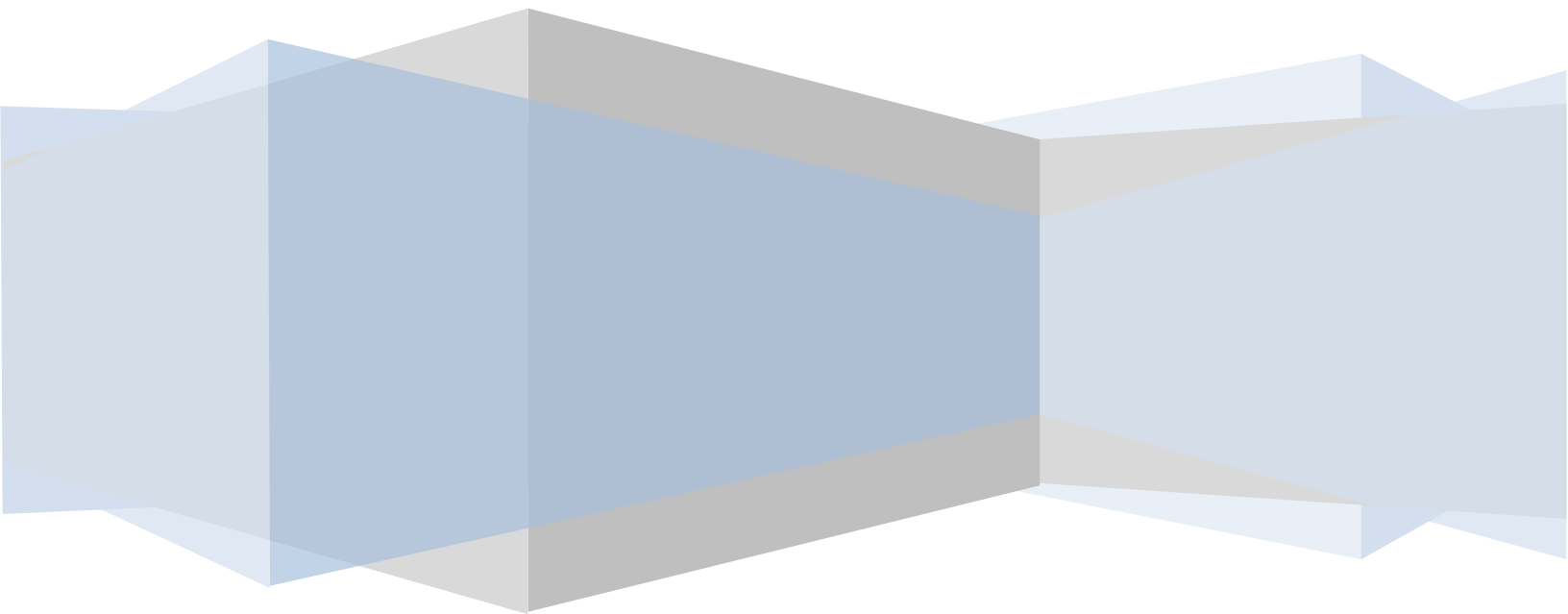


Self-Car Driving



1. INTRODUCTION

- ❖ **A self-driving car** is a vehicle that is capable of sensing its environment and moving safely with little or no human input, the future of this technology may have an impact on multiple industries and other circumstances , Self-driving cars combine a variety of sensors to perceive their surroundings, such as radar, GPS, AI system , Camera , odometry and inertial measurement units Advanced control systems interpret sensory information to identify appropriate navigation paths, as well as obstacles and relevant signage.
- ❖ **The Sensors** used to keep on the safe distance between the Car and other Machines, sense the white Marks on the street so keep in the same Lane without going to other Lane without permission
- ❖ **The Camera** used to determine the size of the objects around the car so the Computer will draw it as a box with its dimensions. determines also the Traffic Lights if the Traffic is red or yellow then give an order to stop, if Green then give an order to pass. It reads the speed limit on Roads too and the system has an AI that determines the best route for travel, recognize the other cars and predict their movement around the car, and calculate every movement the car takes in parking and during the navigation

