Intelligent Vehicle Parking System to overcome Congestion

Sowmya K. B., Tanushree G. V., Bishwapa Sanyal,

Department of Electronics and Communication Engineering, R V College of Engineering, Bangalore, India.

Abstract:
The new developed technologies are helping man to lead a comfortable life. But sometimes these can become troublesome and cause a lot of problems. Parking is an increasingly difficult problem for many drivers in crowded cities. Parking space management plays a major role in urban transport planning process. As the number of vehicles are increasing day by day in rapid manner, it causes problem of traffic congestion, pollution (air and noise), etc. To overcome this problem, a parking system is implemented using Verilog HDL in this case. It uses Finite State Machine Modelling. To overcome this problem, a parking system is implemented using Verilog HDL in this case. It uses Finite State Machine Modelling. The rule of thumb that is used for parking the vehicles in the parking lot is user authorization. Each user is provided with an authorization card which has details like owner name, vehicle number, etc. So when a car wants to enter, first the card is verified at entry and then if there are any empty slots, user is allowed else the user is not allowed even the user is authorized person. The result obtained shows that only 0.09 percent of slice registers, 0.23 percent of LUTs, 0.31 percent of slices and 13.21 percent of Bonded IOBs are utilized in this case. Also total power consumed is 1.442 W, which includes 95 percent (1.369 W) of dynamic power and 5 percent (0.073 W) of static power. This model solves the parking issue in urban areas, also provides security to a vehicle and an unauthorized user is not allowed to enter into a parking place.

I. INTRODUCTION

Vehicle traffic congestion is a worldwide problem. In recent years, efforts have been made to reduce parking problems such as congestion, accidents and hazards. The figure below shows that congestion has grown rapidly year by year. This has led to many problems. Fig. 1 shows the increased congestion on roads year wise.
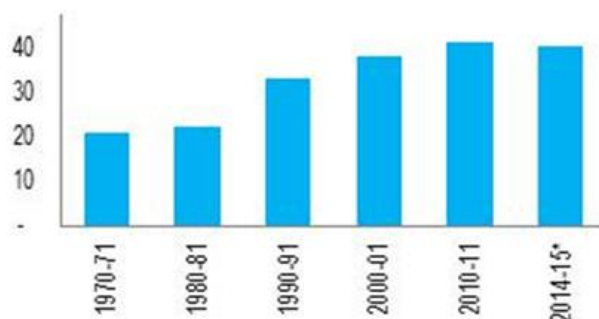

Fig. 1 Increase in road congestion over the year

In today's world the concept of smart city has become an area of interest. Concern regarding parking has become more in urban areas.

The main objective of this project is to implement a car parking system in Verilog. When a vehicle comes, there is a sensor at the entrance of the parking system which gets activated. Once the sensor is triggered, a password is requested to open the gate. The vehicle is allowed inside only if the correct password is entered. Otherwise, the gate is still locked. If a car is leaving the slot, then the exit sensor is detected and gate is locked. Further if another car wants to occupy that slot then the password should be re-entered.

This system proves to be efficient and better than conventional ones.

II. METHODOLOGY

A. INTELLIGENT VEHICLE PARKING SYSTEM

The parking system considered here consists of 16 slots (4 X 4 matrix). The module designed here is for parking the car in one of the slots. It has basic inputs as clock and reset. The reset is active high enable. Apart from these it has two sensor inputs, one at the entrance and other at the exit and two passwords for the same. The module has five states namely START, PASS_WAIT, PASS_CORRECT, PASS_WRONG and PAUSE. The outputs at each stage are denoted by two LEDs, green and red. The state machine is based on Moore model. The working at each of the state is described below and shown in Fig.2

1. START: Initially when the slot is vacant, it is in the start state. It remains in this state until sensor_entry becomes high. If any car wants to occupy it then the sensor_entry becomes high and it moves to the PASS_WAIT and waits for the user to enter the correct password. In this state, both the LEDs are off.

2. PASS_WAIT: After entering into this state the system waits for a predetermined amount of time for the user to enter the password and then decides whether the password is correct or wrong. The

counter increments with every clock pulse. After sometime if the password entered by the user matches with the password of that slot then it moves to
PASS_CORRECT state. Otherwise it goes to PASS_WRONG state. In this state, both the LEDs are on.

3. PASS_WRONG: If the password entered is wrong or the user is unable to enter the password in the predetermined amount of time then the system enters this state. It remains in this state until correct password is entered by the user. As soon as the correct password is entered it moves to correct password state. In this state the green LED is off whereas the red LED keeps blinking.

4. PASS_CORRECT: After the correct password is entered, in this state the sensor values are checked. If sensor_entry is high and sensor_exit is low which signifies that the car successfully parked in the slot, then the system enters into PAUSE state. Otherwise if sensor_ entry is low and sensor_exit is high which signifies that the car wants to move out of the slot, then the system enters into STARTstate and waits for another user. In this state, the red LED is off and the green LED keeps blinking.

5. PAUSE: Here the user has parked the car in the desired slot. The system remains in this state until the user comes back. When they want to take the car out, correct password for exit should be entered. In this state, both the LEDs are on.

