Automatic Visitor Counter and Power control

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Abstract :

Automated Visitor Counting: Utilizes sensors to automatically count incoming visitors and display the count using **7 segment displays**

Bi-Directional Tracking: Accurately records both entries and exits, adjusting the count accordingly.

Laser-Based Detection: Utilizes laser technology to precisely detect incoming and outgoing visitors.

Customizable Limits: Allows users to set maximum occupancy limits for safety and compliance.

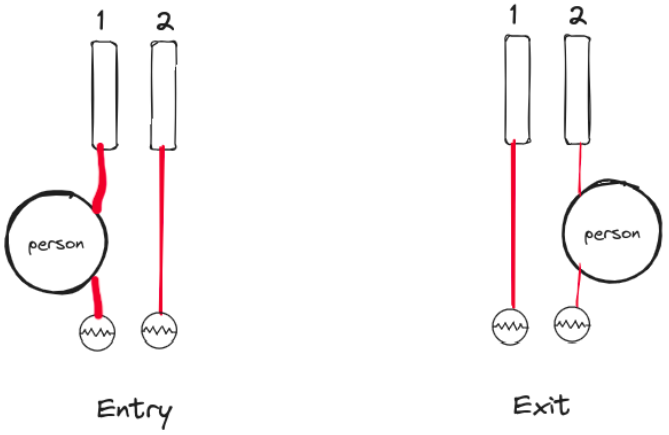
Automatic Restrict System: Features an automatic Restriction system that stops entry when the room reaches its defined occupancy limit, enhancing security and efficiency.

Energy Efficiency and control : Incorporates power management by turning off lights in unoccupied areas and generates live Electricity Bill

Working :

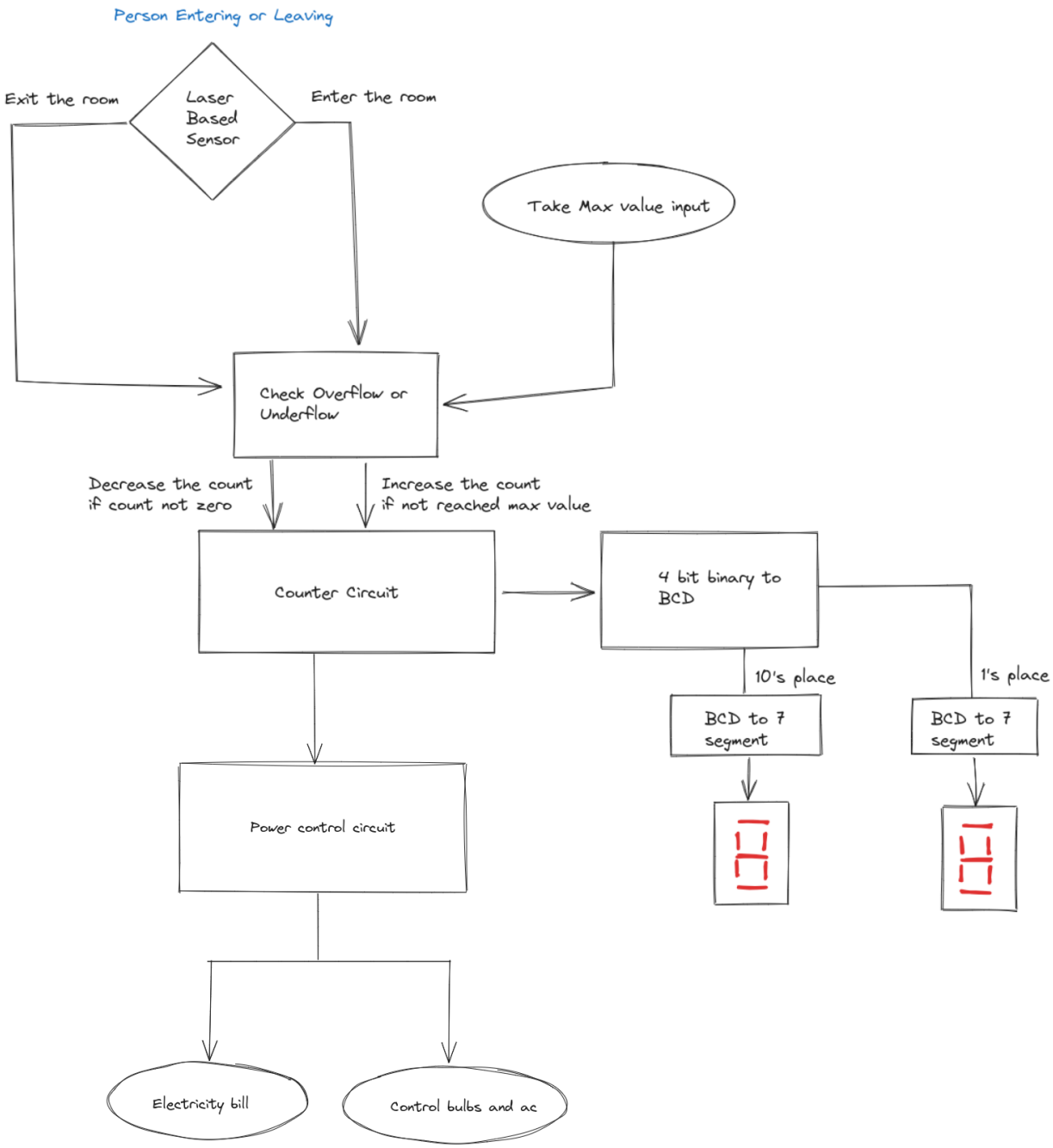
Our project mainly utilizes the usage of lasers , LDRs and delay circuit to detect incoming and outgoing people , counter , 7 segment display to display the number of people , a combinational circuit to check underflow and overflow and more

