motor counter-clockwise for 1 rotation.
- iv. Wait 30 seconds before going back to step (ii) of the 'Initialization Mode'.

### **Requirements**

In this assignment, each student should write an assembly language program using the MCS-51 instruction set to carry out the four basic modes of operation described above and to simulate the system using the Edsim51 simulator. Additional marks will be awarded if extra features (e.g. limit to only 3 attempts to enter correct passcode) or operation modes are implemented. In this case, the extra features or operation modes can only use the devices or peripherals available with the Edsim51 simulator.



**Mode of submission**

- One report per group (marks will be deducted for wrong format):
  - Single spacing with 12-pt Times New Roman; **min** 6 pages, **max** 10 pages excluding cover, source codes and appendices.
  - A cover showing the **subject name and code, name, group number** (will be assigned), **student ID, email and course/major** of each member.
  - The report should include the following sections:
    - Introduction.
    - Discussion of the developed system.
    - Block diagram of the system.
    - Schematic diagram of the system
    - Flowchart of the assembly program.
    - Conclusion.
    - **ONE PAGE** per group member, individually authored, outlining that person's reflections on what he/she has contributed to the team effort and what he/she has gained from his/her participation (must be **SPECIFIC**).
    - Bill of materials (list of hardware components, their price and justifications of why the components are required).
    - Minutes of at least **THREE** online meetings (dates, times, attendees, screenshots of the meetings and a summary of discussions during each meeting).
- Video file demonstrating the working simulation (in landscape mode with subtitle).
- Online submission via Google Classroom in the form of one compress file (e.g. ZIP file) per group containing the following items:
  - i. Complete source codes in ASM format.
  - ii. Assignment report in PDF format.
  - iii. Video file of the simulation.
- Due date: **28 September 2020**.
- Late submission: minus **3%** (out of 30%) per day.

**Assessment Scheme****Report**

A brief but succinct introduction to the assignment	-1.5
A concise discussion of the system	- 3
Block diagram, schematic diagram and flowchart	- 6
A conclusion summarizing the achievement and limitation of the programs	- 1.5
One page on personal reflections (one page per member)	- 2
Bill of materials	- 3
Minutes of meetings (at least 3 meetings with dates, times, attendees, screenshots and a summary)	- 3
<b>Subtotal</b>	<b>- 20</b>

**Video**

All functions are demonstrated via simulation	- 5
<b>Sub-title</b>	<b>- 1</b>
	<b>- 6</b>

**Online interview**

Personal Q & A	- 2
<b>Team Q &amp; A</b>	<b>- 2</b>
	<b>- 4</b>

<b>Total</b>	<b>30%</b>
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