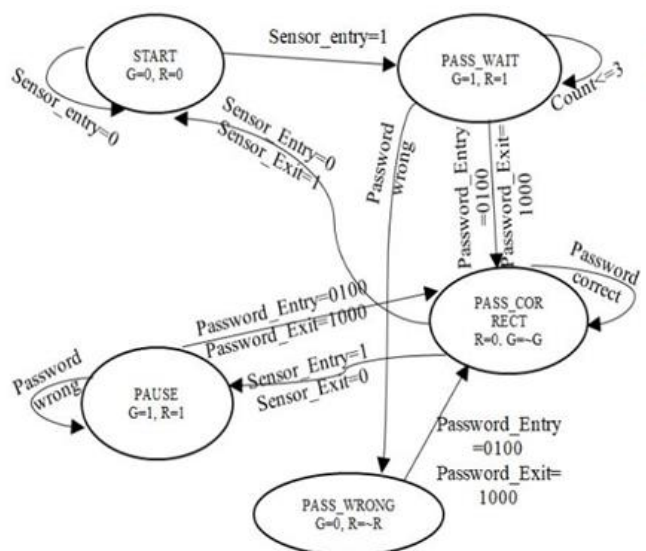### B. STATE DIAGRAM OF INTELLIGENT VEHICLE PARKING SYSTEM

Fig. 2 State Diagram of Intelligent Vehicle Parking System

III. RESULT OBTAINED

The module parking_system is implemented according to the previous state diagram. Following are the conditions given in the test bench:

According to the conditions given in the test bench, the state transitions expected at definite time intervals are:

o   Enters the START state at 10ns remains till 20ns

o   Waits for the entry password for 40ns (since count for waiting is 4). Comes out of WAIT state at 60ns

o   Since password for entry is 0000 at 60ns, it enters PASS_WRONG state.

o   It remains in PASS_WRONG until entry password changes to 0100 at 80ns.

o   Then it moves to PASS_CORRECT and remains till 100ns.

o   Next it moves to PAUSE state. Here the car has been parked.

o   Since the exit password is also correct at 110ns it comes back to PASS_CORRECT state.

o   Finally, it goes to START state at 120ns after the car moves out.

The simulation obtained in fig 3 also shows the same results as mentioned above. Hence for the values of the test bench given the following simulation is obtained
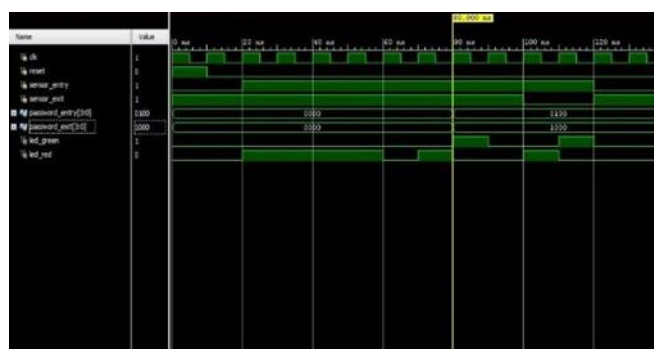

Fig. 3 Output Simulation Intelligent Vehicle Parking System

Hence the obtained simulation results are as desired.

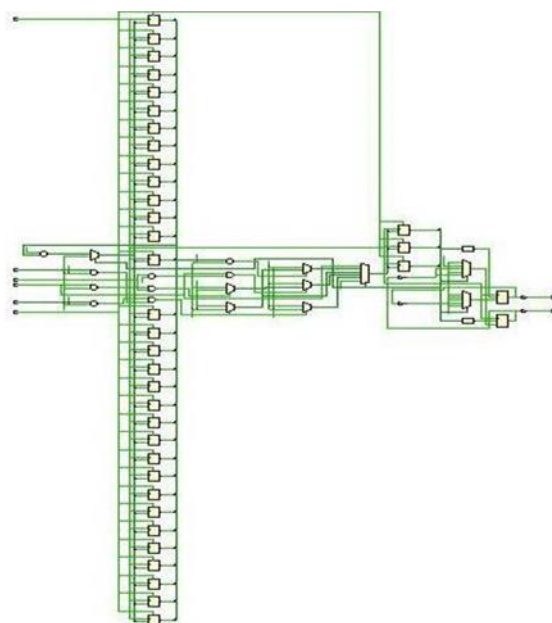The RTL schematic for the same is shown in fig 4 below:

Fig. 4 RTL Schematic of Intelligent Vehicle Parking System

The screenshots of resource utilization of the following circuit obtained after running implementation on Xilinx is given below in fig 5:
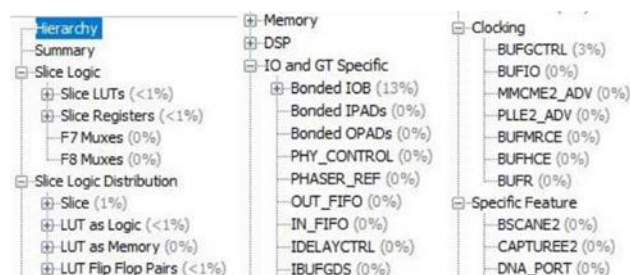

Fig. 5 Resource Utilization Report

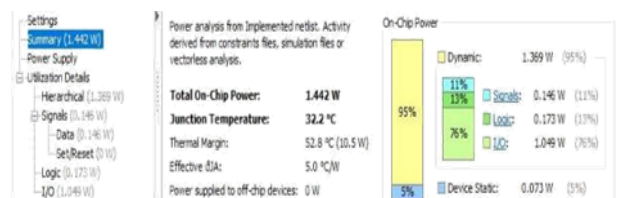The fig 6 below shows the power analysis report obtained indicating total onchip power consumption of 1.442W.

