REPORT

PROJECT TITLE : DESIGN AND IMPLEMENTATION OF ELEVATOR SYSTEM

INTRODUCTION :

The elevator control system is a crucial component in modern buildings, providing efficient vertical transportation. This report presents the design and implementation of an elevator control system using digital circuitry, specifically employing up-down counters for floor selection and movement control. Elevator systems are an integral part of high-rise buildings, enabling convenient and swift vertical transportation. The objective of this project is to design a reliable and efficient elevator control system using digital circuits. The primary focus is on the use of up-down counters to manage floor selection and control the elevator car's movement.

OBJECTIVES:

User Interface: Allows passengers to select their desired floor.

Up-Down Counters: Keep track of the current floor and the selected floor.

Emergency stop : wherever the floor reset to ground floor.

Energy saving mode : saves energy if it the doors are closed and lift is not moving.

Door holding : hold the door of lift.

UP-DOWN COUNTER:

Up-down counters are essential for tracking the elevator's movement. They consist of two modes: up mode for ascending floors and down mode for descending floors. The counters are designed to increment or decrement based on the selected floor, providing precise control over the elevator's position.

Modes of Operation:

Up Mode: The counter increments its value with each clock pulse.

Down Mode: the counter decrements its value with each clock pulse.

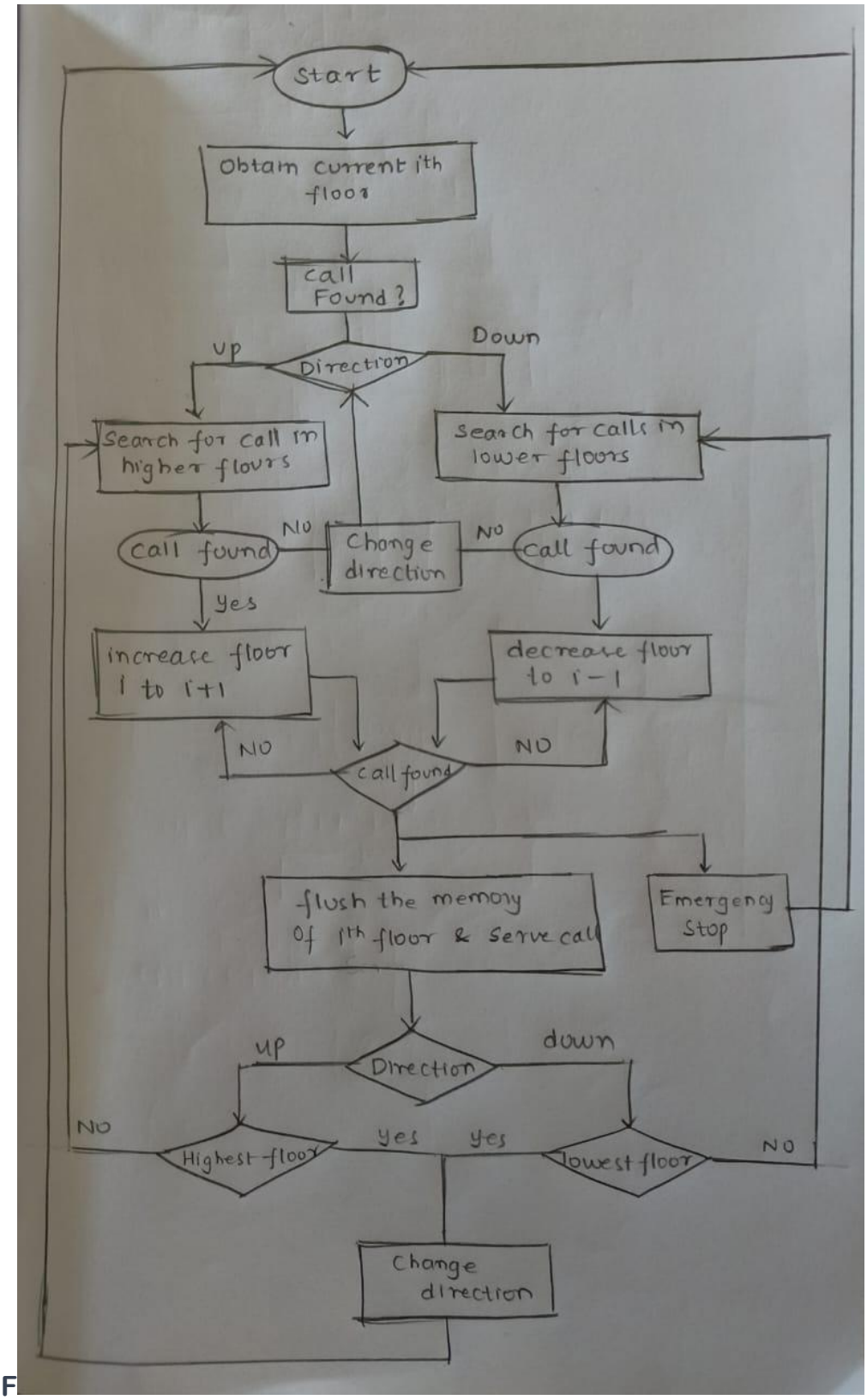
Up-Down Mode: This mode allows the counter to count both up and down based on the control input.

