CAR PARKING SYSTEM DESIGN IN VHDL

This Thesis submitted in partial fulfillment of the requirements for the Award of Degree of Bachelor of Science in Electrical and Electronic Engineering

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CERTIFICATION

This is to certify that this project entitled “CAR PARKING SYSTEM DESIGN IN VHDL” is done by the following students under my direct supervision. This project work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering, Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering. The presentation of the work was held on …….. 2019.

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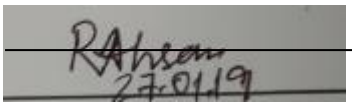

Dr. Md. Rezwanul Ahsan
Assistant Professor, Dept. of EEE

Dedicated to

Our Parents

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LIST OF ABBREVIATION

AHDL	Altera Hardware description Language
FSM	Finite State Machine
FPGA	Field Programmable Gate Array
HDL	Hardware Description Language
LED	Light Emitting Diode
VHDL	VHSIC Hardware Description Language
VHSIC	Very High speed Integrated Circuit Hardware Description language
ATPG	Automatic Test Pattern Generation
I/O	Input and Output
SOPC	System On a Programmable Chip
ASIC	Application-Specific Integrated Circuit
RTL	Register Transfer Logic
VGA	Video Graphics Array
UART	Universal Asynchronous Receiver-Transmitter
DC	Direct Current
SMS	Short Message Service

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ABSTRACT

Presently multi day's vehicle parking is a basic issue and step by step its necessity is expanding. In Bangladesh we are as yet utilizing the manual vehicle parking framework and that is the reason we are confronting issues like wastage of time and fuel discovering free space around the parking ground when we have to park our vehicle which requires a decent measure of lighting. Another issue is clutter that occurs while parking on the grounds that there is no specific framework anybody can park anyplace that at some point makes harm the vehicles while moving out or in the parking area. Security is likewise an issue there.

To tackle these issues we are exhibiting new vehicle parking system. The system fills in as pursues: where the quantity of accessible stopping spaces will be shown in the LED display. While stopping out the driver should give the code to the administrator at the leave gate.

The work presented in this paper gives more insight and deeper understanding of constituting modules of parking system. This paper investigates the optimized parking system through FPGA employing "logic forgathers" including multiple registers as their logic block. And we show that this algorithm is superior to an existing packing algorithm.

CHAPTER 1
INTRODUCTION

1.1 Introduction

Transportation has continually been a crucial aspect of human civilization but in the dynamic evolution of present time, the amount of vehicles are increasing in a rapid manner that produces traffic dirtiness and crowding unreliable parking problems. We live in a country that is developing radically. For this reason, presently we are facing a great deal of very much reached streets, business place and developing amount of vehicles.

When people want to park these vehicles they use the manual technique they park their cars any place they want. They park their cars beside road which creates a huge traffic jam. Sometimes absence of enough space cars can get scratched by knocking with one another. This prompts contentions battles among people which some of the time make immense car influx. Because of parking in the congested road our valuable time is hampered. It harms student, employee and crisis patients all things considered.

Figure: 1.1: Existing Car Parking System.

For this parking problem people are reluctant to go business places, shopping centers and carnivals. As far we are progressing with time for this old car parking system we face wastage of time and some economic losses. Thus we require an answer to solve this problem. Therefore, we are presenting a solution to solve this issues and additionally a substitution to the manual car parking system of business space. The goal of this project is to give an opportunity to avoid manual car parking

system. In this project, Quartus II software was chosen to design a gate logic circuit using schematic edit and write a coding using VHDL for car parking system the purpose of this project is to reduce the wastage of time for searching parking spot besides decreasing the traffic jam as well as park the safely in a specific place. This project need to design a parking system and slot as well as how to park the car automatically without any problem and simulate the code to ensure that the code is working or not using VHDL. This project will help to detect the parking slot and LED with show the amount of vacant parking spot.

Figure: 1.2: Proposed Car Parking System.

1.2 Issues of Old System of Vehicles Parking

1.2.1 Traffic Jam

Old vehicles parking system causes traffic jam. When drivers don't find any parking place they constrained to park their car on roadside and footpath. It causes traffic jam. Sometimes they block the road by parking their car on the road. In manual parking system drivers park their car at their sweet well and because of that there is no discipline at all.

1.2.2 Security Issue

Manual vehicles parking spot controlled by human. Anyone can go and come there. There have no record about the drivers and cars so anyone can do any kind of crime. All above it's not secured and safe for drivers and their cars.

1.2.3 Wasting Time

In manual vehicles parking system drivers don't know whether there are any space for parking their cars or not therefore they search parking place where they can park their

cars. Sometimes at a time more than one or two drivers try to park their cars at same place and when they create jam sometimes they quarrel with each other to park their cars. It wastes their time and sometimes hampers their cars as well.

1.2.4 Economic Loss

In manual car parking system there is a risk to collision with cars and it is hampering the car which may need to repair. So they have to pay for that.

1.3 Advantage of Auto Car Parking System

Population is growing in our country and so is the growing traffic management in our country. Mechanized vehicle leaving frameworks in such countries for at times have furnished alleviation since they accompanied various points of interest

The advantages of automated car parking systems are:

1.3.1: Reduce Traffic Jam

In auto car parking system drivers park their cars in a parking spot so there is no chance to park their car on the roadside or footpath. Which reduce traffic jam.

1.3.2: Save Time

When there is less traffic jam then it will save the valuable time of travelers. They can park their car without wasting their time.

1.3.3: Reduce Attendance

People can park their car by themselves. They do not need any attendance to show them where to park their car. The LED display will show the number of empty parking slot.

1.4 Objective of Project

The main objectives for the project is to create program of intelligent car parking system in real life. This project also ensure a safe and secured parking system to assign the right way and minimizes the waste of time for trying to find out free parking space.

The objectives are below:

- To implement the FSM of an intelligent car parking system on software based.
- To introduce automatic car parking system in our country and get benefits from it.
- To ensure safety and security while park the car.
- Park car without guided by park attendance.
- Park car without wastage of time.

1.5 Background of the Project

Day by day our country has been advanced drastically, now we are in this state that we have a lot of well-constructed roads, commercial building and increasing number of automobiles. With the increasing amount of roads and highways transportation has become the backbone of our day to day life. Transportation has also become the strength of our economy for its wide usage in trade and business. Hence, it has been a matter of thought to park these transportations and vehicles in safe places. We still use the very old fashioned manual procedure of parking when it comes parking these vehicles. These are maintained in unplanned manner, without any discipline. Due to this system people can park their cars anywhere they want to, which creates a mess as people don't follow the discipline most of the time. While parking in and recovering car due mismanagement cars can get dent by bumping with each other as there is lack of sufficient space. This leads to arguments, fights among people which sometimes create traffic jam. This is also an economical lose as we need to repair our damaged car. Due to this disorder in parking our valuable time gets wasted. It harms the students, office going staffs and emergency patients to an excessive scope. It also causes economical loss to commercial places like shopping malls, amusement parks as people are more likely not to visit these places due to this parking hazard. Automated car parking systems will provide several benefits. It will save time and fuel cost. In manual parking system it is too hard to find out the vacant space for parking, it is very much time consuming. Sometimes it causes late in meeting or other important works. It will save fuel as in this system an automatic car parking the vehicle into the required slot. This will reduce the fuel cost of probing for parking space. Here we do not need to lighting all over the parking space all the time. It will only have the lights on when it moves and where is the path and it is very much electricity saving also. It provides security from theft of vehicle and it can earn

revenue. It can introduce us to advanced digitalized systems which show us the Engineering excellence in our country.

CHAPTER 2
LITERATURE REVIEW

2.1 Overview

Car parking system in Bangladesh has become one of the biggest problem in city life. Number of vehicles are increasing so that the manual car parking system is not enough. It is difficult to find out a parking place in main cities to park vehicles. There are several alternatives have been established to reduce this problem. But these are not enough to park a car safe and secure. Therefore more efficient methods need to be researched and developed for solving the problem. Here will discuss about the manual car parking system, automatic car parking system and the proposed car parking system.

2.2 History of Car Parking System

Since, the eve of car invention cars were needed to be parked in a place. In the early 20^{th} century car parking systems were developed. Over the years technology have developed and diversified.

2.3 Manual Car Parking System

In manual car parking system drivers search a place for parking their cars. When they find out parking place first they ensure that whether the place is empty or not. If there are available parking slots then they have to collect a pass by paying required parking amount. After fulfill the requirement they can park their cars.

2.4 Automatic Car Parking System

Automatic car parking system was first introduced in Europe. Early in the 19^{th} century and in the North America in the 1920.

There are two kinds of automatic car parking systems are:

2.4.1 Fully Automated Car Parking System

This parking system is completely robotized. The drivers need to take the cars until the passage zone. The car must be cleared. The driver does installment in a computerized terminal adjacent and he gets the ticket. When everyone of the car's

travelers leave the passage territory then the car parked mechanically in a pre-decided spot. The administrator attempts to fit the vehicles into the littlest parking spot accessible. The driver recovers the vehicle by embedding the ticket or code he had gotten before. The vehicle is lifted from the parking space and is conveyed to the exit area. The purpose of this system is eliminated the need for parking attendants.

Figure 2.1: Fully Automated Car Parking System.

2.4.2 Semi Automated Car Parking System

The working principle of the fully and semi-automated car parking system is same. The primary separating factors between a fully and semi-automated automatic car parking system are frequently space and cost.

2.5 Development of Auto Car Parking System

Day by day automatic car parking system is developing. Automatic car parking includes sensors, information fusion, position estimation, path planning and tracking algorithm. Drivers can use a user interactive interface to select the parking space if it is big enough.

2.6 Car Parking System in Bangladesh

Bangladesh is a developing country. Day by day its population is increasing as well as the number of transportation is increasing. Here, there is not any well planned parking space. The drivers park their cars here and there. For that reason, a huge traffic jam creates. In front of school, hospital and shopping mall drivers park their cars on road

side or footpath. For this kind of car parking system passers-by cannot walk properly also occurred traffic jam. Without some well established companies, hospitals and shopping mall there is no car parking place. So their clients park their cars on the roadside and create a disturbance in the area.

Some companies have come forward to change the manual car parking system. Some automated car parking system is under process as like “PI Lab Company” advertise and encourage to use automatic car parking system.

2.7 Applicability of this Project

Over the vacant with the advancement of our country is such that the old manual system of car parking in business spaces should be supplanted. The old manual system of a car park is creating obstacle as well as tumult in parking spot, accordingly bringing about wastage of time and some financial misfortunes also. Along these lines presenting Automated Car Parking Systems in business areas can be substitution to the manual car parking systems. We can introduce this system in the spots like:

Office Buildings

In this system office workers can easily park their cars without any obstacle and losing their time. It will likewise alleviate their psyche from the pointless parking obstacle. Likewise, in the event that somebody is as of now late he would not be late anymore by searching for the parking spot and park his vehicle. It will likewise give security to their vehicles from taking away.

Shopping Malls

It will assist the clients with parking their vehicles with no obstacle and it will give them an opportunity to temples for more items. It will profit both the clients and the venders as the client will have more opportunity to investigate their alternatives and the merchants have more item choices to move. It will build the quantity of clients coming in the shopping centers. It will expand income as the client needs to pay for the parking spot. It will likewise assist expelling the vehicles which are being parked throughout the day without shopping purposes as they will be charged for parking their autos. As there is a perimeter for the parking spot the clients will remember that and they will expel their vehicles on time. This will assist more clients with coming to these shopping centers every day. It will be safekeeping to their vehicles from taking.

Hospitals

In healing facility when there are a ton of crisis cases there are a ton of a vehicles and ambulances coming in the parking spot. This makes stick which is the reason of delay for the patients to get the therapeutic administrations, which frequently can be lethal to them. In the event that we introduce the robotized system, it will set aside less opportunity to leave vehicle and the patients to achieve the restorative administrations. Likewise they can win income for vehicles other than the ambulances. It will likewise give security to their vehicles from taking.

Carnivals

In the event that we introduce mechanized vehicle parking systems in entertainment meccas it will draw in more peoples to go to these spots. The more income will be earned the more the general population will come. In addition these entertainment meccas calm us from our monotonous and repetitive lives, revives our brain. The more peoples can appreciate these spots because of the propelled parking office. It again expands the income as peoples need to pay for parking their vehicles. It will likewise give assurance to their autos from taking. Alongside these spots we can utilize this framework in instructive foundations and mosques where vehicle parking region is accessible. It will assist peoples with parking their vehicle effectively without making any obstacle. It will likewise give assurance to their autos from taking.

