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FPGA based System Design (2EC202) Assignment Report

"PASSWORD BASED DOOR LOCKED SYSTEM"

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SEMESTER-4

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Objective

The objective of such Systems is to carry out the enhancement of security as well as to give a more simplified control of access by demanding unique passwords for entry. These systems strive to ease the users' and administrators' lives maximizing the possibility of e-access for specific uses and applications; by the way, they have a capacity to grow.

Abstract

This report presents the design and implementation of a password-based door locked system using Verilog Hardware Description Language (HDL). The system allows users to operate different modes to lock, unlock and password change a door using a password mechanism by using FSM and a password verification. The Verilog code is developed to simulate the behaviour of the door locking system, demonstrating its functionality with different modes.

Keywords:

Verilog Hardware Description Language (HDL), door locking system with different modes, password authentication and verifications using FPGA, Finite State Machine, Digital Logic Design, Clock, Reset, Door Sensor, Password Change, Correct or Wrong Password, Door Locked, Input Password.

Literature survey of password-based door lock system

This literature survey gives the knowledge about the whole aspects of password-based door locked system using

Verilog HDL. Here in this Survey, we can describe the History (Introduction), usage, drawbacks and description of the door lock system using Verilog HDL.

Introduction

The main objective of the project is to design the password-based door lock system with low cost and have the reliable security. Recently, robbery cases have been increasing and one of the factors that contributes to the growth of these cases is the weakness on the old-style home security system. The old-fashioned key and lock system may bring many challenges to the effectiveness or reliable of the system. Since the keys are the risks of being lost and duplicated.

The advancement of technology has introduced a Digital logic design combination password-based lock system in which only the house owner and selected people can unlock the doors by knowing the password. A main goal of this system is to design and develop a Digital logic design combination password-based lock system using Verilog code. The entrance door of a house will only unlock if the users give the correct password. A Verilog code of the password-based door lock system had been designed in Intel Quartus 2 Software. The simulations are performed in Modalism Software. And the verification is in FPGA board.

Description Of the Verilog HDL code

The Password based door lock system module had a

several input, output, different operations, and internal registers.

- Inputs: Clock: For Synchronous Operations.

  Reset: Use to reset the system.

  Door sensor: Indicating the state of door 1 ' for locked and '0' for unlocked).
  Password change: Change the password.

  Password input: input for new password.

- Outputs: Correct password: output indicating the password is correct or not.

  Wrong password: output indicating the password is wrong.

Door locked: output indicating the current state of the door ‘1’ for locked and
‘0’ for unlocked.

- Internal registers: Password: 4-bit register for storing the current password.

  Mode: 2-bit register represent the current mode of operations.

Design overflow

The password-based door lock system is designed using Verilog HDL, a hardware description language commonly used for digital circuit design. The system consists of several modules, including input and output interfaces, password management, and control logic.

The overflow of the code for different operation is done in design overflow.

- The module name of the code is "door lock system".
- When reset the system reset the password and goes to default value. Here default value is (1 1 11) and it set the door locked.
- The whole operations are done on the positive edge of the clock.
- When there is no reset, the system depends on current mode and different mode had a Different action.
- If (mode 00) the door sensor indicates that **door is locked** and the input password is correct then the door is unlocked and set the correct password. This mode is called as door locked mode.
- Door unlocks mode (01): If the door sensor indicates that **door is open** and the input password is correct then the system switches back to the door locked mode. If the input password is wrong then the system remains in unlock mode and set the wrong password
- Password change mode (10): When the system receives the **request to change the password** it updates the password to provide input and switches back to door lock mode.
- The default mode is door locked mode.

Limitation Of the Technology

There are many limitations or drawbacks of this password-based door lock system which are as follow:

- The password-based locking door system has several weaknesses that reduce its reliability and operation as a result. Then, there are security risks, including phishing, malware, or social engineering, which can be used to steal passwords and, therefore, eliminate authorized access. Also, the human being part in the password sharing issue, which occurs both intentionally and unintentionally, is critical, and it is very risky at workplaces or households.
- Consequently, the quality of passwords that users themselves select is important because strong passwords better resist data breaches. While the enforcement of strong password policy might help to reduce the risk, users may fail to remember intricate passwords, in consequence, it would be difficult for them. In addition,

challenges of system acceptance and security are user errors that results in authentication failures and therefore access denials.