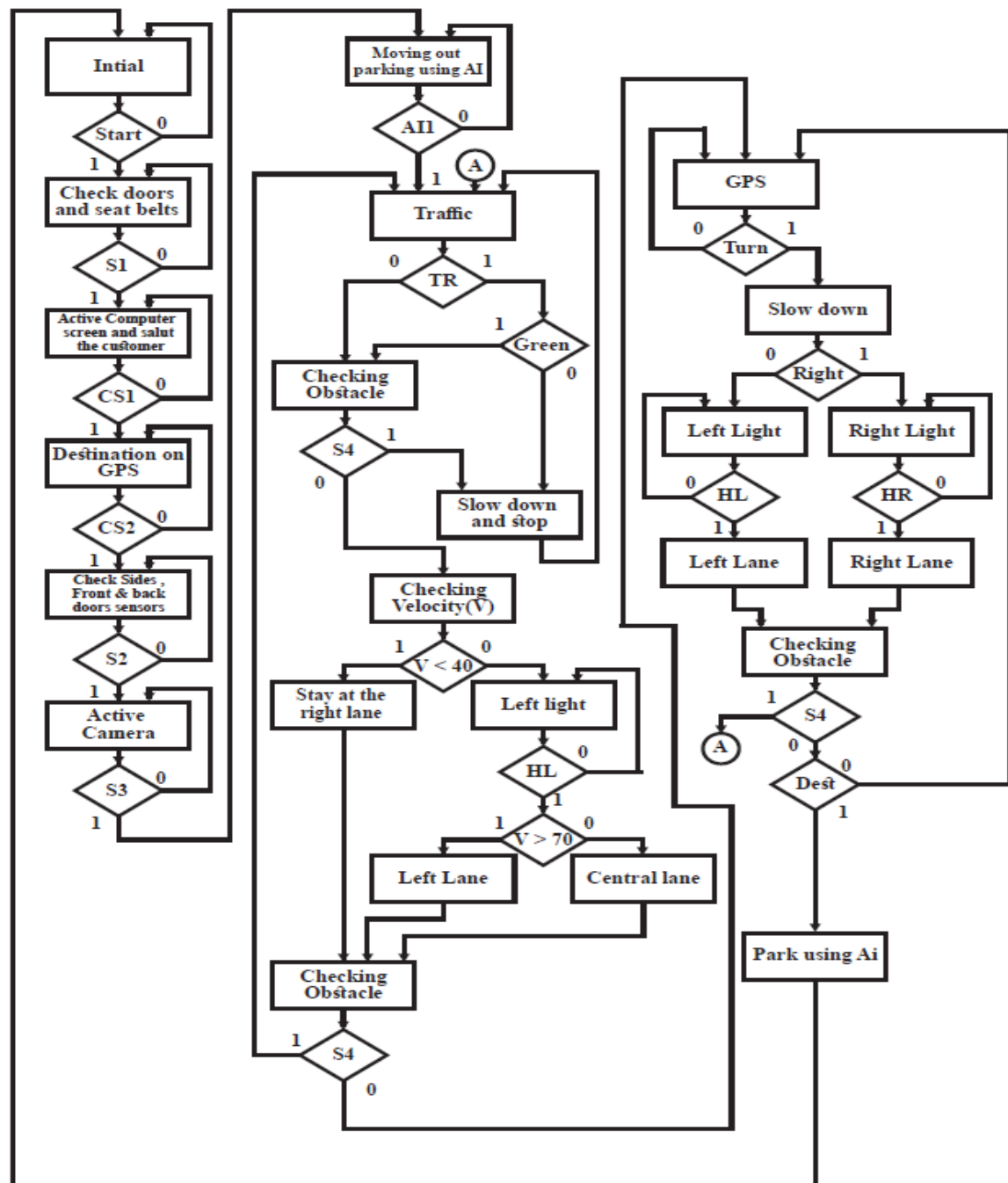
❖ Steps

- 1- The Car is in Initial State.
- 2- Press the Start Drive Button to activate the Engine.
- 3- Check that the Seat Belts are fastened and that the Doors are locked well for Safety.
- 4- Activate the Computer Screen and Salute the Riders.
- 5- The Rider enters the required Destination on GPS Navigator.
- 6- Activate the side, front and back Sensors. Activate the Camera on the top of the Car.
- 7- The car will move out of the parking spot using the AI to control its movement and calculate the safest way to get the car on the road.
- 8- Start the Trip and follow the GPS. If the speed is from [0-40Km/h], then stay at the right Lane. If the Speed is from [40-70Km/h], then Activate the Left Car Rear Headlight for 5 seconds and then change to the Central Lane. If the Speed is above [70Km/h] then Activate the Left Car Rear Headlight for 5 seconds again and change to the Left Lane.

Note : The speed is determined according to the state of the Road.

- 9- If the GPS gives that we need to turn right after a near distance, then Activate the right Car Rear Headlight for 5 seconds and then change to the Right Lane while slowing down till the car reach the right turn and then slide within the same Lane without leaving it.
- 10- If the GPS gives that we need to turn Left after a near distance, then Activate the left Car Rear Headlight for 5 seconds and then change to the left Lane while slowing down till the car reach the left turn and then slide within the same Lane without leaving it.
- 11- If the Camera recognized a traffic light, then it reads if the Lights Are Red or Yellow, then slow down and stop. If the Light is Green, then continue and pass the Traffic Light.
- 12-The sensors and camera are active all the time so that if there is any hindrance in the way or the car in front stopped moving, the rear lights will be turned on and the car will decelerate and stop when the road is clear again the car will continue moving. (Hindrance like a passerby or an animal crossing the street)
- 13-When the destination is reached then drive to the location of nearest open parking space.
- 14-Check if the parking space is for horizontal or vertical parking. Then park the car using the AI.
- 15- Print DISTINATION REACHED on the screen and return to initial state.

