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Digital Access System

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Abstract—

This paper present an approach to design a digital access control system. The heart of the system is a digital controller. The controller specifications are as follows: The numbers from 0 to 9 are coded in natural binary on 4 bits. A, B and O are coded in the following way A: 1010, B: 1011, O: 1111. The controller works in two modes: Day Mode: The door opens while pressing on "O" or if entering the correctcode. Night Mode: The door opens only if the code is correct. To distinguish between the Day and Night modes, an external "timer" generates the signal "day" which is equal to '1' between 8h00 and 20h00 and '0' otherwise. The controller sets an "alarm" signal as soon as one of the entered numbers is not correct. The "reset" signal is also triggered after the door opens. The correct code is chosen to be 53A17. The digital access system is a part of Mentor Graphics Design Contest 2012.

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I. INTRODUCTION

Digital access systems are commonly now replacing the ordinary access systems throughout the world as it brings in stability and technology into the midst. Here the system works in two modes day and night modes and to differentiate these two modes we use a timer generated signal 'day' that returns either a '1' or '0'. The basic working of the system is as follows first there will be an keypad which is connected to a controller via an encoder and the controller is designed using the state machine encoding principles of verilog HDL. Then there is the timer that is connected to the controller for differentiation of the two modes the day and night.

` The day mode works or follows the rule that the door is given access when the key 'O' is pressed and also when the code is entered correctly. Whereas in night mode what happens is that the door is given access only when the correct code is entered that which makes the system more secure and less theft prone. The output of the system is of two led's green and red when the access is granted that is when the output is '1' the led flashes green and when it is entered wrongly the red led is turned on.

Our approach is to design a separate FSM for day and night mode based on the requirement. From FSM we will generate the verilog code and test it with the simulator. The design is tested on the simulator only and is not tested with the actual hardware.

II. KEYPAD MODULE DESIGN

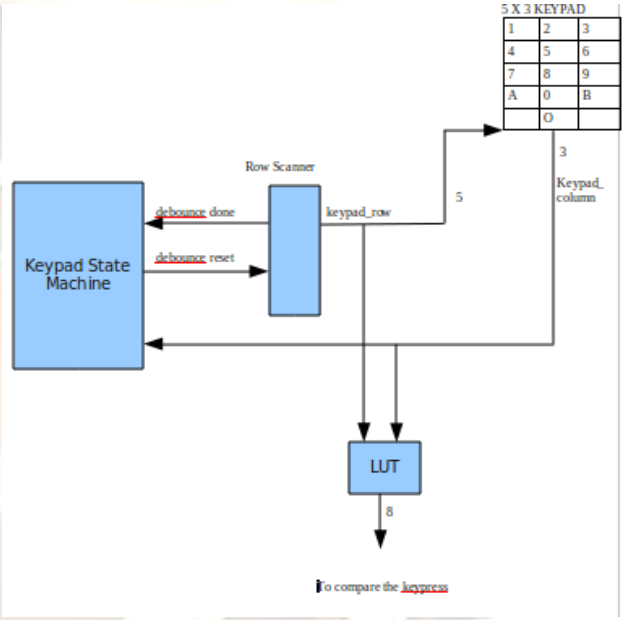

Fig 1: Keypad Module Index

The complete working of the Digital access system is divided into various modules. The various modules are:

Keypad Module Controller

This module controls the components of the keypad. The function of this module is to scan the keypad for user input, translates the coordinates of the keypress to binary values and transfer the binary data to other modules.

Keypad Debounce Counter

This is a counter to implement a delay equal to the debouncing period. The counter has a preset value of 100 with preset being held high. When a keypress is detected, the keypad controller drops the presst signal. The counter then counts down to zero and signals the keypad controller when finished. We have taken the clock speed as 5 MHz so the delay becomes 0.2usec. For a consistent keypad bouncing we require a delay of 2-3 msec so

we need a counter with initial counter value of 10000 which is a 14 bit wide counter.

Keypad Row Scanner

This is a 5 bit counter/register that is used to scan the keypad. It keeps all 1 except 1 zero that cycles through (01111,10111,11011,11101,11110). This pattern is used to scan the rows of the keypad. The '0' enables one row at a time to allow key presses to be detected by columns. The '1's disable the other rows. The scanner also has an enable signal which allows the keypad controller to hold the scanner value in order to determine the coordinates of the key press.

Look Up Tables (LUT)

We have used a look up table for keypad coordinate conversion to binary values. The binary values are used by the comparison module to compare with the desired authentic code.