OPERATION:

Initialization: The system initializes with the elevator at the ground floor. Up-down counters are set to zero.

User Floor Selection: Passengers use the user interface to select the desired floor .The selected floor is input into the up-down counters.

FLOW CHART:


Start
Obtain current ith floor
call Found?
Up
Direction
Down
Search for call in higher flours
Search for calls in lower floors
call found
NO
Change direction
NO
call found
yes
increase floor i to i+1
decrease flour to i-1
NO
call found
NO
flush the memory of ith floor & serve call
Emergency Stop
up
Direction
down
NO
Highest floor
yes
yes
lowest floor
NO
Change direction

F

Movement Control: The system determines the direction (up or down) based on the selected floor and the current floor. Up-down counters control the motor to move the elevator in the appropriate direction until the selected floor is reached.

Arrival and Door Control : Once the elevator reaches the selected floor, the counters stop the motor. Door control circuitry manages the opening and closing of the elevator doors.

Emergency Stop: An emergency stop button interrupts the power supply to the motor in case of an emergency.

Movement Control: The system determines the direction (up or down) based on the selected floor and the current floor. Up-down counters control the motor to move the elevator in the appropriate direction until the selected floor is reached.

Arrival and Door Control : Once the elevator reaches the selected floor, the counters stop the motor. Door control circuitry manages the opening and closing of the elevator doors.

Emergency Stop: An emergency stop button interrupts the power supply to the motor in case of an emergency.

