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Implementation of Automatic Car Parking System Using Verilog HDL

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Abstract:

In the entrance of the parking system, there is a sensor which is activated to detect a vehicle coming. Once the sensor is triggered, a password is requested to open the gate. If the entered password is correct, the gate would open to let the vehicle get in. Otherwise, the gate is still locked. If the current car is getting in the car park being detected by the exit sensor and another the car comes, the door will be locked and requires the coming cars to enter passwords.

Keywords — Parking System, Verilog HDL.

I. INTRODUCTION

In this realistic world each person carried out many tasks without being evasive. Thus, in order to carry out all the activities for the effective use of resources, wise steps should be taken to curb waste of time in ineffective areas such as the most frequently performed practice, which is unfruitful vehicle parking. Therefore, this paper offers an option for an effective use of time in parking relevant to the security problem that serves at its best. The key topic includes the following solutions given below for the efficient use of time that does not take much time for parking purposes and also for providing a safe park without involving risks of any kind. The main goal is systematic parking with protection. Protection requires the use of password when parking, indication of number of available vacancies as well as their locations where only the adjacent vacancies are needed in particular, total number of vacancies available in a specific slot and even distance calculation to obstacles. Public services need a parking network which can effectively operate and be combined with other public utilities. There is no effective way to assign parking

slots and parking management system fails to help and organize information for an efficient system. In order to avoid these problems, design is proposed for secured car parking management system, which will be implemented on FPGA to check vacancies and provide car protection. Recently, a reconfigurable FPGA architecture is an effective method for implementing a digital logic, as FPGA offers an arrangement between processors for general use and ASIC. The FPGA architecture is robust, programmable and can be re-functioned. It can easily change the FPGA based design by changing the software component. Our proposed system is designed for FPGA design and the modeling of gate levels.

HE main cause of parking problems worldwide is ever increasing population and with it the number of vehicles. The place available for parking is limited but the number of vehicles increasing on road daily has no check. According to the recent trends, there has been an exponential rise in the sale of cars. The number of cars sold worldwide increased tremendously from 39.2 million in 1999 to 81.57 million in 2018. In 20 years the sales were raised by a value as high as approximately equal 40 million. The statistics in the form of a graph are represented in Figure 1.

Due to this enormous increase in traffic on road, the immediate next consequence that was observed was a sudden increase in congestion problems on road. Figure 2 depicts the increase in congestion problems from 987 to 2003. This gave rise to an increasing number of accidents on roads and also the travelling time required to reach destination increased. Even to cover a small distance consumed much.

To solve and sort out these parking problems in huge malls, educational institutes and to avoid wastage of time at parking, of people visiting such organizations, here is an attempt made to make the parking process a lot easier. Also, with the help of evolving technologies, the system can be updated further to bring about a fully automated parking system. At places with parking problems, people have to wait in a long queue and search for free slots available as there is no method to trace the vacant slots automatically. Even if there are slots available, visitors don't get to know due to huge infrastructure and they end up wasting time in searching for slots, at that time this proposed method would have been useful.

II. LITERATURE SURVEY

Soh Chun Khang, et.al (2010) presented work on parking system in which the number of slot which is available for parking is send as a message to driver. Driver can resend sms

demanding for a new position when the earlier allotted slot gets filled. Huachun tan, et.al (2009) proposed a system which is helpful to find the park at places where there a large parking lot. This is done by capturing images through camera mounted at each parking slot. Information such as number plate of car and colour are recognized and stored in data. This data therefore includes information about all cars parked in the lot and hence it is possible to find any car easily. S.V.Srikant, et.al(2009) camp up with system to detect the free parking slots. Author has used wireless communication technology to make the parking system more efficient. Gongjun Yan, et.al (2011), proposed an intelligent parking system which was based on secured wireless system and sensor communication. Efficient parking space utilization and quick search of free slot was the work involved.

Insop Song et.al, (2006) worked upon system using Field Programmable Gate Array (FPGA) using Fuzzy Logic Controller. Advantage of this system is reduction in computation time.

Several literatures have been done related to the proposed work. In proves the feasibility of the approach. This strategy is cost-effective and includes many of the aspects of smart car parking management. The project's central idea is to avoid troubles we face in the daily routine of parking our cars. Day by day the problem of parking cars proliferates. To this end a literature survey was performed in order to ensure that this would not be replicated as before. This is created using MATLAB, and it uses cameras to locate the free parking slots. Using this program photos collected by a surveillance camera were processed in real time to test the parking lot occupancies. The information is processed through a central control unit and is directed to the display panels located at strategic parking area locations. Through the details shown on the panels the drivers will know the empty parking lot.