2.8 Comparison between the Existing System and Proposed System

In present days we are confronting numerous issues with the current vehicle parking system. As we have to park our vehicle physically and there is no control in this procedure it makes an enormous obstacle. Peoples can park their vehicles any places they need to, which makes a wreck as peoples don't pursue a specific sign more often than not. Because of this a colossal congested driving conditions happens in that put. While parking in and recovering vehicle due bungle autos can get scratch by knocking with one another as there is absence of adequate space. This prompts contentions, battles among peoples which now and then make car influx. This is additionally a conservative lose as we have to fix our harmed vehicle. This turmoil likewise prompts vehicles devouring additional fuel.

Car influx is a concern because it hampers our valuable time. Because of this mayhem in parking our significant time gets squandered. For spots like shopping centers or entertainment meccas it causes practical misfortune, as because of this bedlam many peoples are reluctant to visit these spots which decline the quantity of the clients in these spots. Again the clients inspire less time to peruse for choices through these spots which can again diminishes the chance to moving the items. Once in a while the clients can't enter in these spots because of this parking disarray. This vehicle parking risk causes issue for the pupil and the office workers as they can't achieve their goal on time which once in a while causes enormous misfortune in their individual vocation. It can make lethal harm the patients as it can make delay for them achieve the restorative administrations might be only a couple of floor away in the doctor's facility building. Additionally there is no installment framework for vehicle leaving in the vast majority of the parking spots in our country. So by presenting the mechanized car parking systems we can deal with the both of parking spot spare time and recoup misfortunes caused by the current framework and furthermore win cash by charging cash for vehicle parking.

2.9 State Machine

For designing a computer program or digital logic the state machine concept can be used. There are two types of state machine, one is finite and another one is infinite. Our project will work using the finite state machine concept. State machines are spoken to utilizing state charts. The yield of a state machine is an element of the information and the present state. It is easy to design and gives the designer great flexibility when the designer needs to weak the design either for speed or area optimization.

2.10 Explanation about Software

A software is used for simulation. In this project, VHDL (VHSIC Hardware Description Language) is used for writing a code using Quartus11 software. After writing and simulate the code to see whether the theme is working or not.

2.10.1 Quartus11 Software

The Altera Quartus11 structure software gives an entire, multiplatform plan condition that effectively adjusts to explicit design needs. It is a thorough situation for system

on-a-programmable-chip (SOPC) structure. The Quartus11 software incorporates answers for all periods of FPGA and CPLD structure.

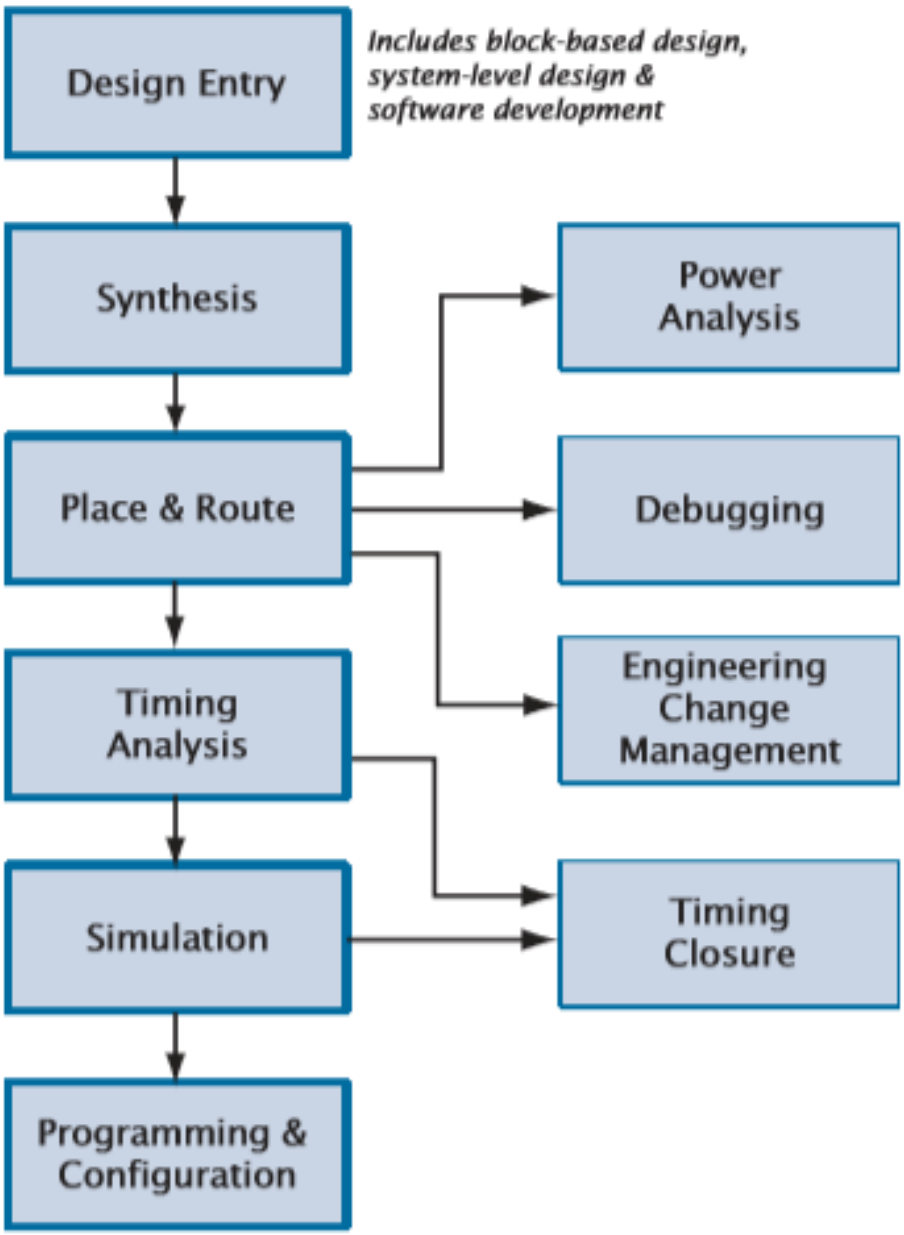

Figure 2.2: Quartus11 Design Flow

In this software, we can use the Text Editor to create a Verilog HDL, VHDL, or Altera Hardware Description Language (AHDL) design. Use the simulator to simulate the code. A VHDL are used in this project for writing a coding and the simulator is used to ensure the working principle of car parking system.

2.10.2 Benefit of Using VHDL

VHDL is generally used to write text models that describe a logic circuit. Such a model is processed by a synthesis program, only if it is part of the logic design. A simulation program is used to test the logic design using simulation models to represent the logic circuits that interface to the design. This collection of simulation models is commonly called a test bench.

Hardware description language (HDL) is divided by two types, Verilog and VHDL (VHSIC – Very High Speed Integrated Circuit Hardware Description Language). Both have its advantages and disadvantages. In this project, VHDL was chosen because it's

- Executable specification
- Validate spec in system context (Subcontract)
- Functionality separated from implementation
- Simulate early and fast (Manage complexity)
- Explore design alternatives
- Get feedback (Produce better designs)
- Automatic synthesis and test generation (ATPG for ASICs)
- Increase productivity (Shorten time-to-market)
- Technology and tool independence (though FPGA features may be unexploited)
- Portable design data (Protect investment)

The advantages using VHDL are shown below

- Standard Language
- Powerful and versatile description language
- Multiple mechanisms to support design hierarchy

CHAPTER 3

METHODOLOGY

3.1 Introduction

In this chapter discuss about process and design of a car parking system.

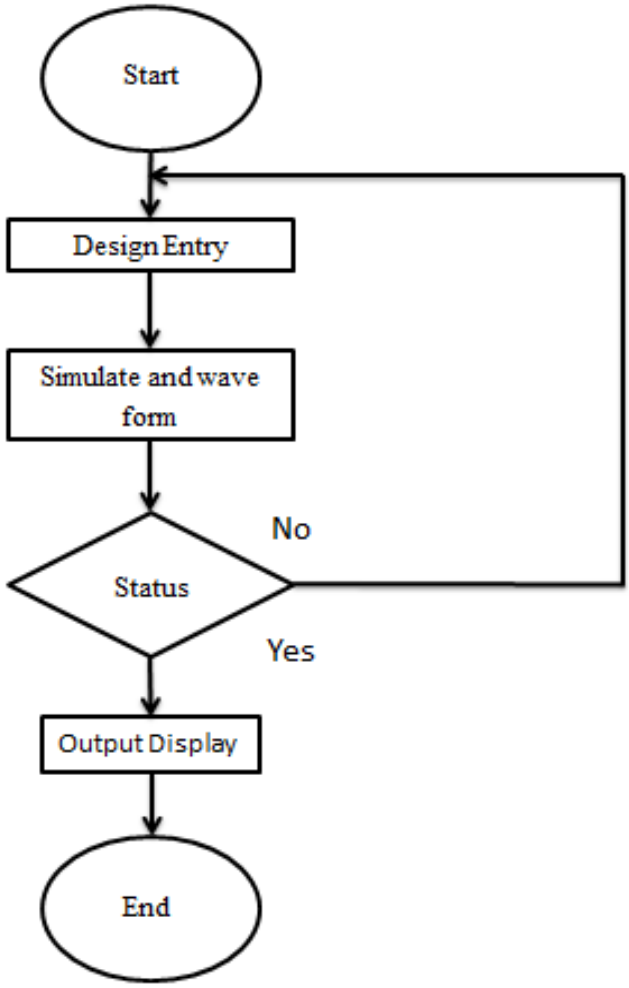

Figure 3.1: Flow Chart of Car Parking System Design

This project consists of two parts, design a program and implement this with software. Quartus II software was chosen for designing a program of the car parking system. In this software VHDL text editor is used to design of car parking system. After finish write a codding, continue with simulate to get wave form in software.

3.2 Direction of Car Parking System

The next important phase to undergo after conducting the study on the problem of tropical parking system is to identify the parking place situation. In a manual car parking system there are a guard who direct the drivers to park their cars and drivers follow the guard's direction. Sometimes the guard directs them wrong for that reason collision with each other. It causes hamper the car and the car have to repair which mean a financial loss. Sometimes drivers injured seriously causes of this collision. Here we exhibits a car parking system in VHDL utilizing Finite State Machine (FSM). The VHDL code and test bench for the car parking system is utilize to create the procedure. The VHDL car parking system is appeared in the accompanying figure. There is a front sensor to recognize vehicles heading off to the gate of the car parking system. Another back sensor is to distinguish if the coming vehicle pass the entry way and getting into the car park. The goal of this project is to remove the car attendance, park the car safe and secured in a discipline way.

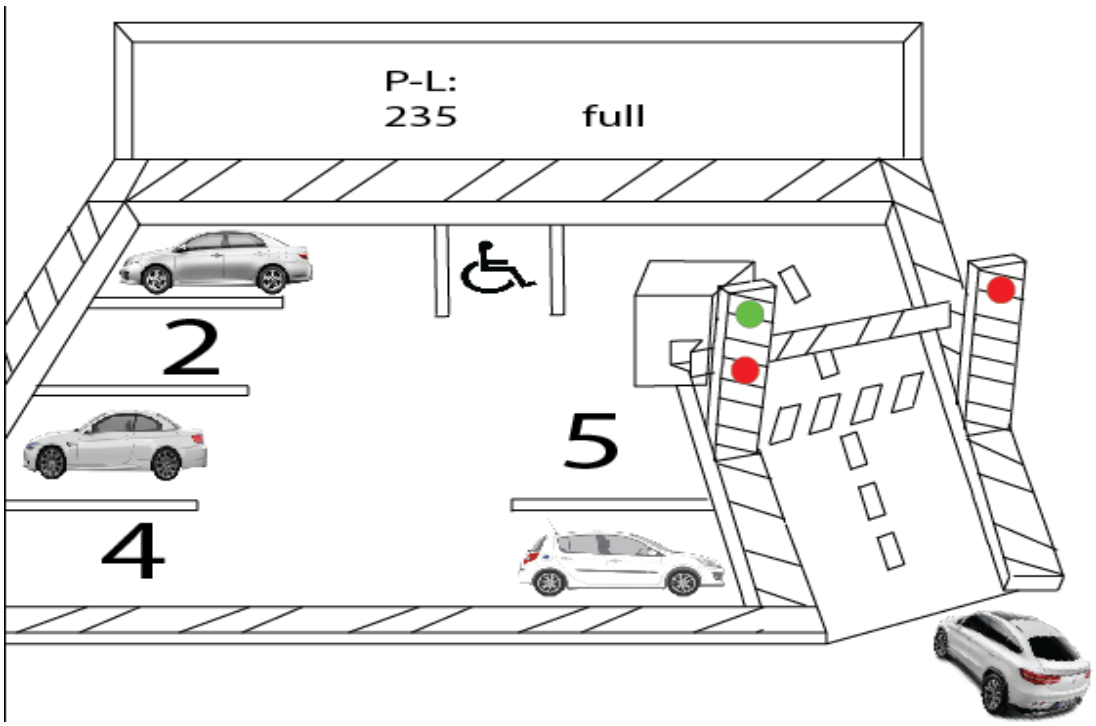

Figure 3.2: Automatic Car Parking System.