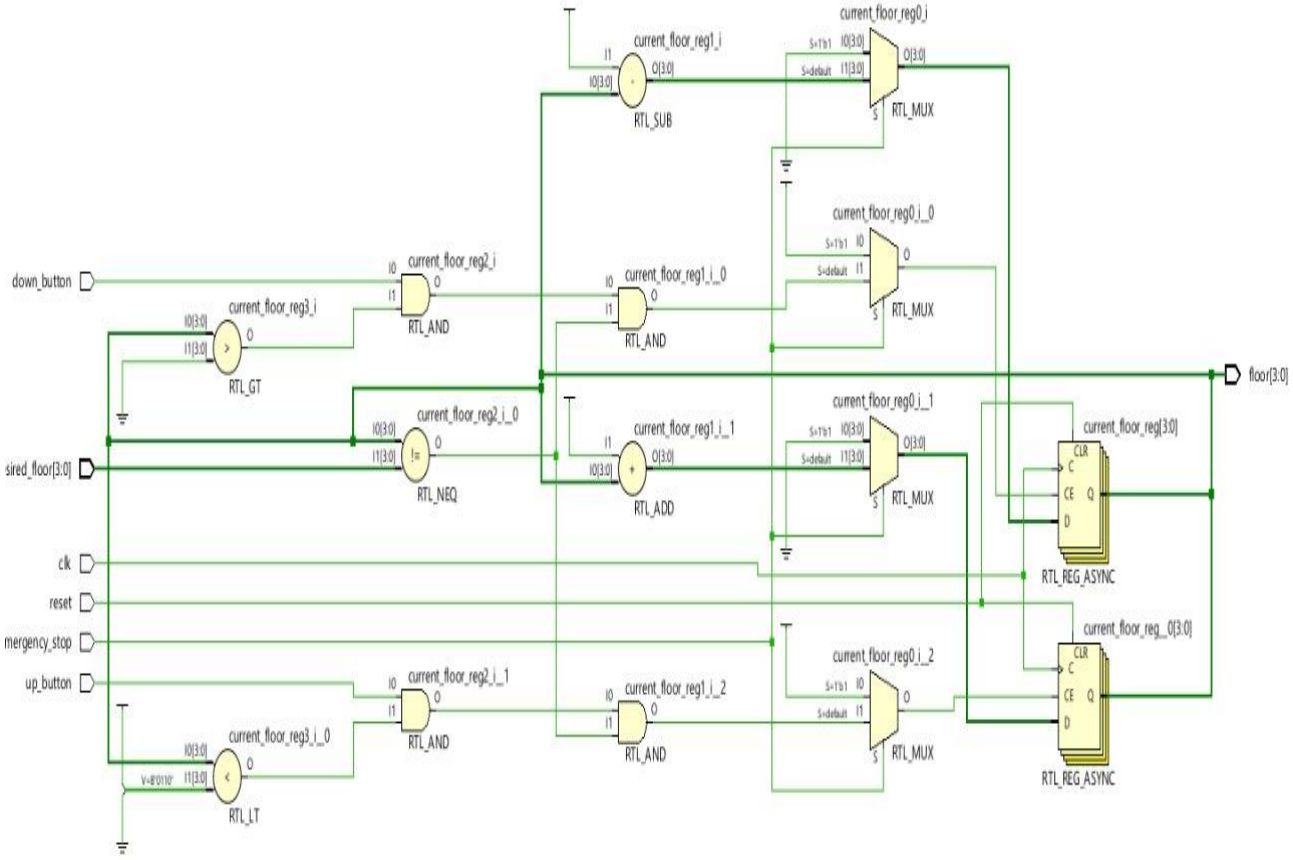
CODE:

```
module ElevatorController(
  input wire clk,
  input wire reset,
  input wire up_button,
  input wire down_button,
  input wire door_hold_button,
  input wire [3:0] desired_floor,
  input wire emergency_stop,
  output wire [3:0] floor,
  output reg energy_saving_mode,
  output reg door_hold_active,
  output reg [2:0] display_panel
);

  reg [3:0] current_floor;
  reg elevator_stop;
```

```
always @(posedge clk or posedge reset)
  if (reset || emergency_stop)
    current_floor <= 4'b0000;
  else if (up_button && (current_floor < 4'b0110) && (current_floor != desired_floor))
    current_floor <= current_floor + 1;

always @(posedge clk or posedge reset)
  if (reset || emergency_stop)
    current_floor <= 4'b0000;
  else if (down_button && (current_floor > 4'b0000) && (current_floor != desired_floor))
    current_floor <= current_floor - 1;

always @(posedge clk or posedge reset)
  if (reset || emergency_stop)
    elevator_stop <= 1;
  else if (current_floor == desired_floor)
    elevator_stop <= 1;
  else
    elevator_stop <= 0;

always @(posedge clk or posedge reset) begin
  if (reset || emergency_stop || up_button || down_button || elevator_stop)
    energy_saving_mode <= 0;
  else
    energy_saving_mode <= 1;
end

always @(posedge clk or posedge reset) begin
  if (reset || emergency_stop || up_button || down_button)
    door_hold_active <= 0;
```

```
  else if (door_hold_button)
    door_hold_active <= 1;
end

always @(posedge clk or posedge reset) begin
  if (reset)
    display_panel <= 3'b000;
  else
    display_panel <= current_floor;
end
endmodule
```

SCHEMATIC:



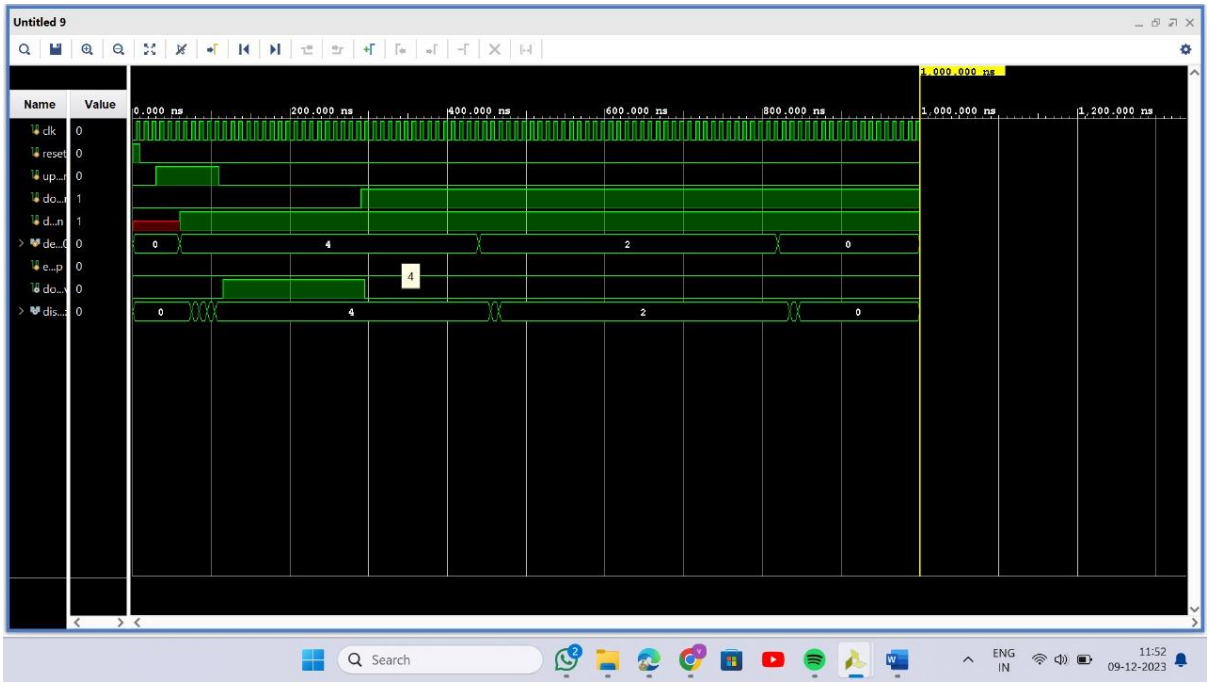
TEST BENCH:

```
module ElevatorController_TB;
 reg clk;
 reg reset;
 reg up_button;
 reg down_button;
 reg door_hold_button;
 reg [3:0] desired_floor;
 reg emergency_stop;

 wire door_hold_active;
 wire [2:0] display_panel;

 ElevatorController uut (
  .clk(clk),
  .reset(reset),
  .up_button(up_button),
  .down_button(down_button),
  .door_hold_button(door_hold_button),
  .desired_floor(desired_floor),
  .emergency_stop(emergency_stop),
  .door_hold_active(door_hold_active),
  .display_panel(display_panel)
 );
```

```
// Clock generation
initial begin
  clk = 0;
  forever #5 clk = ~clk;
end

initial begin
  reset = 1;
  up_button = 0;
  down_button = 0;
  desired_floor = 4'b0000;
  emergency_stop = 0;

  #10 reset = 0;

  #20 up_button = 1;
  #30 desired_floor = 4'b0100;
  #50 up_button = 0;

  #80 desired_floor = 4'b0100;


  #100 down_button = 1;
  #150 desired_floor = 4'b0010;
  #180 down_button = 1;
  #200 desired_floor = 4'b0000;

  #210 $finish;
end
initial begin
  #60 door_hold_button = 1;
```

```
  end


endmodule
```

WAVE FORM:



ADVANTAGES:

- Elevators enable people and goods to move between different floors in buildings quickly.
- Elevators make buildings accessible to individuals with mobility challenges, allowing them to navigate easily between floors.
- Elevators take up less space compared to staircases, allowing for more efficient use of building space.
- Elevators facilitate the transport of heavy goods or equipment between floors, especially in commercial and industrial settings.

DISADVANTAGES:

- The installation of elevators can be expensive, particularly in existing buildings where retrofitting is required.

- Elevators require regular maintenance to ensure proper functionality and safety. Maintenance costs can be significant over the lifespan of the system.
- Elevators depend on a stable power supply. Power outages can disrupt elevator service, potentially causing inconvenience and delays.
- In emergency situations such as fires, elevators are often unavailable, and occupants must rely on staircases for evacuation.

CONCLUSION:

Elevator systems represent a fundamental and indispensable component of modern urban and architectural landscapes. They offer a myriad of advantages, enhancing efficiency, accessibility, and convenience in multi-story buildings. The ability to facilitate rapid vertical transportation is crucial for individuals with mobility challenges and contributes to the optimization of space within structures. Moreover, elevators align with contemporary architectural designs, providing flexibility and creative freedom to architects and builders.