Fig. 6 Power Consumption Report

IV. RESULT ANALYSIS

On comparing our obtained results with the conventional method, we conclude that our design uses less number of LUTS and slice registers. But the number of bonded IOBs are more as compared to previous. Utilization report of the conventional method are shown in Table 1

Table 1: Utlization report of the conventional method[2]

Resourced	Available	Used stream	Percentage
No of slice registers	11440	142	1%
No of LUTs	5720	395	6%
No of applied slices	1430	113	7%
No of bounded IOBs	102	6	5%

Utlization report of the Modern Car Parking System is shown in Table 2

Table 2: Utlization report of Intelligent Vehicle Parking System

Resources	Available	Used stream	Percentage
No of slice registers	41600	37	0.09%
No of LUTs (Slice, Logic and Flip-Flop pair LUTs)	62400	141	0.23%
No of applied slices	8150	25	0.31%
No of bounded IOBs	106	14	13.21%

Hence, we can see that obtained results are better than the conventional method since the number of slice registers, the LUTs and the applied slices used is very less compared to the conventional method.

The following Table 3 shows the changes made in the design concerning the conventional design.

Table 3: Comparision Intelligent Vehicle Parking System the conventional design.

S. No.	Parameters of comparison	Reference work[2]	Intelligent Vehicle Parking System
1.	Verification at entrance	Required only once at the entry of the entire parking lot.	Individual unique passwords are required to enter each slot.
2.	Verification	No password	Password

May-June 2020
ISSN: 0193-4120 Page No. 6963 - 6968

	at exit	or verification is required at exit.	is required to take a car out of the slot at the time of exit.
3.	Security	Once someone enters, there are chances he might steal some other vehicle since there is no verification at the exit. Hence less secure.	The person needs to th enter e exit passwo rd to unlo ck the individ ual slot. Hence this system is more secured.
4.	Power Consumpti on	The system is common for the entire parking lot. Hence there is counter to count slot free s and LCD for display. This consum es extra power.	Since everything is managed here according to the individual slots, therefore counter and LCD are not included. This lowers the power consumpt ion.

REFERENCES

1. H. Chaudhary, P. Bansal and B. Valarmathi, "Advanced CAR parking system using Arduino," 2017 4th International Conference on Advanced Computing and Communication Systems (ICACCS), Coimbatore, 2017, pp. 1-5.
2. S. N. Shinde and S. S. Chorage, "Intelligent car parking system," 2016 International Conference on Inventive Computation Technologies (ICICT), Coimbatore, 2016, pp. 1-4.
3. V. Padiachy et al., "Development of an automated multi-level car parking system," 2015 2nd Asia-Pacific World Congress on Computer Science and Engineering (APWC on CSE), Nadi, 2015, pp. 1-7.
4. J. Propst, K. Poole, and J. Hallstrom. An Embedded Sensing Approach to Monitoring Parking Lot Occupancy, Proceedings of the 50th Annual Southeast Regional Conference (ACM-SE '12), Tuscaloosa, AL, 2017, 309-314
5. Bhavana Chendika, Alapati Manideepu, Fazal Noorbasha, "Implementation of Secured Car Parking Management System Using Verilog HDL", Journal of Engineering Research and Applications ISSN: 2248-9622, Vol. 5, Issue 7, (Part - 3) July 2015, pp.01-03
6. D.J. Bonde, R. Shende, K. Gaikwad, A. Kedari and A. Bhokre, "Automated car parking system commanded by android application", International Conference on Computer Communication and Informatics, 2017.
7. E. Soni, K. Kaur and A. Kumar, "Design And Development Of RFID Based Automated Car Parking System", The International Journal of Mathematics, Science, Technology and Management, Vol. 2., 2016.
8. L. Chen, J. Hsieh, W. Lai, C. Wu, and S. Chen. VisionBased Vehicle Surveillance and Parking Lot Management Using Multiple Cameras, Proceedings of the 6th International Conference

Published by: The Mattingley Publishing Co., Inc.
6967

on Intelligent Information Hiding and Multimedia Signal Processing (IIH-MSP), Darmstadt, Germany, 2015.

9. H. G. Jung, D. S. Kim, P. J. Yoon, J. Kim, "Uniform User Interface for Semi-Automatic Parking Slot Markings Recognition", IEEE Trans. Veh. Technol., vol.59, no.2, pp 616–626, Feb. 2010.