3.3 Developing Diagram and Interface Signal of Car Parking System

With the information given in above the inputs and outputs for the system can be accumulate through the interface known as State Machine. This Machine will process the inputs and executes those inputs in parallel with the outputs intended.

In order to produce the intended outputs based on various conditions, the inputs needed to know the situation of car. The inputs include the clock to set the time, the reset and the sensors. Table 3.1 provides the list of both the inputs and the outputs for the State Machine with their description while Figure 3.3 illustrates the interface between inputs and outputs.

Table 3.1: List of input and output terminals of the state machine

Signal Name	Direction	Description
Clock	Input	Clock input to the state machine
Reset	Input	Reset signal to "reset" the state machine to a known state
Front Sensor	Input	Detect the coming vehicles
Back Sensor	Input	Detect the car into the car park
Password 1	Input	Gate is opened to let the car into the car park
Password 2	Input	If paas_1 is incorrect it will check again and let the car into the car park
Green LED	Output	FSM turns to RIGHT_PASS state; a Green LED will be blinking.
Red LED	Output	Wrong pass state and if the next car is coming before parking the current car then Red LED will be blinking
HEX 1	Output	Display 7-segment LED
HEX 2	Output	Display 7-segment LED

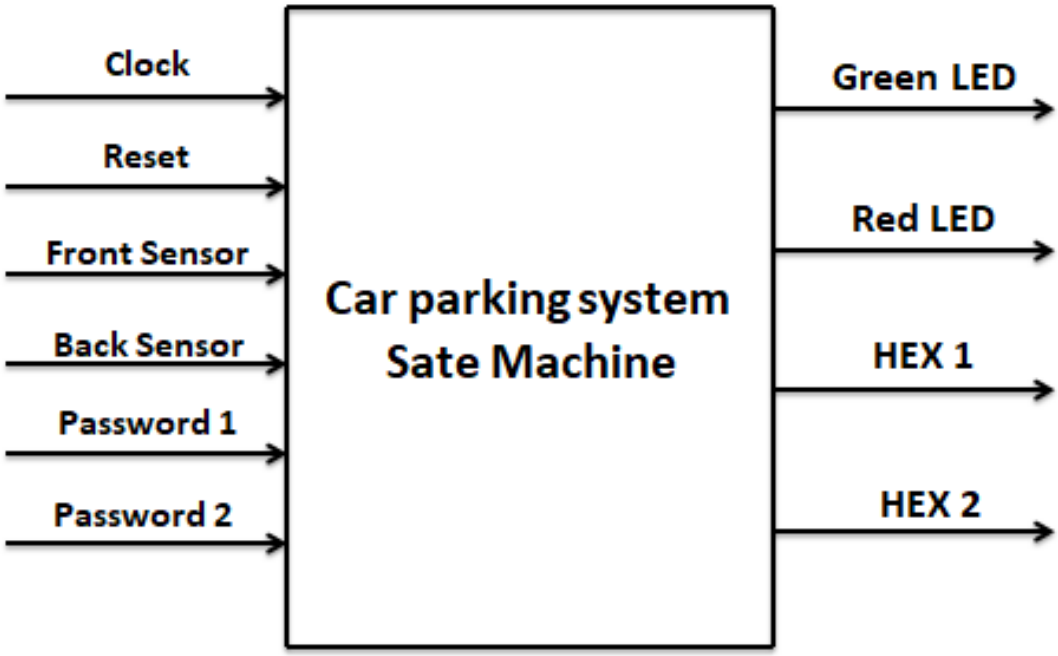

Figure 3.3: Interface Diagram

3.4 State Diagram of Car Parking System

The state diagram of car parking system is shown in Figure 3.4. Each of five states is worked according to their program, as indicated by the circles. The looping arrow at each state indicates that the system remain in that state under the condition defined by the associated expression. Each of the arrows going from one state to the next state indicates a state transition under the condition defined by the associated expression. Based on the Finite State Machine our project is worked as follows:

- **First State:** At first the FSM is in IDLE position. When any car enters and senses by the front sensor the FSM turns into the next state.
- **Second State:** FSM changed to WAIT_PASSWORD state for 4 cycles. In this state the car will input the password. If the password which is entered by the driver is right then the gate is opened and the give the car a chance to entry in the parking zone and FSM express RIGHT_PASS and blink the Green LED.
- **Third State:** If the driver enters a wrong password the FSM swings to WRONG_PASSWORD state and blink the Red LED. Then the vehicle has to re-enter the secret word again and again until it is right.

- **Fourth State:** When password is right the car gets into the parking zone and identified by the back sensor. If there is another car coming to park the FSM turns into STOP state and blink the Red LED. The Red LED is blinking for the following car to notice to stop and the password. The FSM comes back to the IDLE state after the car passes the gate and gets into the car park.

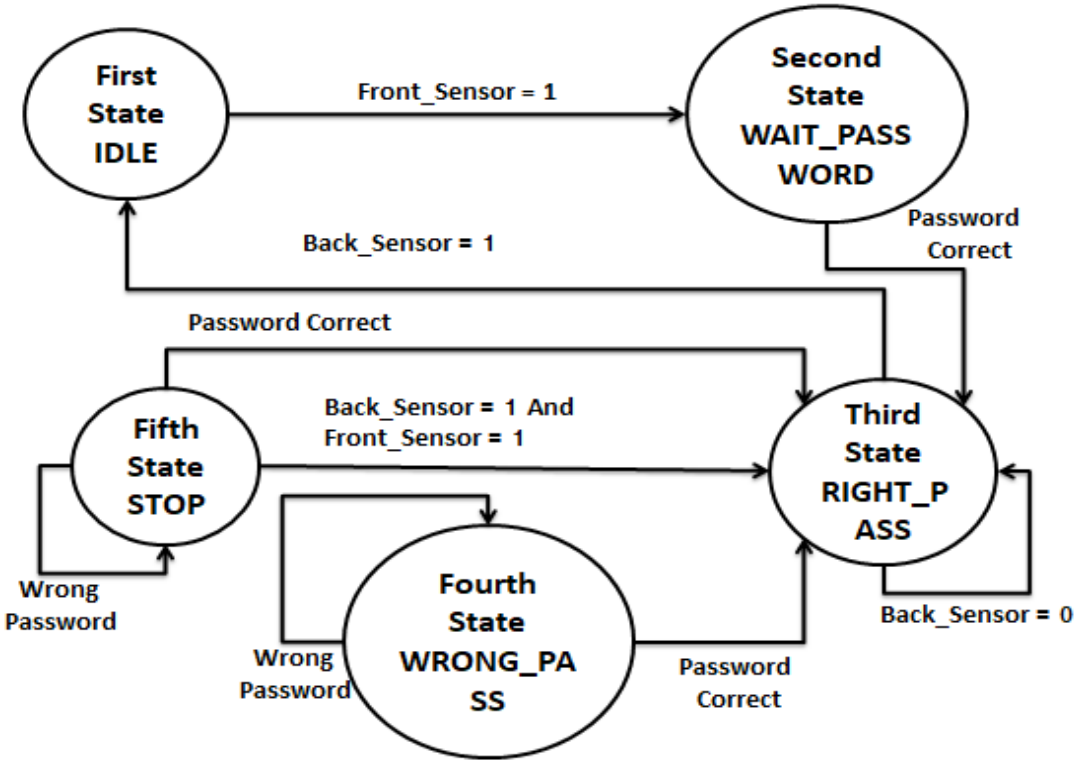

Figure 3.4: Finite State Machine

3.5 Working Procedure of Prototype

3.5.1 The Display

The display will demonstrate the quantity of slots is accessible for parking.

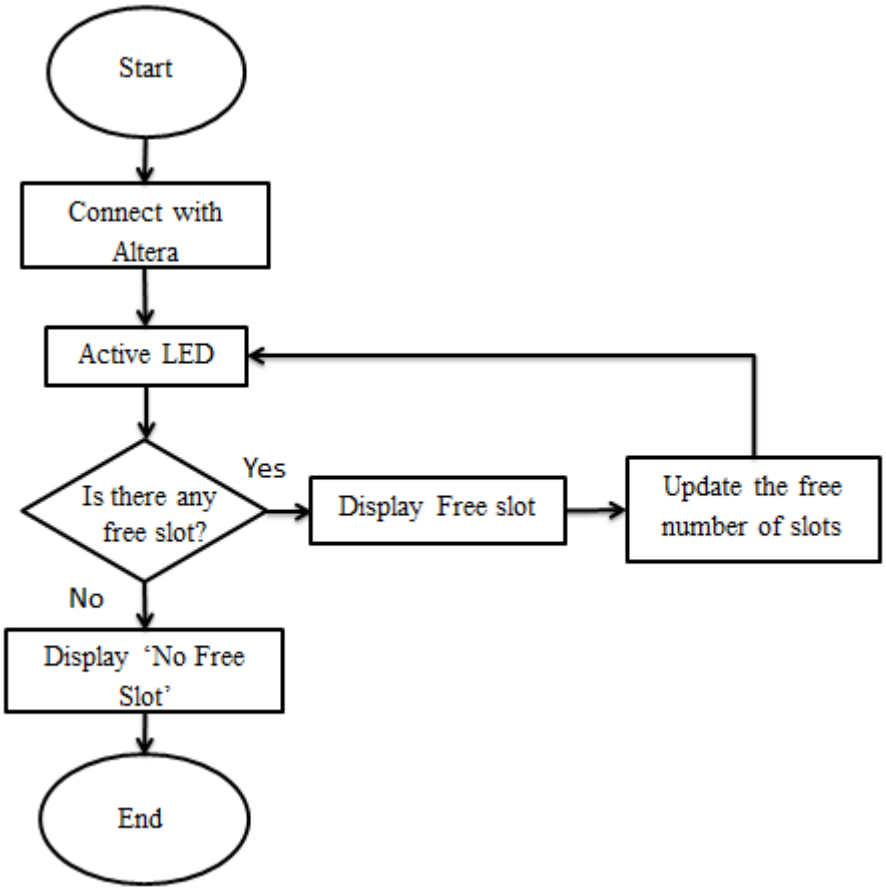

Figure 3.5: Flowchart for the Display

First connect with Altera then active LED display. If there any free slot LED will display the number for parking car otherwise it will display 'No Free Slot'.

3.5.2 The Gate

The administrator will open the gate by offering direction to Altera.