III. NIGHT FSM.

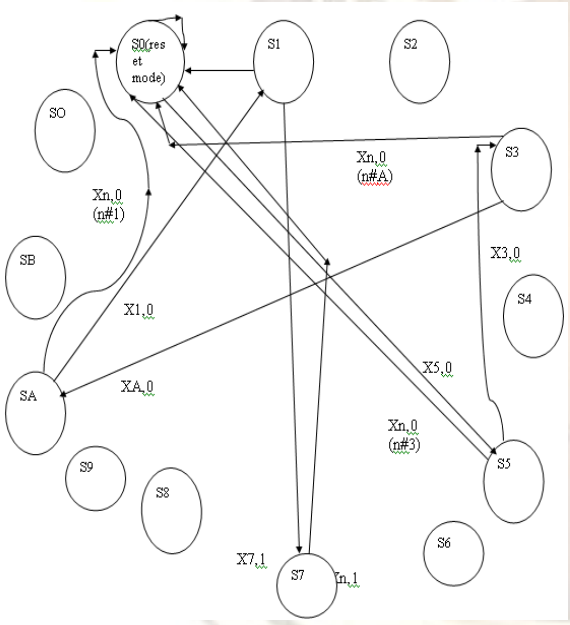

Fig 2: FSM of Night Mode

As mentioned the night mode works only when the correct code is pressed and the correct code to be pressed is "53A17".

The keypad has 13 keys thus a possible 13 states. Here the FSM used is a mealy one as it depends both on the input and present state.

IV. DAY FSM

The FSM is similar to the night mode the only addition being that when the key 'O' is pressed the door opens thus an additional state is required and this is also an mealy machine.

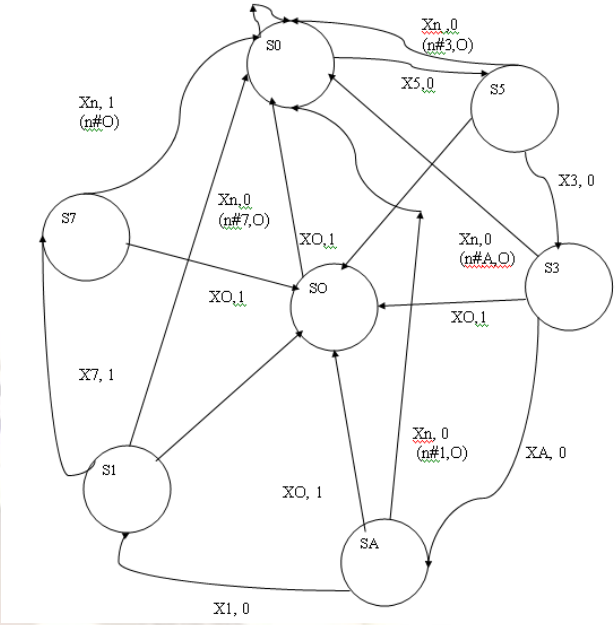

Fig 3: FSM in Day Mode

V. RESULTS

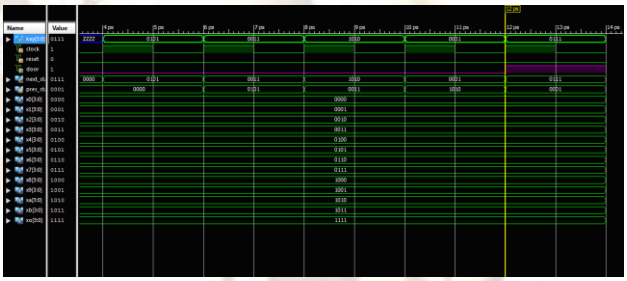

Fig 4: Output waveform for night mode module

Fig 5: Output waveform for day mode module when "o" is given as input

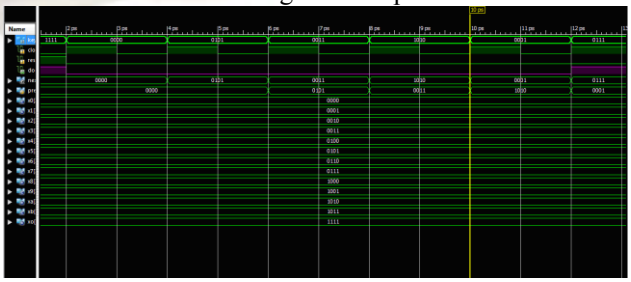

Fig 6: Output waveform for day mode module

From Fig 4 we can say that as soon as the correct code is entered, that is, 53A17 the output is high

means that the door will open. In the day mode, we can switch on the door directly by pressing the O button which is shown in Fig 5.

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