

INDJECE-0000623_T

by FDRP Journal's

Submission date: 09-May-2024 08:27AM (UTC-0700)

Submission ID: 2375178355

File name: INDJECE-0000623.docx (242.88K)

Word count: 868

Character count: 4797

FPGA Implementation of Highway Accident Prevention Traffic Control system using FSM

Banothu Basuji¹, Salivoju Laharika², Nenavath Tharun³, Bommidi Sridhar⁴, Prahas Sarabhi⁵

¹UG Student, Dept of ECE, Scient Institute of Technology, bapof2214@gmail.com

²UG Student, Dept of ECE, Scient Institute of Technology, laharikasalivoju@gmail.com

³UG Student, Dept of ECE, Scient Institute of Technology, nenevaththarunnay36@gmail.com

⁴Professor, Dept of ECE, Scient Institute of Technology, bommidi.sridhar@gmail.com

⁵UG Student, Dept of ECE, Scient Institute of Technology, prahas.sarabhi14@gmail.com

Abstract— Road accidents on national highways and expressways at junctions can be dramatically reduced with an effective traffic control system. In this work, we propose a better traffic control system. The proposed method was designed using the Moore Model FSM in Verilog HDL. The performance of the design is evaluated using various FPGAs to develop a low-power, high-speed architecture.

Index Terms—FSM-Finite State Machine, FPGA-Field programmable Gate Array.

I. INTRODUCTION

In India, on national highways and expressways, road accidents are considerably high. Some of the contributing factors to road accidents include improper traffic control at junctions, such as Highway Road and Country Road. The traffic control system is used to control the traffic [1][2] and prevent accidents by giving the proper signal based on crowd detection. The sensors present on the traffic signal will detect the vehicles and give different signals for the different roads. In this work, we have designed a Dynamic traffic control system using Moore Model FSM in Verilog HDL, and this work is synthesized and simulated using the XILINX ISE 14.7 software environment.

II. PROPOSED METHOD

The following fig. shows the Moore model finite state machine state diagram of the proposed method for traffic light control systems.

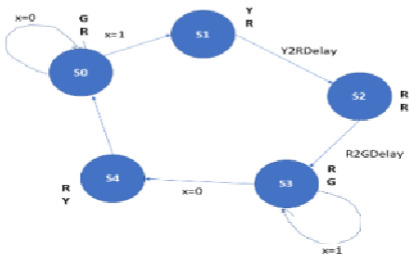


Fig 1: State Diagram of Traffic Light Control System

The above-proposed method shows that the FSM diagram of the traffic light [3][4] control system, in which it consists of five states for both highway roads and country roads.

The following are the states and signals of the traffic light control system:.

States	Highway Road	Country Road
S0	Green	Red
S1	Yellow	Red
S2	Red	Red
S3	Red	Green
S4	Red	Yellow

The X value in Fig. 1 indicates the sensor at the country side road.

If $X = 0$, no vehicles are present on the country side road.

If $X = 1$, vehicles are present on the country side road.

Initially, the priority is given to the highway side green signal; when the X value[5] at the country side goes to Logic HIGH, then the priority is changed to Country Side Road.

In this system, the delay for red to green and yellow to red is provided, which is from states $s1-s3$.

III. HDL IMPLEMENTATION

The traffic light control system has been implemented using the Verilog HDL in behavior modeling, and we have done the power and delay analysis on different FPGAs in the XILINX ISE 14.7 environment.

The following are the RTL schematic, technology schematic, and simulation waveform.

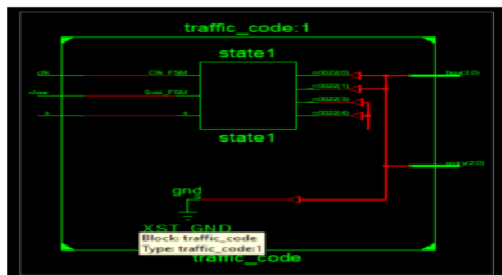


Fig 2: RTL Schematic of traffic light control system

The above fig. shows the RTL schematic of the traffic light control system.

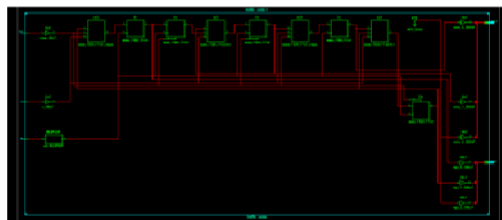


Fig 3 Technology schematic of traffic control system

The above figure shows the technology schematic of the traffic light control system.

IV. RESULTS

The below fig. shows the simulation waveform of the traffic light control system.



Fig 4 waveform of traffic light control system

The following figure shows a power analysis graph.

The power analysis is done on the various FPGAs, and the values are noted down as shown in the below graph.

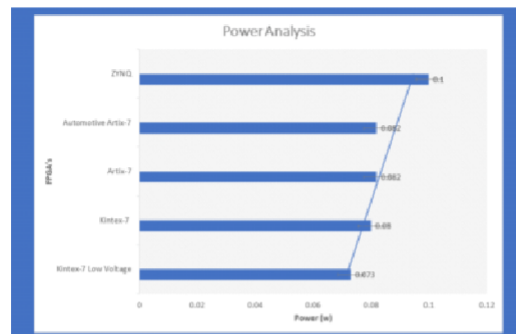


Fig 5: power analysis of traffic light control system

IV.III DELAY ANALYSIS

The following figure shows the delay analysis of the traffic light control system. The delay analysis is done on the various FPGAs, and the values are noted down as shown in the below graph.