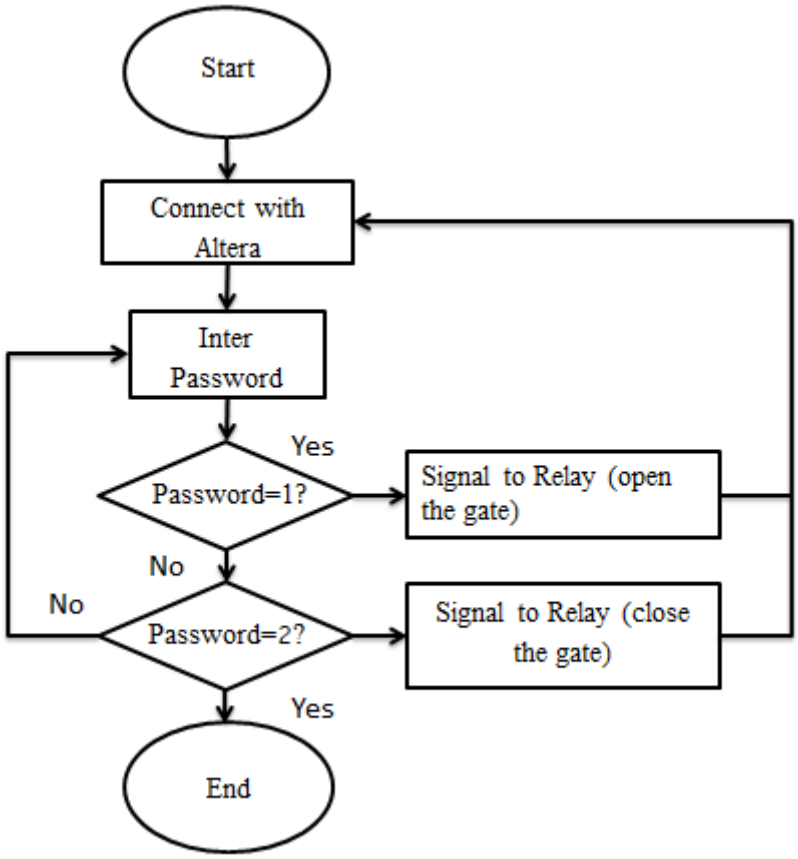

Figure 3.6: Flowchart for the gate

First connect with Altera, enter password for open the gate. If password =1 is correct relay will active to open the gate otherwise have to give password=2 to give signal in relay and then open the gate. Then car can enter into the parking lot and a signal give to rely to close the gate.

3.5.3 The central command

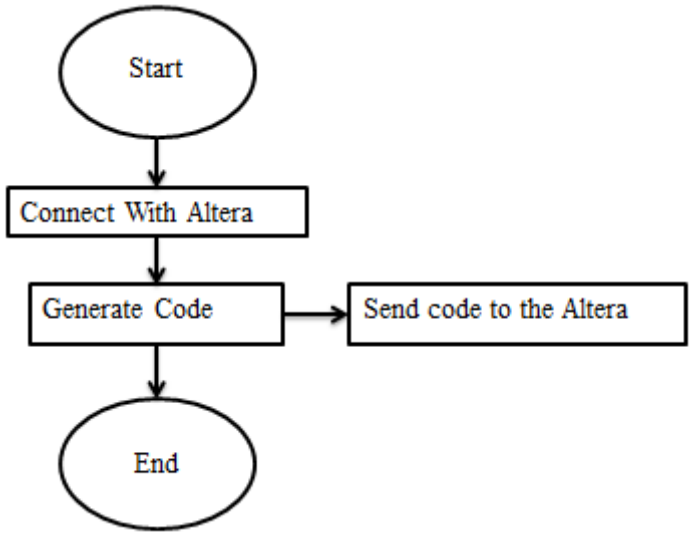

Figure 3.7: Flow Chart for the central command

Connect with Altera and generate the code using software. Send code to the Altera. Now Altera can do the central work for car parking.

3.5.4 The Exit

Wait until the previous car is parked. And continue the process again.

3.6 Implementation in VHDL

The Finite State Machine (FSM) of Intelligent Car Parking System will be used as a reference in writing the VHDL code. The states shown in the FSM will act as a reference case in the code to indicate the condition of the sensors. Quartus11 software is used to writing the code and simulates it. The code will work according to the FSM. After simulate the code we can identify that our code is working or not according to our desire.

3.7 Compile Program in Quartus II Software

In Quartus II software we can generate code and compile it. In our project we used Quartus II 9.1 (64-Bit). First we open the software then create a file and the file name must similar with the entity name. Open a new file then from there select VHDL file. Here we write our program and compile it.

3.7.1 Getting Started with Altera Quartus II

Launch the Altera Quartus II Software. See a screen such as this

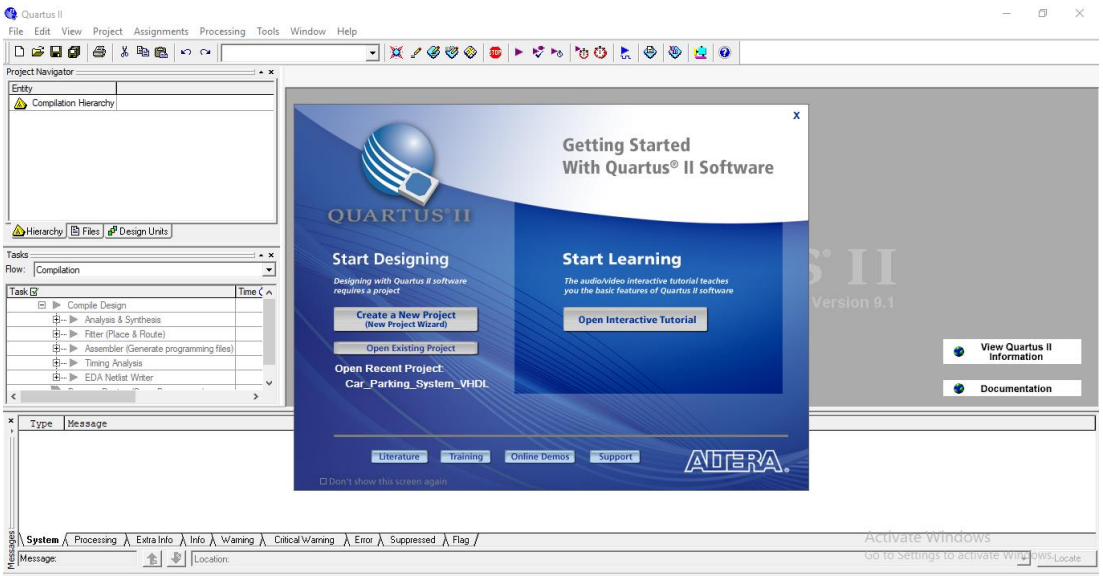

Figure 3.8: Opening Quartus II Software.

3.7.2 Create a new project

Select the File → Project Wizard; a window like the following will appear.

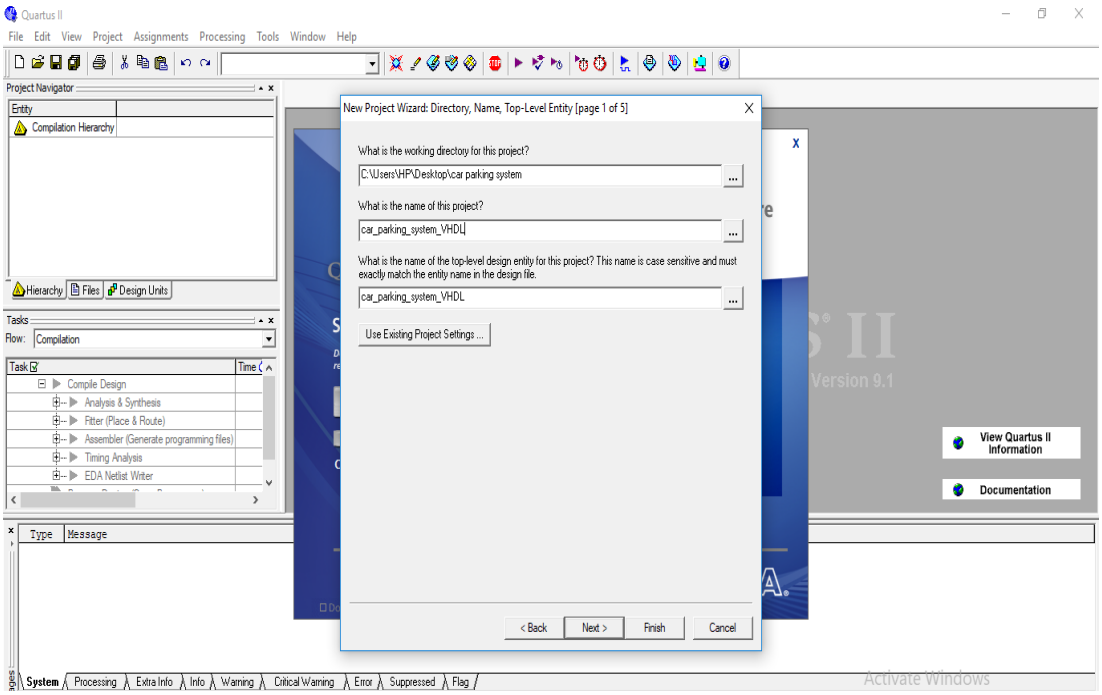

Figure 3.9: Creating New Project Wizard.

3.7.3 Choosing a Device

The programmable device which we'll use for our design can be chosen now.

Select MAX7000S from the "Family" pull-down list. Select the "Specific device selected" and then choose EPM7064SLC44-10, which is the device we are using in our lab. Select "OK."

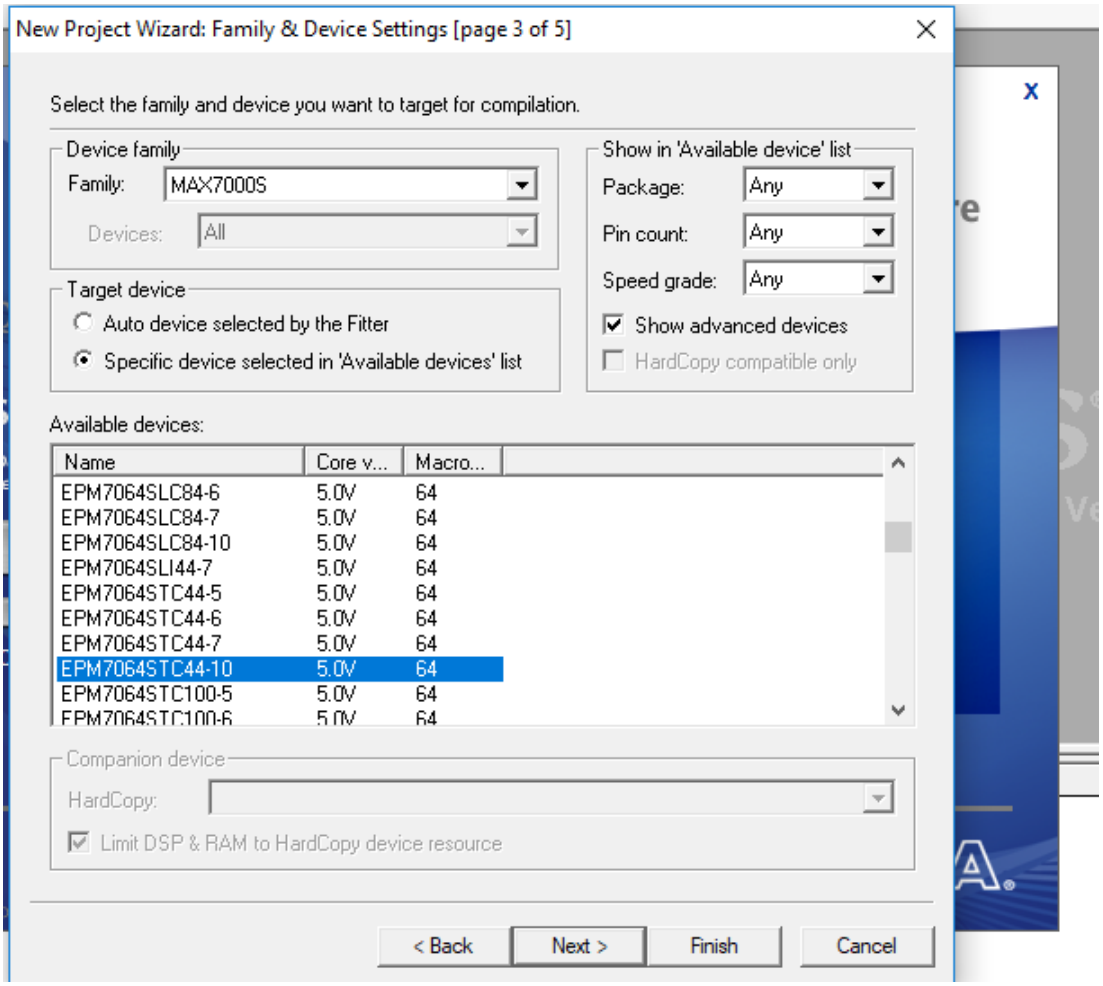

Figure 3.10: Selecting a Device

3.7.4 Creating a New File

Select File → New - A window as seen in the following picture will open. Select 'VHDL File' and press OK.