In it was proposed to introduce a safe car parking management framework using Verilog HDL. This safe control system for car parks is split into two parts. Another is parking slot recognition and LCD display screens and another is safety warning that will provide the car with protection if the unauthorized individual decides to vacate the vehicle. The system uses four LCD screens, namely Total Vacancies, Adjacent Row Vacancies, and Nearest Vacancy screens. When showing vacancies, total number of empty parking spaces. Line Vacancies indicates the number of open empty slots in a given row. Next Vacancies reveals the number of vacancies in the parking lot next to it. Nearest Vacancy shows the number of nearest vacancies from

the given list. That car will be given a password or key when the car is parked in a certain vacant location. An individual can enter a key only three times after the device doesn't work and the control or security person needs permission. This device will include safe vehicle parking. An approach using an intelligent car parking network based on WSN (Wireless Sensor Network), in which wireless sensors are deployed into the parking area, with each parking lot consisting of one sensor node that tracks the parking lot occupancy. In the framework was implemented using programming language C. First the C code was checked on personal computer (PC) to see how the filter and other blocks operate. The implementation made clear the concept behind the project. The same method has been used for Xilinx MicroBlaze soft processor device after successfully testing it on a Mac. Floating point operations are expensive so it has been determined not to use floating point unit.

A fixed-point system was introduced due to the absence of a floating-point network. The real light speed is 299792458 but was rounded down to 3 * 10^(-8). This rounding off resulted in a minor variation in the decimal component and was intended to do so. First results are printed using Hyper-terminal, connecting Microblaze serial port to PC serial port. Later we built-in LCD to display performance. This paper deals with the implementation of FPGA and ASIC designs to measure a moving remote object's distance and speed using laser source and echo pulses reflected from that remote object. With FPGA implementation, the project proceeded in three phases: All-in- C design using Xilinx Microblaze soft core processor system, accelerated design with custom co-processor and Microblaze soft core processor system, and complete custom hardware architecture implemented using Xilinx FPGA VHDL. The full framework was later introduced at ASIC. The design of ASIC optimized the Area and Timing modules for a process technology of 130 nm.

- Parking is costly and limited in almost every major city in the world. Innovative parking systems for meeting near-term parking demand are needed. This paper proposes a novel, secure, and intelligent parking system (SmartParking) based on secured wireless network and sensor communication. From the point of users' view, SmartParking is a secure and intelligent parking service. The parking reservation is safe and privacy preserved. The parking navigation is convenient and efficient. The whole parking process will be a non- stop service. From the point of management's view, SmartParking is an intelligent parking system. The parking process can be modeled as birth-death

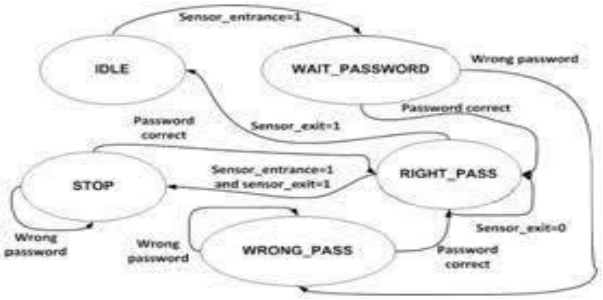
stochastic process and the prediction of revenues can be made. Based on the prediction, new business promotion can be made, for example, on-sale prices and new parking fees. In SmartParking, new promotions can be published through wireless network. We address hardware/software architecture, implementations, and analytical models and results. The evaluation of this proposed system proves its efficiency.

- This paper has shown the concept of an automatic car parking system. Everything in the modern world is going automatic, we have built a system which can automatically sense the entry and exit of cars through the gate and then display the number of cars in the parking lot. This automated car parking system reduces the time taken to check the space for vehicles by displaying the available spaces for parking on an LCD displayer by using infra-red (IR) sensors installed at the entrance and exit. This project is developed using 89c52 microcontroller.

III. PROPOSED SYSTEM AND PROPOSED DIAGRAM

In the entrance of the parking system, there is a sensor which is activated to detect a vehicle coming. Once the sensor is triggered, a password is requested to open the gate. If the entered password is correct, the gate would open to let the vehicle get in. Otherwise, the gate is still locked. If the current car is getting in the car park being detected by the exit sensor and another the car comes, the door will be locked and requires the coming car to enter passwords. What is an FPGA, as some of you might already be aware of an FPGA is a type of integrated circuit (IC) that can be programmed for different algorithms after fabrication. Modern FPGA devices consist of up to two million logic cells that can be configured to implement a variety of software algorithms.