- While security is of paramount importance, forgotten passwords or loss of passwords lead to situations where the users are lock out however the entry is possible with the manual key on such occasion. In order to solve the problem users should remember their passwords but at the same time these shortcomings are rather built-in weaknesses of the password system of the smart door lock.

Proposed solutions

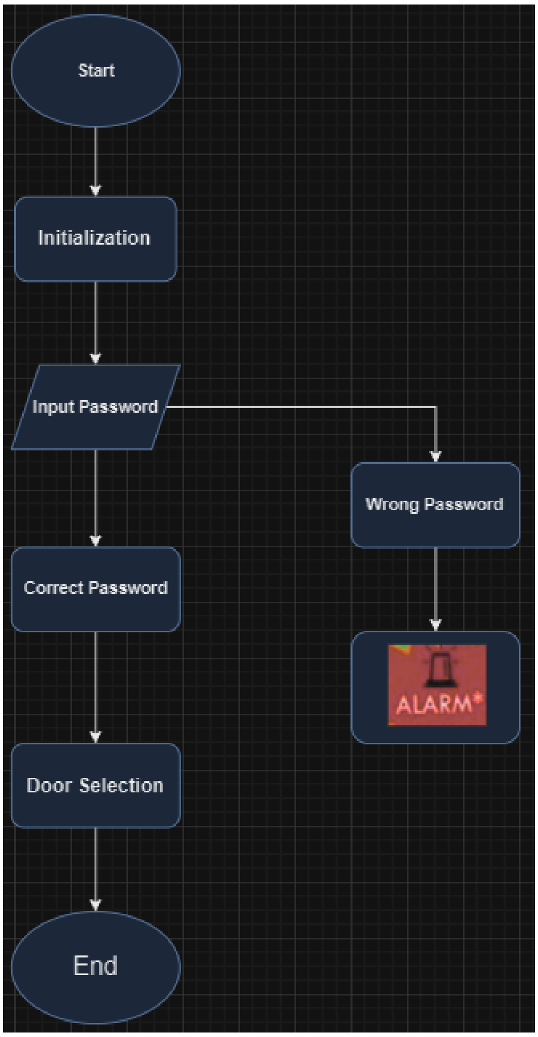
There are many solutions or we can say the methodology by which the password-based door lock system is protected which are as follow:

- The concept of password locks security is mostly attention via various methods. Besides, putting into practice strong password policies means that users must create complex and secure passwords which consist of groups lowercase and uppercase, numbers, and special characters. Consumers need to understand the necessity of assigning repeatable passwords and refrain from using simple things like birthdates or the common words.

- Using a different password every month (password rotation) prescribed to reduce the probability of password stealing. The system promptly invites users to frequently execute password renewal of fresh ones which has nothing to do with repetition of old keys which then ensures reduction of vulnerabilities. Likewise, awareness programs not only equip users with demonstration sessions on common cyber threats, but also teach them how to choose good passwords and what responsibility users have towards safeguarding their account information. There are repeated reminders about the need of the password truthfulness that shows them an immediate action to be taken in case of a suspicious transaction happening.

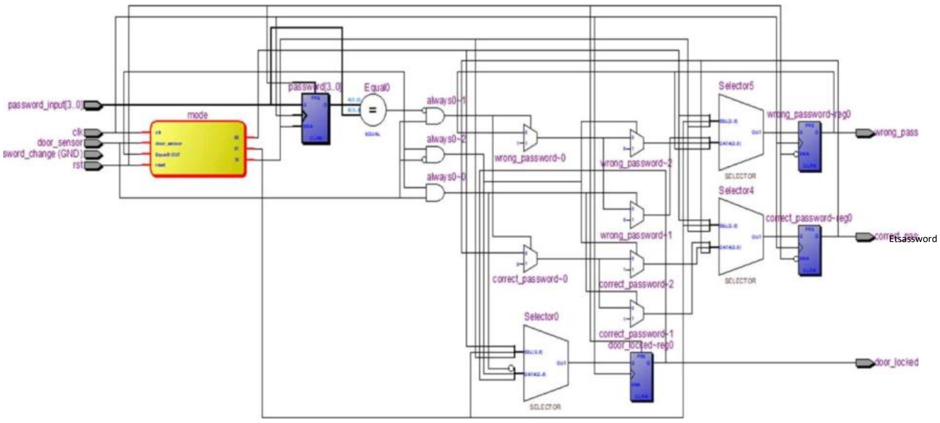
- Integration with password managers become the already-existing solution for the purpose of safely storing and managing passwords. For example, by relying only on password management tools, the users may not get tempted to choose weak or guessable passwords. Besides this, keeping in sync with password managers streamline more the process of password management and this gives no opportunity for password thief to steal them. Therefore, an intelligent password less access system consists of all these options, its security stays high above, while at the same time offer a superior user experience.