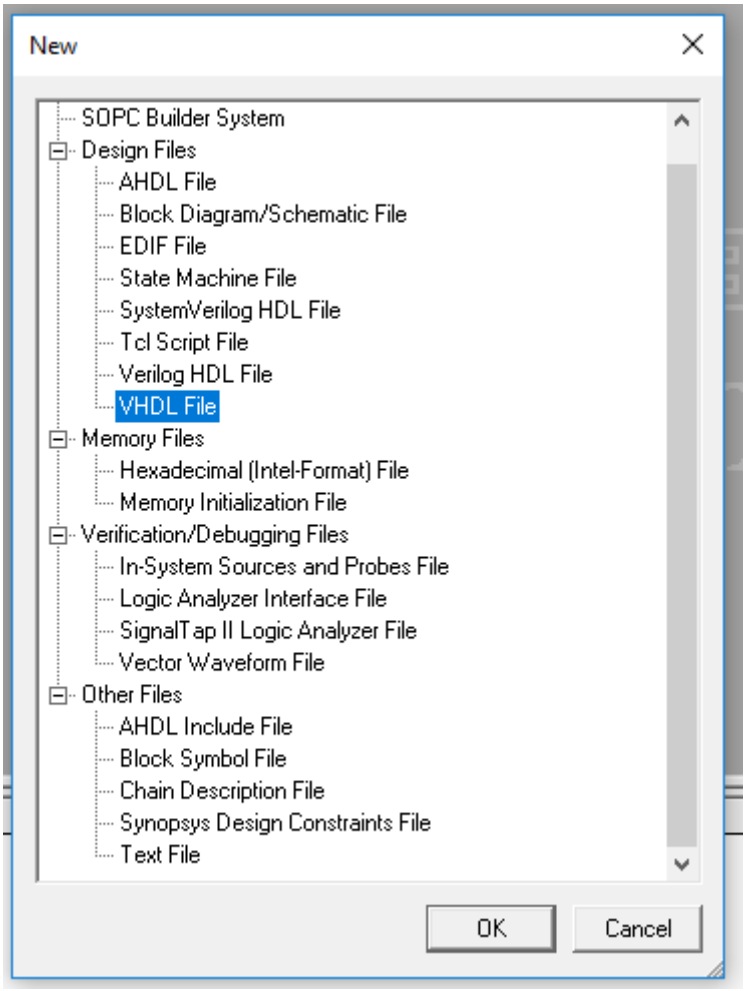

Figure 3.11: Creating a New File.

This should open a palette where we will write our code. We choose any file form here according to our program. Here we select VHDL File.

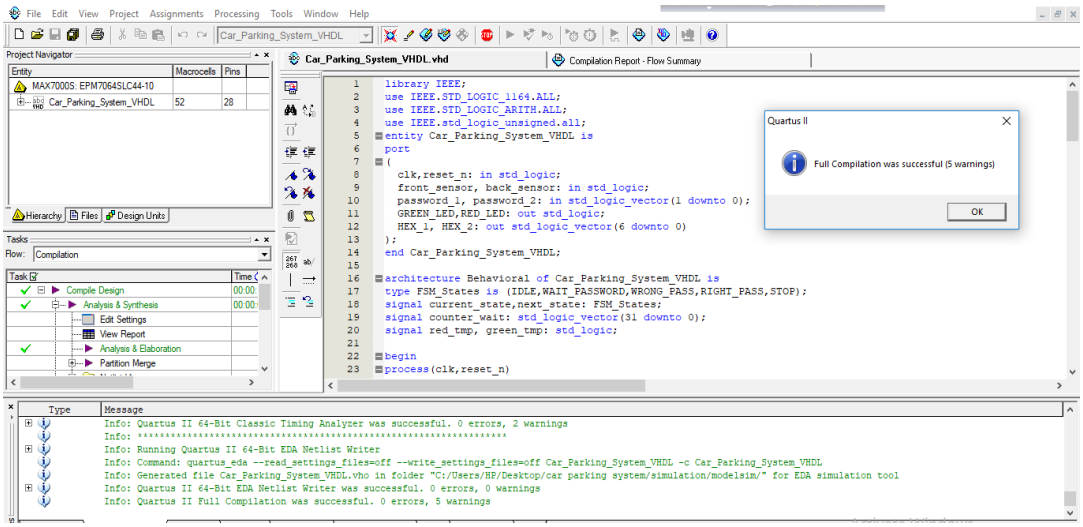

Figure 3.12 : VHDL Code Compilation.

Here shown that it's compiled successfully. And the compilation report is given below.

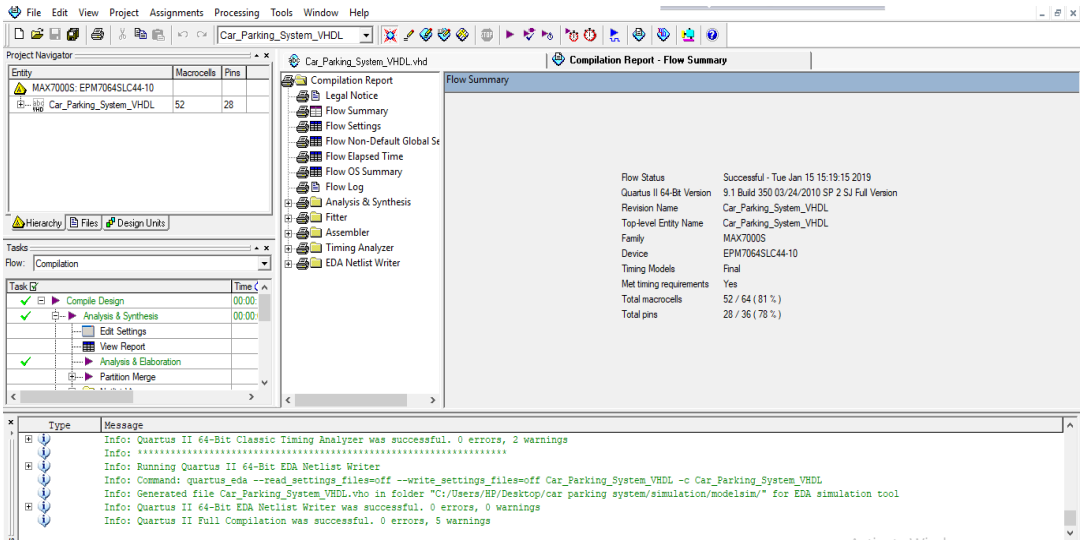

Figure 3.13 : Compilation Report.

From the report we can see MAX7000S family is used and it's device is EPM7064SLC44-10. The device contains total 52 microcells and our total pin is 28.

3.7.5 Create a Testbench

We can get Quartus to produce a shell test bench file by selecting Processing | Start | Start Test Bench Template Writer.

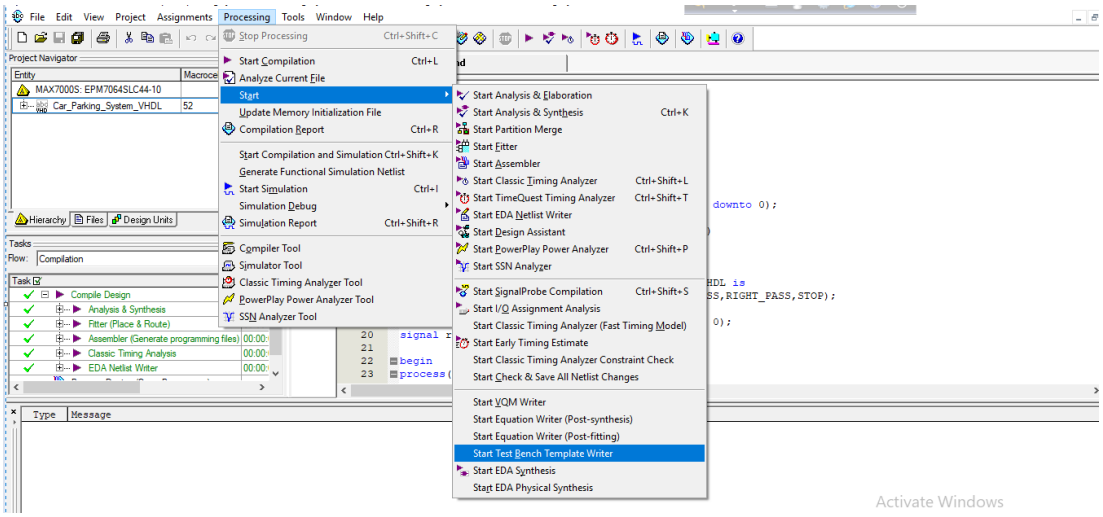

Figure 3.14 : Generating a Testbench.

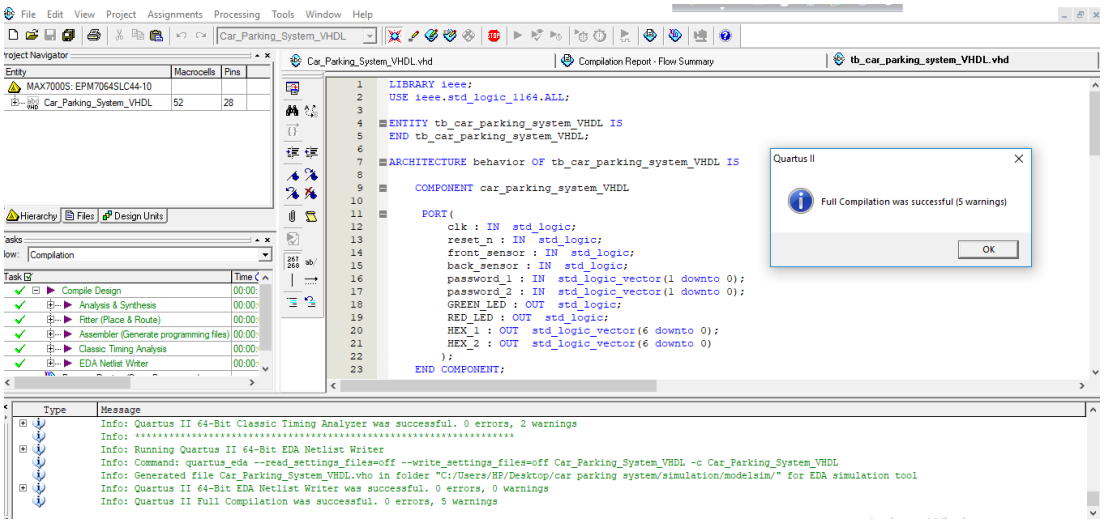

Figure 3.15: Compilation Report of Testbench.

Insert instructions for how we want the inputs to change through the simulation. And compile the test bench.

3.8 Analyzing Synthesis Results with the Net List Viewers

The quartus11 RTL viewer and State machine viewer provide graphical representation of design.

3.8.1 The RTL Viewer

To display the RTL viewer, on the tools menu, point to net list viewers and then click RTL viewers.

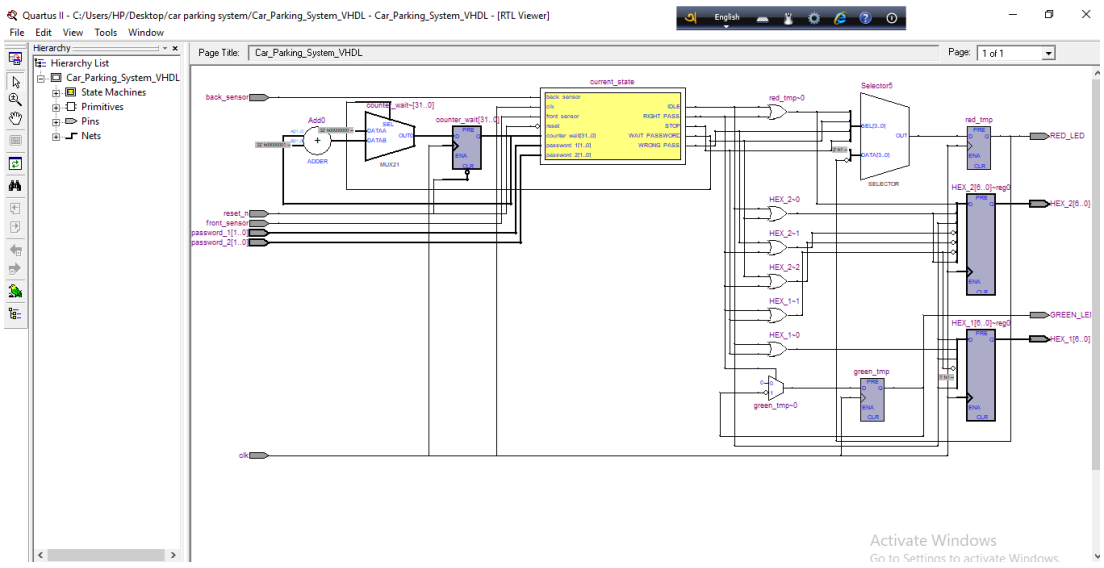

Figure 3.16: RTL Viewer.