Although the traditional FPGA design flow



is more similar to a regular IC than a processor, an FPGA provides significant cost advantages in comparison to an IC development effort and offers the same level of performance in most cases. Another advantage of the FPGA when compared to the IC is its ability to be dynamically reconfigured. This process, which is the same as loading a program in a processor, can affect part or all of the resources

available in the FPGA fabric. For this documentation the FPGA being used is Zynq™-7000 All programmable SoC devicein which we specifically use the Zynq 7020 (ZC702) FPGA board.

To solve and sort out the problems in parking system, here is a solution. A sensor is at the entrance of the parking system which is activated to detect a vehicle coming. When a car enters in, a password is needed. If the password entered is correct the gate will open or else it will be locked. This is also the same for the exit process. And with the help of ultrasonic sensor the distance is measured in which the next car is available, the number of vacant slots and the number of cars parked already will be given in the form of a message.

3.1 Proposed Diagram

Fig. 1 - Finite State Machine

- In which the output depends only on the state of the system. Hence, in state transition diagrams for Moore machines, the outputs are labeled in the circles. Recall that mealy machines are much like Moore machines, but the outputs can depend on inputs as well as the current state. Hence, in state transition diagrams for Mealy machines, the outputs are labeled on the arcs instead of in the circles. The block of combinational logic that computes the outputs uses the current state and inputs, as was shown in Fig. 1
- A finite state machine is a mathematical model of computation usually represented as a graph, with a finite number of nodes describing the possible states of the system, and a finite number of arcs representing the transitions that do or do not change the state, respectively. Such a machine is mostly used to model computer programs and sequential logic. There are two types of FSMs: mealy machine, where the output values are determined based on the current state together with the current input, and Moore machines, where the output is determined solely based on the current state. Extended finite state machine (EFSMs) [allow for internal variables than can store more detailed internal state information. Thus, EFSMs allow for a larger number of internal states. Mapping the large number of internal states to a smaller number of visible states requires an abstraction of the system, which can influence the testing process.

3.2 Car Parking System

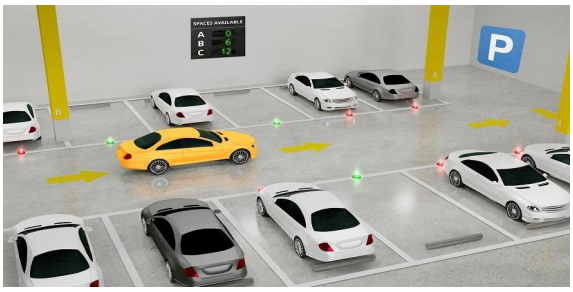


Fig. 2 - Parking System

The above Fig. 2 shows the demo of the proposed parking system

- It is a simple project is to implement a car parking system in verilog
- In the entrance of the parking system, there is a sensor which is activated to detect a vehicle coming
- Once the sensor is activated, a password is request to open the gate
- Till that time the car will be in the idle state. Before entering the sensor entrance the current state will be in idle
- In the sensor entrance it ask the password if it is wait password then it will be idle state
- If it is correct password then it goes into parking
- If it is wrong password then it give another chance and ask password again
- If it is correct password it goes to parking if it is wrong password then again it goes to idle state
- It give 2 chances for password
- If the entered password is correct,the gate would open to let the vechicle get in
- Otherwise the gate is still locked.if the current car is getting in the car park being detected by the exit sensor and the another the car comes ,the door will be locked and requires the coming car to enter the pass.
- The simulation is designed with the help of Xilinx software.

The final design is shown in output section

IV. OUTPUTS AND CONCLUSION

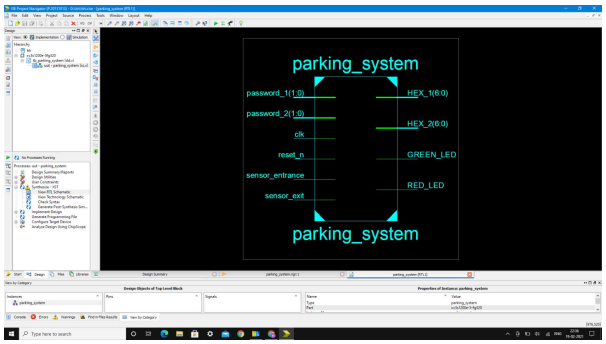


Fig.3 RTL Schematic

- The above Fig. 3 result show about the pin diagram of the parking system of the project