Flow Chart of the Code



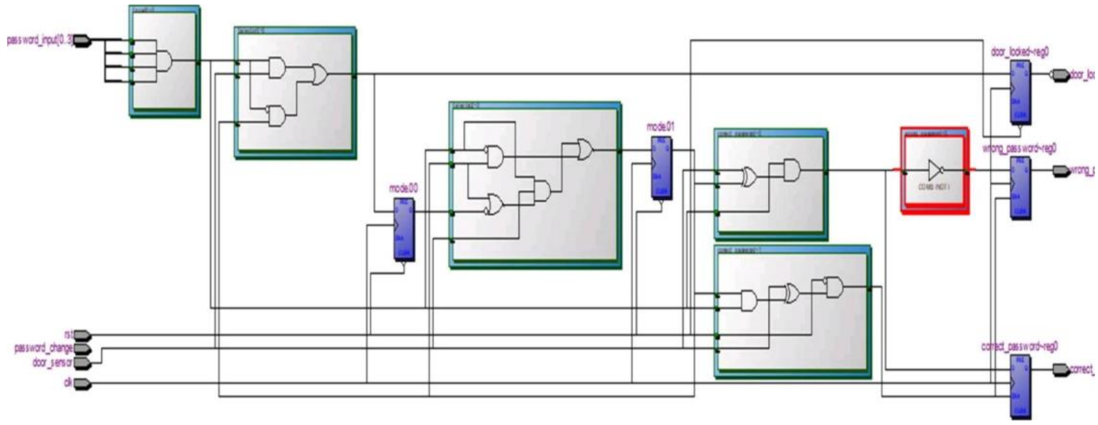
Results of the code:

RTL VIEW:

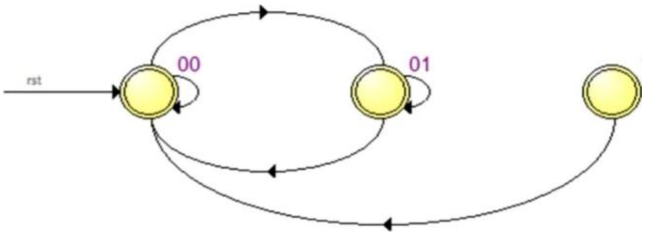


assw«d

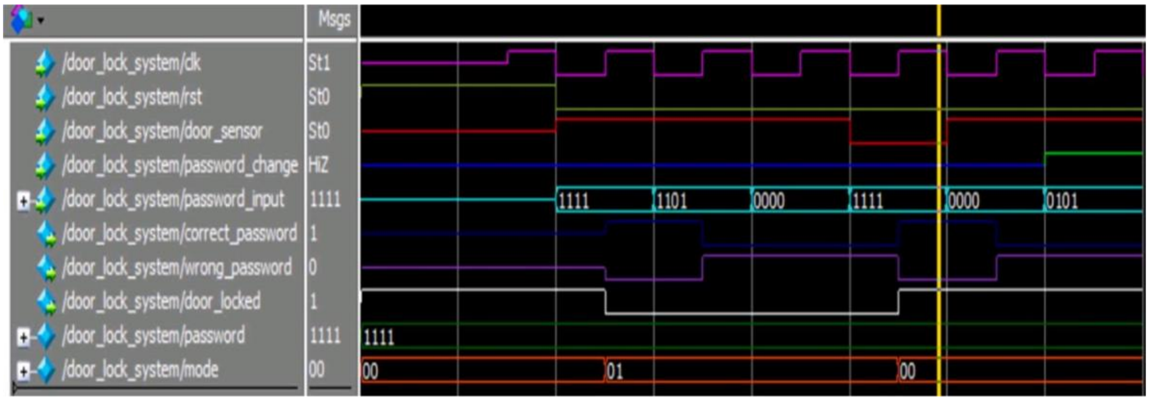
TTL View:



State Diagram in RTL:



Simulation Waveforms:


Msgs
/door_lock_system/clk St1
/door_lock_system/rst St0
/door_lock_system/door_sensor St0
/door_lock_system/password_change HiZ
/door_lock_system/password_input 1111
/door_lock_system/correct_password 1
/door_lock_system/wrong_password 0
/door_lock_system/door_locked 1
/door_lock_system/password 1111
/door_lock_system/mode 00
1111
1101
0000
1111
0000
0101
1111
00
01
00

Conclusion

In this project we learnt about how to use an FSM in the practical applications.

We learned how to use a Finite State Machine (FSM) practically in our project. We designed a door lock system that uses a password for basic security. It's cheaper and more convenient than traditional key and lock systems. Through this project, we understood the pros and cons of using passwords from a user's perspective.

References

We have taken the references from the following sources which are mentioned below:

(l) You-tube video for flow chart: https://youtu.be/31MLtQekqn8?si=dBQdIQZSwFYExomA

(2) Literature work:
https://www.academia.edu/27260900/Design_of A Keyless_Coded Home Lock System_
Using Verilog Hardware Description Language

(3) Some reference from report.

(4) With the help of internet.

CODE IN THE APPENDIX:

```
module door_system(
   input wire clk, // Clock
input
   input wire rst, // Reset
input
   input wire door_sensor,
// Door sensor input(user
will tell whether the door
is open or close if 1 then
door is locked and 0 then
unlocked)
   input wire
passward_change, //
Input to change passward
   input wire [3:0]
passward_input, // Input
for new passward
 output reg
correct_passward,
 output reg
wrong_passward,
 output reg door_locked
);

reg [3:0] passward =
4'b1111; // Default
passward '1111'
reg [1:0] mode = 2'b00; //
Default mode is door lock

always @(posedge clk or
posedge rst) begin
   if (rst) begin
      passward <=
4'b1111; // Reset
passward to default '1111'
      mode <= 2'b00; //
Reset mode to door lock
      door_locked <=
1'b1; // Lock the door by
default
   end else begin
      case(mode)
         2'b00: begin //
Door lock mode
            door_locked <=
1'b1;
```

```
              if
(door_sensor==1 &&
passward_input==passwa
rd ) begin
                  mode <=
2'b01; // Change to door
unlock mode as input
passward is correct and
door was in locked state

  door_locked<=1'b0;


correct_passward<=1'b1;


wrong_passward<=1'b0;
              end else if
(door_sensor==1 &&
passward_input!=passwa
rd) begin

wrong_passward<=1'b1;

  door_locked<=1'b1;

  mode <= 2'b00;
```

```
correct_passward<=1'b0;
        end
      end

      2'b01:   begin   //
Door unlock mode
        door_locked <=
1'b0;
        if
(door_sensor==0       &&
passward_input==passwa
rd ) begin
          mode       <=
2'b00; // Change to door
locked mode if requested

 door_locked<=1'b1;


correct_passward<=1'b1;


wrong_passward<=1'b0;
        end    else    if
(door_sensor==1       &&
passward_input!=passwa
rd) begin
             mode       <=
2'b01; // Change back to
door open mode if sensor
passward_input   is   not
correct

  door_locked<=1'b0;



correct_passward<=1'b0;



wrong_passward<=1'b1;
          end
        end

        2'b10:   begin   //
Passward change mode
          passward     <=
passward_input;          //
Update   passward   with
new input
          mode <= 2'b00;
// Change back to door
lock mode after passward
change
```

```
         end

         default: begin
            mode <= 2'b00;
         end

      endcase
   end
end

endmodule
```