The RTL viewer displays the analysis and elaborations results for VHDL design. Our RTL design consist of above information.

3.8.2 State Machine Viewer

The state machine viewers allow to view state machine diagram for the relevant logic in our design. For state machine viewer click on the tools menu, point to net list viewers, then click state machine viewer.

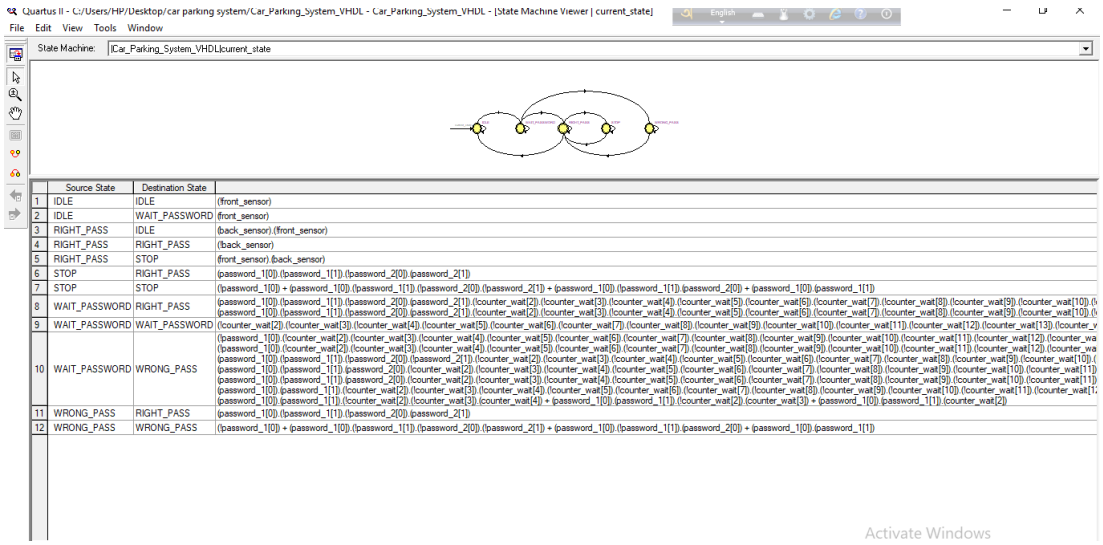

Figure 3.17: State Machine Viewer.

3.8.3 The Technology Map Viewer

The Quartus II technology map viewers provides a low – level or atom level technology- schematic representation of a design. After perform analysis and synthesis or a full compilation has to run the technology map viewer for a Quartus II project. After successfully performed analysis and synthesis display the technology map viewer by pointing.

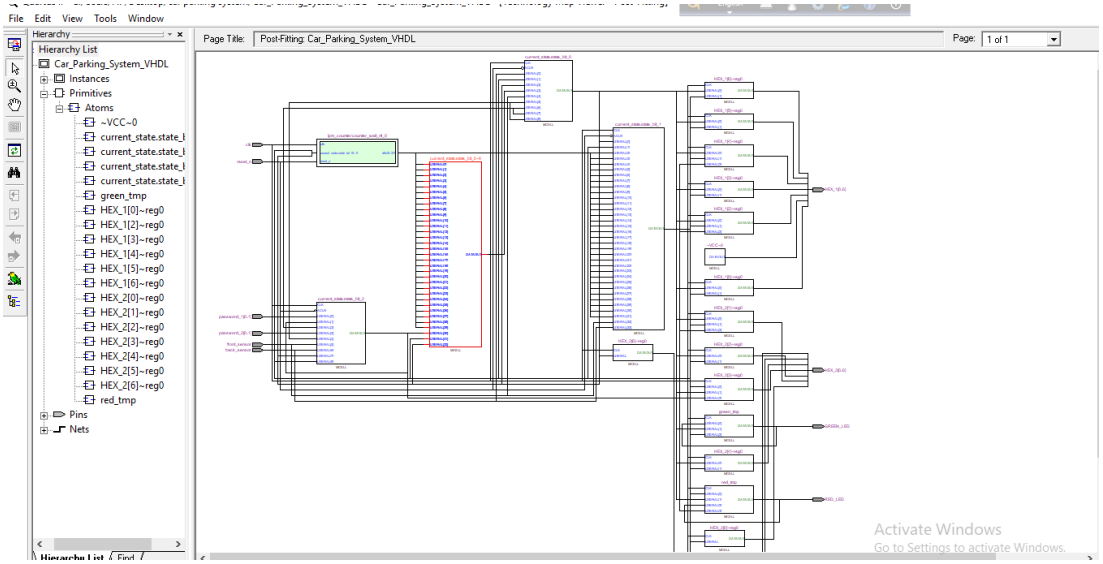

Figure 3.18: Technology Map Viewer.

To net list viewer on the tool menu and then clicking technology map viewer. The technology map viewer includes a schematic view, and also includes a hierarchy list, which lists the instances, primitives, pins and nest for the entire design net list.

3.8.4 The Pin Planner

The Pin Planner allows to make assignments to pins and groups of pins. It includes a package view of the device with different colors and symbols that represent the different types of pins and additional symbols that represent I/O banks. The symbols used in the Pin Planner are very similar to the symbols used in device family data sheets. It also includes tables of pins and groups.

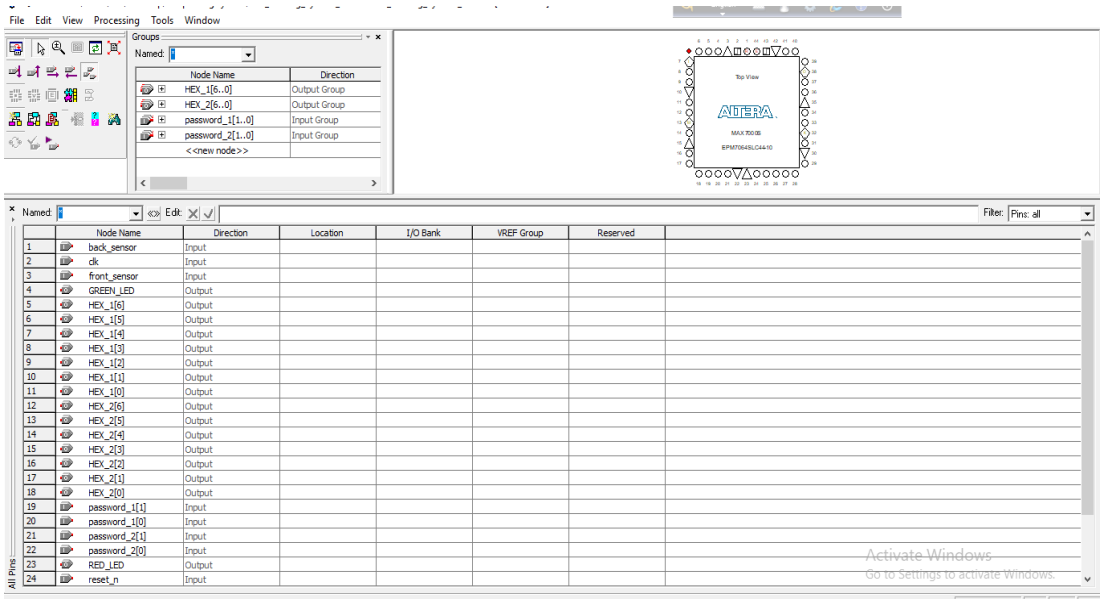

Figure 3.19: Pin Planner.

From the pin planner a groups list, and all pins list and a package view diagram of the device can be displayed. By dragging pins from the groups list and all pins list to an available pin or I/O bank locations in the package diagram can be made pin assignments. From the all pins list can filter the node names, change the I/O standards, and specify options for reserved pins. Can also filter the all pins list to display on the unassigned pins, so it can be changed the node name and direction for user added nodes. Reserved pins options can also be specified.

3.9 Hardware Components

We've utilized the accompanying hardware segments for our project:

- Altera FPGA Board
- Sensor
- LED Display
- H-Bridge
- Relay
- Power Supply

3.9.1 Altera FPGA Board

A field-programmable gate array (FPGA) is an integrated circuit and is fabricated to be effortlessly reconfigured by engineers, fashioners or clients. FPGAs are logical blocks and interconnects that can be programmable by Hardware Description Languages (Verilog HDL/VHDL) to perform distinctive complex capacities. FPGA boards as pursues:

1. Xilinx FPGA board
2. Altera FPGA board

Here we utilized Altera FPGA board in this project. This board is comprises of single LED, 7-segment LED, IOs for LCD. On board PS/2, VGA, RS232 port for UART communications. Offer example code and programming record to test.

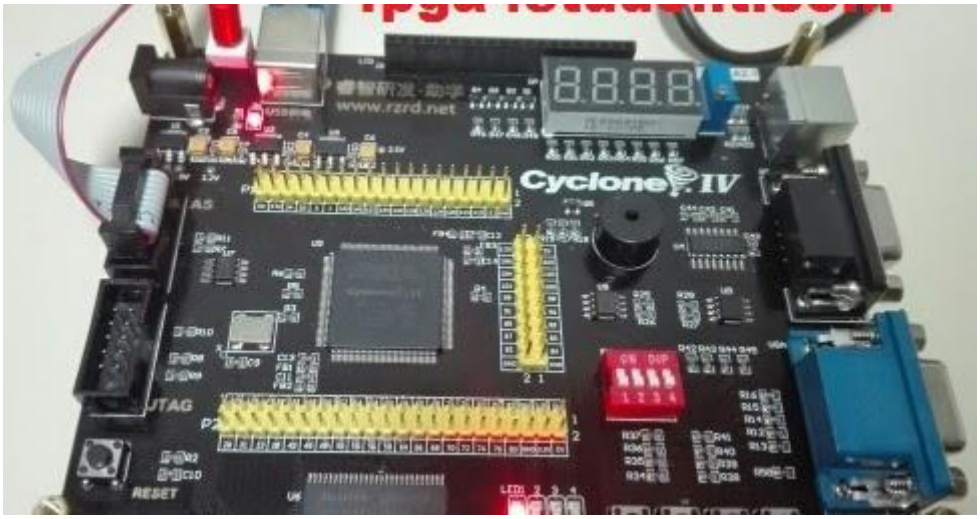

Figure 3.20: Altera FPGA Board.

3.9.2 Sensor

A sensor is a device, module, or subsystem which is utilized to identify events or changes to some kind of contribution from the physical condition and send the data to different hardware. The explicit information could be light, heat, motion, moisture, pressure, or any of an extraordinary number of other natural wonders. The yield is commonly a signal that is changed over to comprehensible showcase at the sensor area or transmitted electronically over a system for perusing or further preparing.

Figure 3.21: Different Type of Light Sensor.

3.9.3 LED Display

An LED show is a level board show, which utilizes a variety of light-emitting diodes as pixels for a video show. LEDs are accessible for 7-fragment show, as in a computerized clock. Driven showcase is one of the fundamental screen shows that are as a rule monetarily utilized. The greatest favorable position of the LED show is its

effective and low-vitality utilization, which is particularly required for handhelds and chargeable devices, for example, cell phones and tablets. An LED show comprises of various LED boards that, thusly, comprise of a few LEDs. LEDs have various points of interest over other light-radiating sources that can be utilized on the other hand. Besides being power effective, LEDs create more brightness and more noteworthy light force.