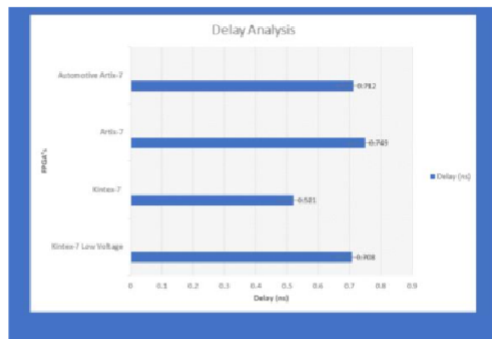


Fig 6: Delay analysis of traffic light control system

VI. CONCLUSION

The proposed method assures a better solution for reducing accidents on highways and expressways at junctions on Country Road and Highway Road. Are meeting.

The performance of the proposed method was evaluated on various FPGAs, and we found the following:

- The proposed method can be implemented with high speed and performance using the Kintex-7 FPGA.
- The proposed method can be implemented with low power consumption using a Kintex-7 low-voltage FPGA.

The proposed method can be easily adopted for any other dynamic traffic control application.

VI. REFERENCES

- [1] L. F. P. Oliveira, L. T. Manera and P. D. G. Luz, "Smart Traffic Light Controller System," 2019 Sixth International Conference on Internet of Things: Systems, Management and Security (IOTSMS), Granada, Spain, 2019, pp. 155-160, doi: 10.1109/IOTSMS48152.2019.8939239. keywords: {Sensors;Internet of Things;Electronic circuits;Wireless sensor networks;Communication system security;Wireless communication;Microcontrollers;Smart traffic light;smart city;smart mobility}
- [2] David Beymer, Philip McLachlan, Benn Coifman, and Jitendra Malik, —A real-time computer vision

system for measuring traffic parameters, I IEEE Conf. on Computer Vision and Pattern Recognition,(1997)..

[3] B. Coifman, D. Beymer, P. McLauchlan, and J. Malik, "A real-time computer vision system for vehicle tracking and traffic surveillance," Transportation Research Part C, vol. 6, pp. 271-288, 1998.

[4] R. Cucchiara, C. Grana, M. Piccardi, A. Prati, and S. Sirotti, "Improving shadow suppression in moving object detection with HSV color information," in Proc. IEEE Int. Conf. Intell. Transport. Syst., Aug. 2001, pp. 334-339.

17%

SIMILARITY INDEX

9%

INTERNET SOURCES

11%

PUBLICATIONS

0%

STUDENT PAPERS

PRIMARY SOURCES

1	www.ijitr.com Internet Source	4%
2	Bandi Narasimha Rao, Modela Balakrishna, Reddy Sudheer, Kondepudi Prudhvi Raj et al. "Smart Traffic Management System using IoT", 2022 IEEE International Symposium on Smart Electronic Systems (iSES), 2022 Publication	3%
3	Wan Nur Suryani Firuz Wan Ariffin, Cheah Seng Keat, Terrance Prasath A/Ludhaya Suriyan, Nurfadzilah Aqilah Mohamad Nore et al. "Real-time Dynamic Traffic Light ControlSystem with Emergency Vehicle Priority", Journal of Physics: Conference Series, 2021 Publication	2%
4	Singh, Shwetank, and Shailendra C. Badwaik. "Design and implementation of FPGA-based adaptive dynamic traffic light controller", 2011 International Conference on Emerging	1%

Trends in Networks and Computer Communications (ETNCC), 2011.

Publication

5	cms3.koreatech.ac.kr Internet Source	1 %
6	Cihan Karakuzu, Osman Demirci. "Fuzzy logic based smart traffic light simulator design and hardware implementation", Applied Soft Computing, 2010 Publication	1 %
7	(2-13-14) http://140.138.180.205/Academic/Manuscripts/2005060 Internet Source	1 %
8	journals.uhd.edu.iq Internet Source	1 %
9	Abdul Hadi M. Alaidi, Ibtisam A. Aljazaery, Haider TH. Salim Alrikabi, Ibrahim Nasir Mahmood, Faisal Theyab Abed. "Design and Implementation of a Smart Traffic Light Management System Controlled Wirelessly by Arduino", International Journal of Interactive Mobile Technologies (iJIM), 2020 Publication	1 %
10	Yi-Sheng Huang, , Yi-Shun Weng, MuDer Jeng, and Bo-Yang Chen. "Based on Synchronized Timed Petri Nets for Urban Traffic Control	1 %

Systems", 2013 IEEE International Conference on Systems Man and Cybernetics, 2013.

Publication

11

Huang, Yi-Sheng, Yi-Shun Weng, and MengChu Zhou. "Critical Scenarios and Their Identification in Parallel Railroad Level Crossing Traffic Control Systems", IEEE Transactions on Intelligent Transportation Systems, 2010.

Publication

1%

Exclude quotes On

Exclude matches Off

Exclude bibliography On



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Article Error You may need to remove this article.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Article Error You may need to use an article before this word.



Compound These two words should be written as one compound word.

PAGE 2



Compound These two words should be written as one compound word.



Compound These two words should be written as one compound word.



Article Error You may need to remove this article.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Missing ", " You may need to place a comma after this word.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Article Error You may need to use an article before this word. Consider using the article **the**.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Article Error You may need to remove this article.



Article Error You may need to use an article before this word.



Article Error You may need to use an article before this word. Consider using the article **the**.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

PAGE 3



Article Error You may need to use an article before this word.



Confused You have used **Are** in this sentence. You may need to use **our** instead.



Missing "?" Remember to use a question mark at the end of a question.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Prep. You may be using the wrong preposition.



Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.



Wrong Article You may have used the wrong article or pronoun. Proofread the sentence to make sure that the article or pronoun agrees with the word it describes.