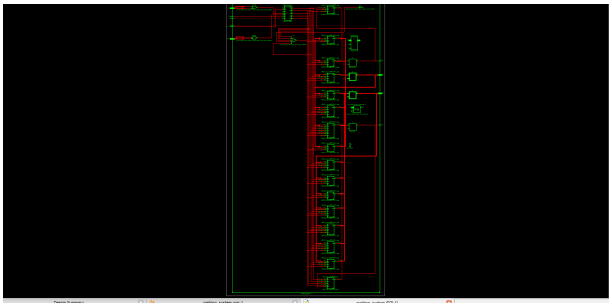


Fig. 4 - RTL Schematic

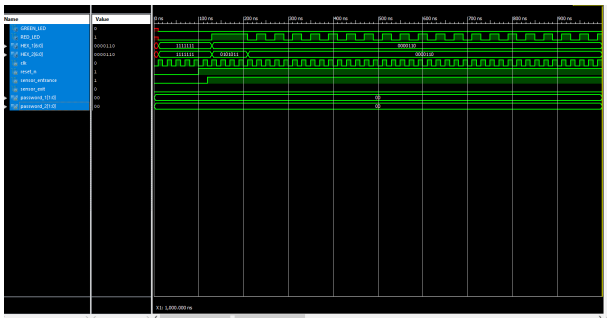
- The above Fig. 4 shows the RTL Schematic of automatic car parking system in Verilog HDL.
- 

Fig. 5 – Simulation Waveform-1

- The above Fig. 5 result show that output waveform of the parking system (when red light is 0 and green light is 1)
- The below Fig. 6 result show that output waveform of the parking system(when red light is 0 and green light is 0)

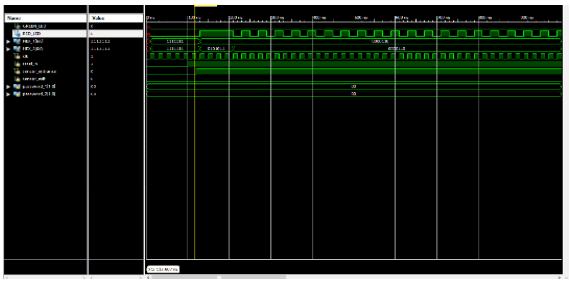


Fig. 6 – Simulation Waveform-2

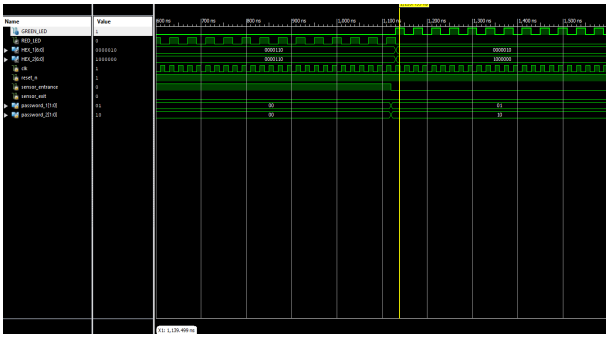


Fig. 7 – Simulation Waveform-3

- The above Fig. 7 result shows that the parking place (when green light is 1 red light is 0)

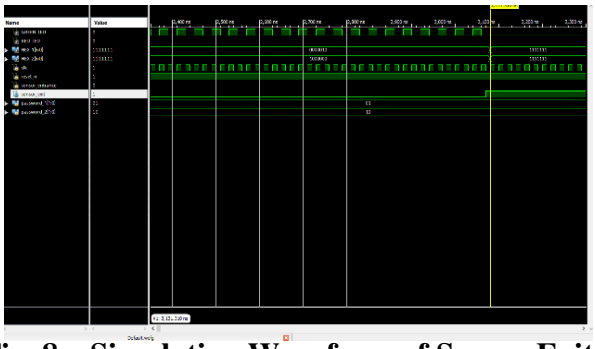


Fig. 8 – Simulation Waveform of Sensor Exit

- The above Fig. 8 result shows the sensor exit is 1

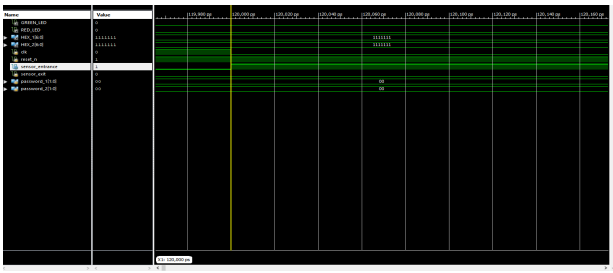


Fig. 9 – Simulation Waveform of Sensor Enter

The above Fig. 9 result shows the sensor enter 1

4.1.CONCLUSION

- The goal of this project was to develop a most effective smart car parking system. This was the key impetus in deciding to incorporate the FPGA method. With the support of Xilinx ISE Design Suite, smart car parking system is implemented using Verilog HDL. The design is tested on FPGA kit Spartan6. The FPGA increases productivity, reduces costs and speeds up market time. The system built can be used for many applications, and can easily increase the number of slot choices and increase parking protection. Through using the above implemented program parking becomes simple. The car is correctly identified and parking safety will be stressed. Even the drivers can easily pick the slot.

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