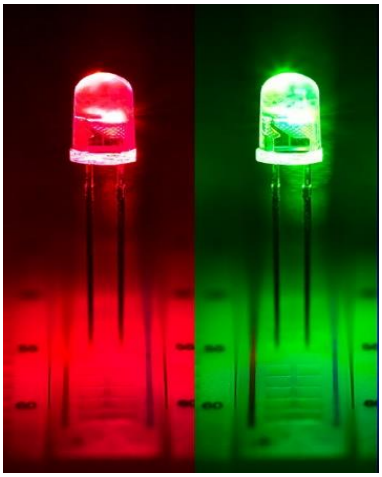

Figure 3.22: LED

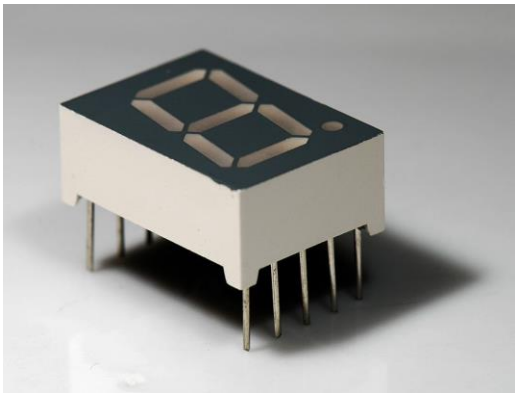

Figure 3.23: A Typical 7-Segment LED Display

3.9.4 Relay

A relay is an electromagnetic switch which is worked by a moderately little electric flow that can turn on or off a lot bigger electric flow. An electromagnet is the core of a relay (a loop of wire that turns into an impermanent magnet when power moves through it). Numerous sensors are unimaginably touchy bits of electronic hardware and deliver just little electric flows. Yet, frequently we require them to drive greater bits of mechanical assembly that utilization greater flows. Transfers cross over any barrier, making it workable for little flows to actuate bigger ones. That implies transfers can work either as switches (turning things on and off) or as amplifiers (changing over little flows into bigger ones).

Figure 3.24: Relay

3.9.5 H-Bridge

An H bridge is an electronic circuit that switches the extremity of a voltage connected to a load. These circuits are frequently utilized in mechanical autonomy and different applications to permit DC motors to run advances or in reverse.

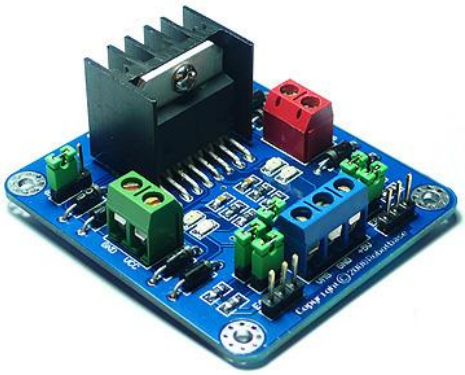

Figure 3.25: H-Bridge

3.9.6 Power Supply

A power supply is a part that provisions capacity to an electric load. Regularly it changes over electric flow from a source to the right voltage, current, and frequency to control the load. All power supplies have a power input association, which gets energy as electric flow from a source, and at least one power yield associations that convey current to the load. A power supply is otherwise called a power supply unit, power brick or power adapter.

Figure 3.26: Power Supply.

3.10 Summery

From above discussion, it is obvious that designing an automated car parking system that pleases all the criteria simultaneously is a complicated task. Due to time limitation we do not implement our work in hardware. We only analysis and synthesis the VHDL code using software. In future we hope we will implement our project in hardware.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

In this chapter we will simulate our VHDL program using Vector Waveform File in Quartus II Software. The result for simulation will be detailed in this chapter. The output simulation result will also be shown in this chapter.

4.2 Result for Automated Car Parking System

After compilation the VHDL code we can generate waveform from the code. From the wave we will know about our exertion is working or not. We add input output pins in the wave as shown as below.

Figure 4.1: Diagram Showing Simulation Result of Car Parking System

From the above diagram we can see the input output pins and wave of our code. Based on the interface diagram of car parking system in previous chapter (Figure 3.3) and the table 3.1 to synthesizable VHDL code is written and circuit gate logic was design.

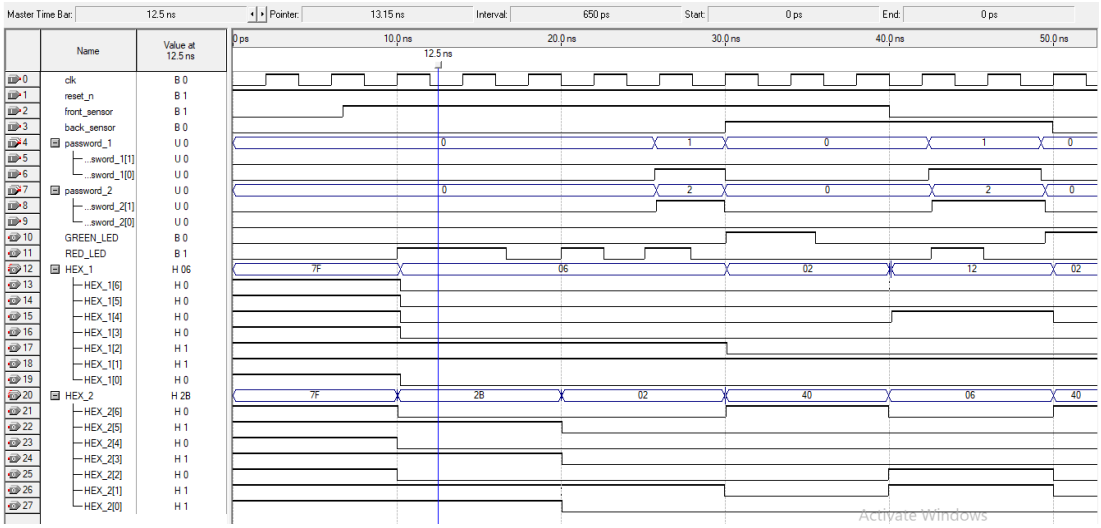

Figure 4.2: Diagram Showing Simulation Result of Car Parking System

We expand all the pins to show the wave in details. Various pins are assigned in the wave form. HEX_1 and HEX_2 indicates the empty parking space number.

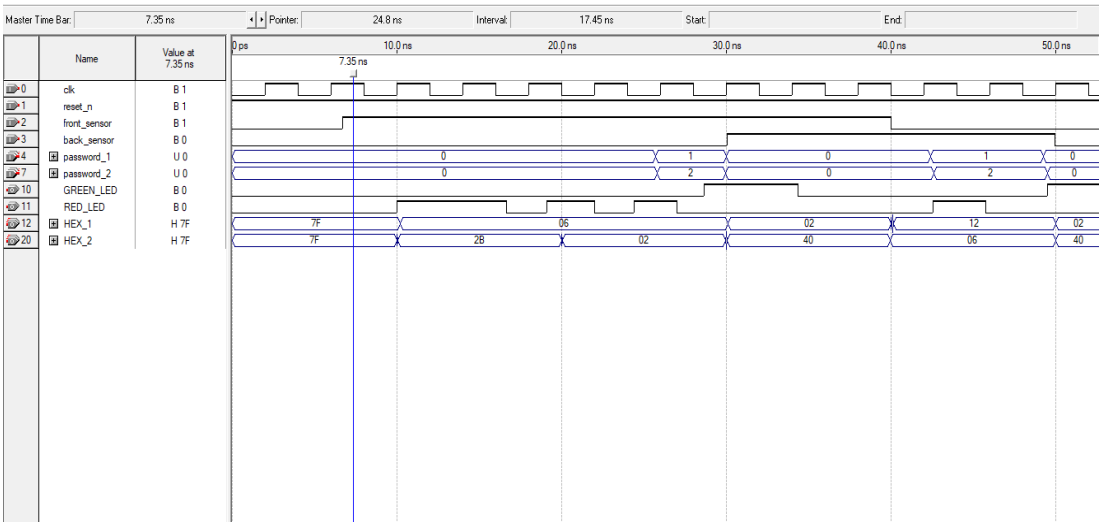

Figure 4.3: Waveform of front_sensor =1 @7.35ns

In Fig.4.3 at front_sensor =1, front sensor detects the presence of vehicles. Therefore, the FSM turns into the next state.

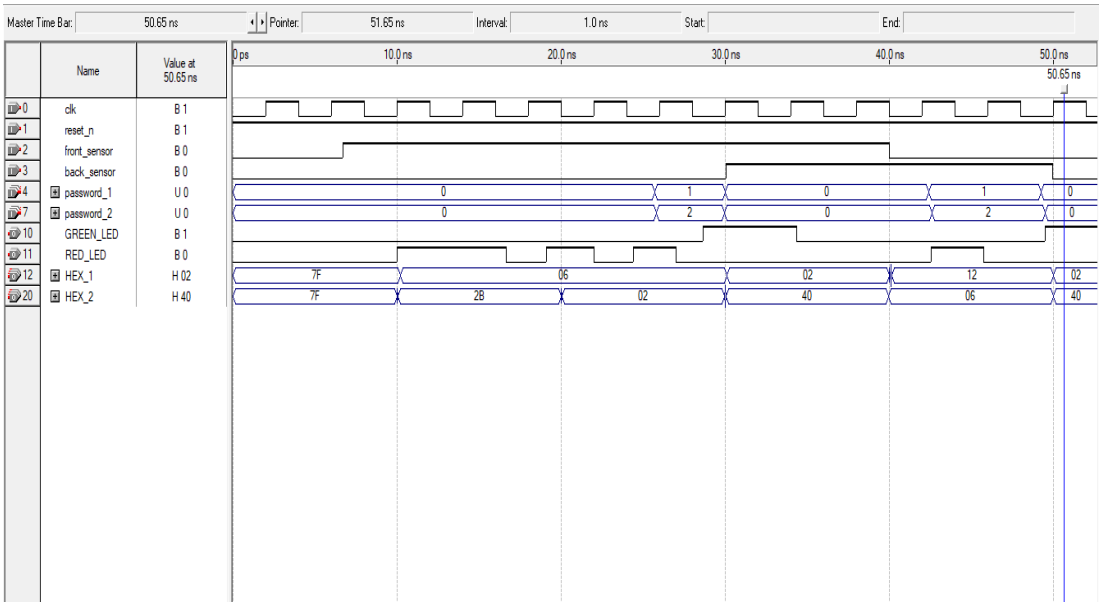

Figure 4.4: Waveform of GREEN_LED =1 @50.65ns

Now the FSM turns into Wait Password state. Here driver enter the password. In Fig.4.4 at GREEN_LED =1, it means the password is correct and FSM turns into RIGHT_PASSWORD state. Then open the gate for the car to enter into the parking space.

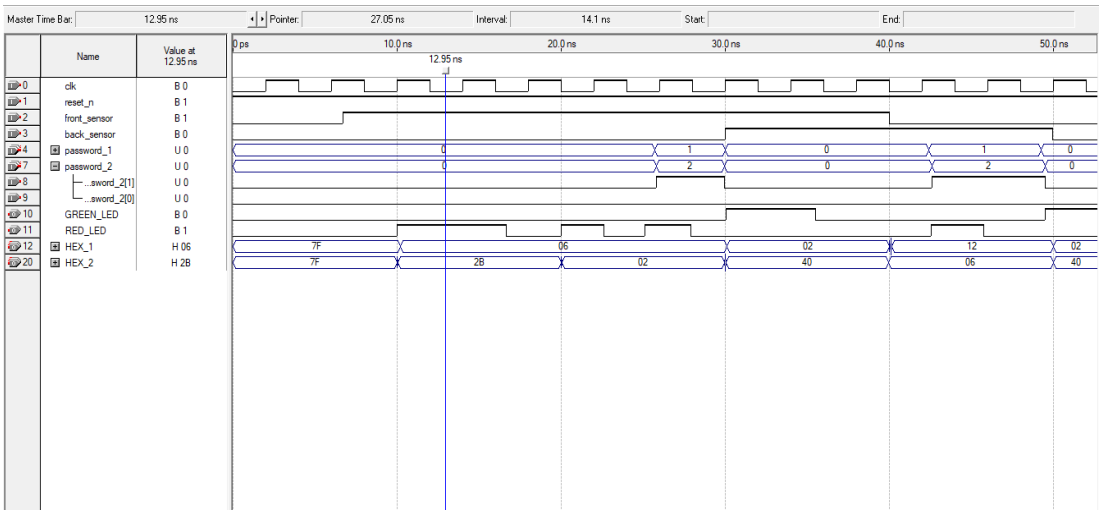

Figure 4.5: Waveform of RED_LED =1 @12.95ns

In Fig.4.5.at RED_LED=1, the enter password is wrong so the FSM turns into WRONG_PASSWORD state. Until the password is right the gate will not be opened.

