

You are required to design a door lock system with the following features:

- 1- System is consisted of the following hardware components:
 - An atmega32 microcontroller.
 - A 2*16 character LCD with the Hitachi44780 controller.
 - A 4*4 phone keypad.
 - A 5v dc motor.
 - An ultrasonic sensor with two control pins.(HC-SRO)
 - A potentiometer.
 - A 5v relay.
 - Two limit switches.
- 2- System main features:
 - System shall provide a door access using 6 digits password.
 - System shall provide an ability to change the system password.
 - System shall provide motion detection to activate the user interface.
 - System shall provide an control to the door opening speed.
- 3- Main scenario:
 - By default Door is closed, screen is off.
 - Once motion detected, screen will be turned on and a welcome message shall be moved from one screen side to the other.
 - A request shall be displayed to ask the user to enter the password.
 - Once a password is entered successfully door will be open then wait for 10 seconds then closed.
 - If password is not entered successfully, door will not be open and a request shall be displayed to the user to try again.
 - Maximum number of triers are three. After that system shall wait for 5 seconds and then reset the number of triers.
 - The wait time shall be doubled every time the user use all the triers.
 - If a power off happened, both triers and password shall keep their last values.
 - At any time, door speed shall be controlled in an analogue way.
 - If the user pushed # for three seconds, he will have the ability to change the password after entering the old one with the same triers' algorithm.
 - After door closing, screen shall be powered off.
- 4- More constraints per each functionality.
 - Motion detection:
 - o Ultrasonic sensor shall be used for motion detection.
 - o Detection distance is 4 cm.
 - o Scanning period shall be 200 ms.

- Door opening and closing:
 - DC motor shall be used for door opening and closing.
 - The limit switches shall be used to detect if the door reached its destination.
 - Limit switches scanning period shall be 20 ms with debounce handling feature.
 - In the debounce handling, a press shall be detected only if 5 successive samples read as 0.
 - At any time, motor speed shall be controlled using potentiometer.
 - Potentiometer scanning period shall be 50ms.
- Password scanning:
 - Keypad scanning periodicity is 100ms.
 - Only one press shall be considered from a keypad key. The new press shall be considered after releasing the last one.
 - * key shall be used to delete one digit.
 - # key shall be used to enter password in case of being pressed for a time less than three seconds.
 - # key shall be used to request a password change in case of being pressed for more than three seconds.
 - In case of entering password, # key press shall be considered only if there are 6 digits on the screen.
 - Digits shall be displayed as *.