❖ ASM chart



❖ VHDL CODE

```
library ieee;
use ieee.std_logic_1164.all;

entity selfdrivingcar is
    Port (
        clk,rst,start,s1,cs1,cs2,s2,s3,Ai1,tr,s4,v40,h1,v70,hr,g,tu,right
        ,dest : in STD_LOGIC;

        sc,sen,ca,Ai,stop,rl,ll,v,cl,llight,rlight,gps,sd,e,traffic,cd,ob
        st: out STD_LOGIC);
end selfdrivingcar;

architecture Behavioral of selfdrivingcar is
    type state
    is (T0,T1,T2,T3,T4,T5,T6,T7,T8,T9,T10,T11,T12,T13,T14,T15,T16,T17,
        T18,T19,T20,T21,T22,T23);
    signal pr,nxt:state;
begin
    seq:process(clk)
    begin
        if rising_edge(clk) then
            if (rst='1')
                then
                    pr<=T0;
                else
                    pr<=nxt;
                end if;
            end if;
        end process seq;
```

```
comb:process (pr, start, s1, cs1, cs2, s2, s3, Ai1, tr, s4, v40, HL, v70, Hr, g,
tu, right, dest)

begin
  case pr is
  when T0=>
    e<='0'; sc<='0';
    sen<='0'; ca<='0';
    Ai<='0'; stop<='0';
    rl<='0'; ll<='0'; cl<='0';
    llight<='0'; rlight<='0';
    gps<='0'; sd<='0';
    cd<='0'; traffic<='0';
    obst<='0'; v<='0';
    if (start='1') then
      nxt<=T1;
    else
      nxt<=T0;
    end if;
  when T1=>
    e<='1';
    cd<='1';
    if (s1='1') then
      nxt<=T2;
    else
      nxt<=T1;
    end if;
  when T2=>
    sc<='1';
    if (cs1='1') then nxt<=T3;
    else
      nxt<=T2;
    end if;
```

```
when T3=>
gps<='1';
    if(cs2='1') then nxt<=T4;
    else nxt<=T3;
    end if;
when T4=>
sen<='1';
    if(s2='1') then nxt<=T5;
    else nxt<=T4;
    end if;
when T5=>
ca<='1';
    if(s3='1') then nxt<=T6;
    else nxt<=T5;
    end if;
when T6=>
Ai<='1';
v<='1';
    if(Ai1='1') then nxt<=T7;
    else nxt<=T6;
    end if;
when T7=>
traffic<='1';
    if(tr='1') then
        if(g='1') then nxt<=T8;
        else nxt<=T9;
        end if;
    else nxt<=T8;
    end if;
when T8=>
obst<='1';
    if(s4='1') then nxt<=T9;
    else nxt<=T10;
```



```
        end if;
    when T9=>
        sd<='1';
        stop<='1';
        v<='0';
        obst<='0';
        nxt<=T7;
    when T10=>
        sd<='0';
        stop<='0';
        v<='1';
        if (v40='1') then nxt<=T11;
        else nxt<=T13;
        end if;
    when T11=>
        rl<='1';
        nxt<=T12;
    when T12=>
        obst<='1';
        rl<='0';
        if (s4='1') then nxt<=T7;
        else nxt<=T16;
        end if;
    when T13=>
        obst<='0';
        llight<='1';
        if (hl='1')
            then
                if (v70='1') then nxt<=T14;
                else nxt<=T15;
                end if;
            else
                nxt<=T13;
            end if;
        end if;
```

```
end if;
when T14=>
  llight<='0';
  ll<='1';
  nxt<=T12;
when T15=>
  ll<='0';
  cl<='1';
  nxt<=T15;
when T16=>
  cl<='0';
  if ( tu='0') then nxt<=T16;
  else nxt<=T17;
  end if;
when T17=>
  sd<= '1';
  if ( right='1') then
    nxt <= T20 ;
  else nxt<=T18 ;
  end if ;
when T18 =>
  sd<='0' ;
  llight<= '1' ;
  if (hl='1') then
    nxt <= T19 ;
  else nxt<=T18 ;
  end if ;
when T19=>
  llight <= '0' ;
  ll<='1' ;
  nxt <= T22 ;
when T20 =>
  ll<='0' ;
```

```
        rlight<='1' ;
        if (hr='1') then nxt<=T21 ;
        else nxt<=T20 ;
        end if;
    when T21=>
        rlight <='0' ;
        rl<='1';
        nxt<=T22;
    when T22=>
        rl<='0' ;
        if (s4='1') then nxt<=T7 ;
        else
            if (dest='1') then nxt<=T23 ;
            else nxt<=T16 ;
            end if ;
        end if;
    when T23=>
        nxt<=T0 ;

end case;
end process comb;

end Behavioral;
```

❖ Self Driving Car Chip