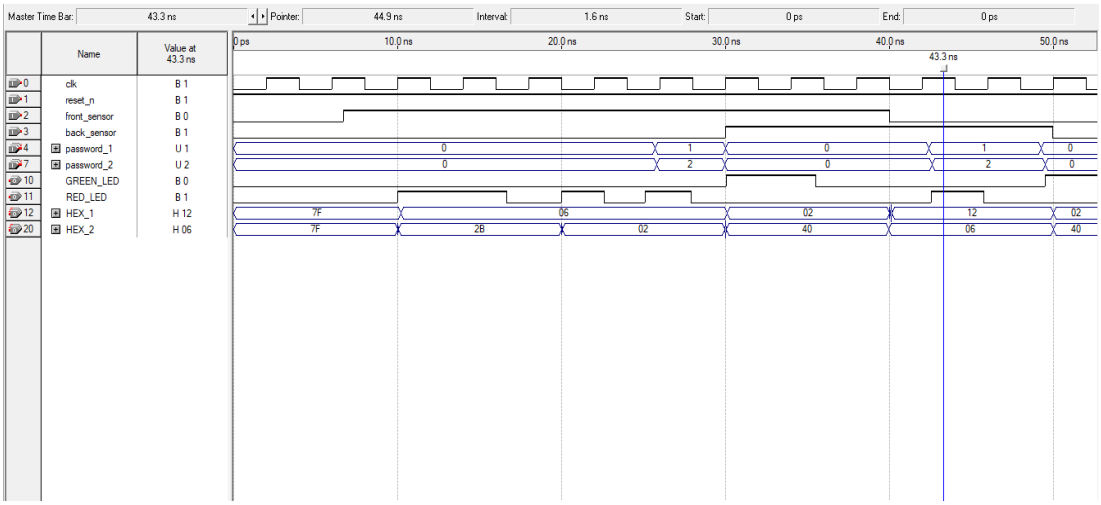

Figure 4.6: Waveform of RED_LED =1 and back_sensor = 1 @43.3ns

In Fig. 4.6 at RED_LED =1 and back sensor = 1 it means another car is coming to the parking space before parking of the previous car. So the FSM turns into STOP state and blink the RED_LED to notify the next car that one car is already in the parking lot.

4.3 Discussion

The output for car parking system is dependent on the password which is in the entry gate. The gate will open or not accroding to the password accurateness.FSM is used to do the whole sytem. From the output we the various diffenrence in every step. We face various problem to generate our wave. We can change the VHDL code to increase the blinking period of the Green LED and Red LED. Also, can change the period of waiting for password being entered in the FSM VHDL code of the car parking system.

The step of this project is difficult to finish. Before begin a plan a program, the all data and expected yield must be recorded and the interface info and yield additionally ought to be know in detail. Structure a graph for the interface info and yield ought to be a simple was to see plan the system.

CHAPTER 5
CONCLUSION

5.1 Conclusion

Subsequent to doing study on computerized car parking system it is discovered that robotized car parking systems can be presented in our country and it will be recipient with regards to our country. The primary advantages are time and diminish congested driving conditions. It can likewise give supportable stopping the board in an eco-accommodating way. As the Green House Gas outflow will be less in sum and the environment will be spotless. There is less support cost for this framework so it is helps the property designer in cost sparing. It gives security to the parking ground. Computerized car parking systems lessen the issue in parking grounds and road turned parking lot. It will profit the property designer to build their income which will add to the administration impose income. So in a way it is additionally helping the administration by expanding charge income. It will likewise empower Automation Engineering in our country which will make progression in expanding use of innovation. In this manner we ought to present computerized car parking systems and appreciate the advantages.

5.2 Future Ideas

This idea can be connected to the techno-business use of the car park. Later on, we will consider the case with 200 car parks. In the experimentation, the 200 car parks will be partitioned into 4 areas every one of 50 parcels separately.

5.2.1 Smart Acknowledgment of Vehicles

We can perceive the vehicles by their number plates with the assistance of picture preparing in computerized car parking system. By utilizing this sort of innovation clients can specifically pay for their car parking utilizing cell phone's prepaid parity or car parking account balance.

5.2.2 Updating Users About Accessible Slots and Record Balance

Client can get refreshes about accessible slots of a specific parking spot and record balance by sending a basic SMS to the information base.

5.3 Commercialization Potential

The purposes of this project are to design a safe and efficient parking space and to assign the right way to minimize delay waiting time to park car. This project, a car parking system is to improve the movement of the vehicles on the parking space. This project is design to remove the unplanned car park on the road.

The intelligent car parking system was chosen because to practice designing a program. When using this product, it will be able to reduce a traffic jam in road, ensure car safety and it also to minimize a waiting time to park car.

I believe that my product is very brilliant idea to solve a parking problem. This is because almost of the car parking system in city using a manual parking system.

In the market, there are has similar idea with my project. The automatic system is not widely used in Dhaka. This product actually designs for Dhaka to solve the parking problem.

This product is not expensive compare with the other product. It product can uses in anywhere. This product not only can use in Dhaka, it also can use for the other city.

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5. Maria Rodriguez Ferandez, Eduardo Zalama Casanova and Ignacio Gonzalez Alonso “Review of Display Technologies Focusing on Power Consumption”
6. Insop Song; Gowan, K.; Nery, J.; Han, H.; Sheng, T.; Li, H.; Karray, F.; ,(2006) "Intelligent Parking System Design Using FPGA," Field Programmable Logic and Applications,
7. Srikanth, S.V.; Pramod, P.J.; Dileep, K.P.; Tapas, S.; Patil, M.U.; Sarat, C.B.N.;(2009) , "Design and Implementation of a Prototype Smart Parking (SPARK) System Using Wireless Sensor Networks."
8. www.fpga4student.com

APPENDIX A:

VHDL code for the car parking system using FSM:

```
library IEEE;
use IEEE.STD_LOGIC_1164.ALL;
use IEEE.std_logic_unsigned.all;
entity Car_Parking_System_VHDL is
port
(
  clk,reset_n: in std_logic;
  front_sensor, back_sensor: in std_logic;
  password_1, password_2: in std_logic_vector(1 downto 0);
  GREEN_LED,RED_LED: out std_logic;
  HEX_1, HEX_2: out std_logic_vector(6 downto 0)
);
end Car_Parking_System_VHDL;

architecture Behavioral of Car_Parking_System_VHDL is
type FSM_States is
(IDLE,WAIT_PASSWORD,WRONG_PASS,RIGHT_PASS,STOP);
signal current_state,next_state: FSM_States;
signal counter_wait: std_logic_vector(31 downto 0);
signal red_tmp, green_tmp: std_logic;

begin
process(clk,reset_n)
begin
 if(reset_n='0') then
  current_state <= IDLE;
 elsif(rising_edge(clk)) then
  current_state <= next_state;
 end if;
end process;

process(current_state,front_sensor,password_1,password_2,back_sensor,counter_wai
t)
 begin
 case current_state is
 when IDLE =>
```

```
if(front_sensor = '1') then

 next_state <= WAIT_PASSWORD;
else
 next_state <= IDLE;
end if;
when WAIT_PASSWORD =>
if(counter_wait <= x"00000003") then
 next_state <= WAIT_PASSWORD;
else
if((password_1="01")and(password_2="10")) then
next_state <= RIGHT_PASS;
else
next_state <= WRONG_PASS;
end if;
end if;
when WRONG_PASS =>
 if((password_1="01")and(password_2="10")) then
next_state <= RIGHT_PASS;
 else
next_state <= WRONG_PASS;
 end if;
when RIGHT_PASS =>
 if(front_sensor='1' and back_sensor = '1') then
next_state <= STOP;
  elsif(back_sensor= '1') then

next_state <= IDLE;
 else
next_state <= RIGHT_PASS;
 end if;
when STOP =>
 if((password_1="01")and(password_2="10"))then

next_state <= RIGHT_PASS;
 else
next_state <= STOP;
 end if;
when others => next_state <= IDLE;
end case;
```

```
 end process;

process(clk,reset_n)
 begin
 if(reset_n='0') then
 counter_wait <= (others => '0');
 elsif(rising_edge(clk))then
  if(current_state=WAIT_PASSWORD)then
  counter_wait <= counter_wait + x"00000001";
  else
  counter_wait <= (others => '0');
  end if;
 end if;
 end process;

 process(clk)
 begin
 if(rising_edge(clk)) then
 case(current_state) is
 when IDLE =>
 green_tmp <= '0';
 red_tmp <= '0';
 HEX_1 <= "1111111";
 HEX_2 <= "1111111";
 when WAIT_PASSWORD =>
 green_tmp <= '0';
 red_tmp <= '1';

 HEX_1 <= "0000110";
 HEX_2 <= "0101011";
 when WRONG_PASS =>
 green_tmp <= '0';
 red_tmp <= not red_tmp;
 HEX_1 <= "0000110";
 HEX_2 <= "0000110";
 when RIGHT_PASS =>
 green_tmp <= not green_tmp;
 red_tmp <= '0';
 HEX_1 <= "0000010";
 HEX_2 <= "1000000";
```

```
when STOP =>
green_tmp <= '0';
red_tmp <= not red_tmp;
HEX_1 <= "0010010";
HEX_2 <= "0001100";
when others =>
green_tmp <= '0';
red_tmp <= '0';
HEX_1 <= "1111111";
HEX_2 <= "1111111";
 end case;
end if;
end process;
 RED_LED <= red_tmp;
 GREEN_LED <= green_tmp;

end Behavioral;
```

APPENDIX B:

VHDL Testbench code for the car parking system using FSM:

```
LIBRARY ieee;
USE ieee.std_logic_1164.ALL;

ENTITY tb_car_parking_system_VHDL IS
END tb_car_parking_system_VHDL;

ARCHITECTURE behavior OF tb_car_parking_system_VHDL IS

  COMPONENT Car_Parking_System_VHDL
  PORT(
     clk : IN  std_logic;
     reset_n : IN  std_logic;
     front_sensor : IN  std_logic;
     back_sensor : IN  std_logic;
     password_1 : IN  std_logic_vector(1 downto 0);
     password_2 : IN  std_logic_vector(1 downto 0);
     GREEN_LED : OUT  std_logic;
     RED_LED : OUT  std_logic;
     HEX_1 : OUT  std_logic_vector(6 downto 0);
     HEX_2 : OUT  std_logic_vector(6 downto 0)
    );
  END COMPONENT;



  signal clk : std_logic := '0';
  signal reset_n : std_logic := '0';
  signal front_sensor : std_logic := '0';
  signal back_sensor : std_logic := '0';
  signal password_1 : std_logic_vector(1 downto 0) := (others => '0');
  signal password_2 : std_logic_vector(1 downto 0) := (others => '0');

  signal GREEN_LED : std_logic;
  signal RED_LED : std_logic;
  signal HEX_1 : std_logic_vector(6 downto 0);
  signal HEX_2 : std_logic_vector(6 downto 0);
```

```
  constant clk_period : time := 10 ns;


BEGIN


  Car_park_system: Car_Parking_System_VHDL PORT MAP (
        clk => clk,
        reset_n => reset_n,
        front_sensor => front_sensor,
        back_sensor => back_sensor,
        password_1 => password_1,
        password_2 => password_2,
        GREEN_LED => GREEN_LED,
        RED_LED => RED_LED,
        HEX_1 => HEX_1,
     HEX_2 => HEX_2);


  clk_process :process
  begin
clk <= '0';
wait for clk_period/2;
clk <= '1';
wait for clk_period/2;
  end process;

  stim_proc: process
  begin
     reset_n <= '0';
front_sensor <= '0';
back_sensor <= '0';
password_1 <= "00";
password_2 <= "00";
    wait for clk_period*10;
reset_n <= '1';
wait for clk_period*10;
front_sensor <= '1';
```

```
  wait for clk_period*10;
  password_1 <= "01";
  password_2 <= "10";
  wait until HEX_1 = "0000010";
  password_1 <= "00";
  password_2 <= "00";
  back_sensor <= '1';
  wait until HEX_1 = "0010010";
  password_1 <= "01";
  password_2 <= "10";
  front_sensor <= '0';
  wait until HEX_1 = "0000010";
  password_1 <= "00";
  password_2 <= "00";
  back_sensor <= '1';
  wait until HEX_1 = "1111111";
  back_sensor <= '0';


    wait;
  end process;

END;
```