Part 1 : Working of Entry and exit detection



- We use two lasers in this setup to distinguish between two directions, either entry or exit. One laser is responsible for detecting upward movement, while the other is dedicated to detecting downward movement.
- Upon detecting a person, the respective laser's functionality is temporarily deactivated for a brief period using a delay circuit. During this interval, the Toggle pin (pin 4) of the CD40110 is activated, and it is subsequently deactivated just before moving on to the second laser.
- Once the delay period has elapsed, the second laser comes into play, detecting the person's movement in the opposite direction. The signal from this laser is then sent to the counter to update the count value accordingly.

Part 2 : Counting , Entry restriction and other



- **User-Defined Max Capacity:**
    - The maximum room capacity is established as user input.
- **Combinational Circuit for Count Restriction:**
    - A combinational circuit is employed to enforce count restrictions in two scenarios:

        Count at 0:
        - Restricts further decrement of the count when it reaches 0.

Count at Max:

- Detects when the current count aligns with the user-defined maximum capacity.
- Utilized to prevent additional individuals from entering.

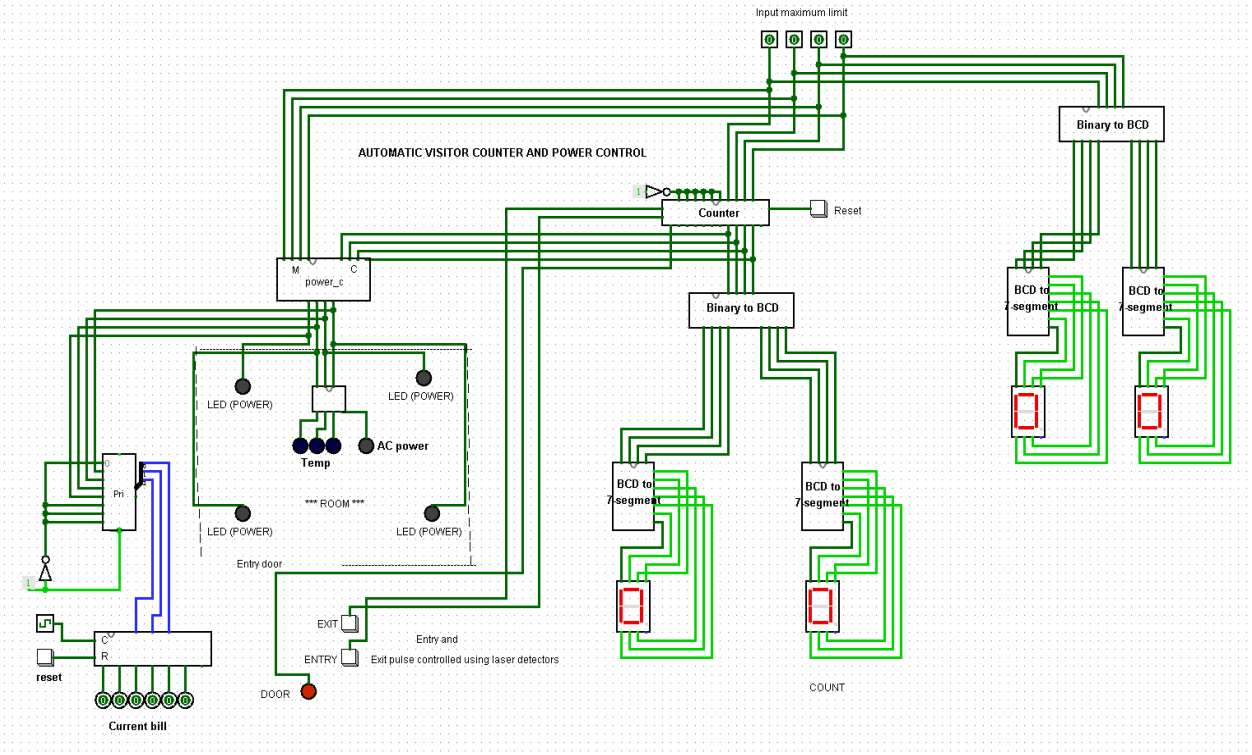
- **Count Data for Power Control:**
  - The count data is used for power management.
  - Power is activated when there are occupants in the room, ensuring energy-efficient lighting control based on occupancy.

Let us consider Maximum Value 5 i.e 0101 (in 4-bit Binary) and initial value 0000(zero). Let us assume When a person enters consider “1”, also when a person exits consider “0”.

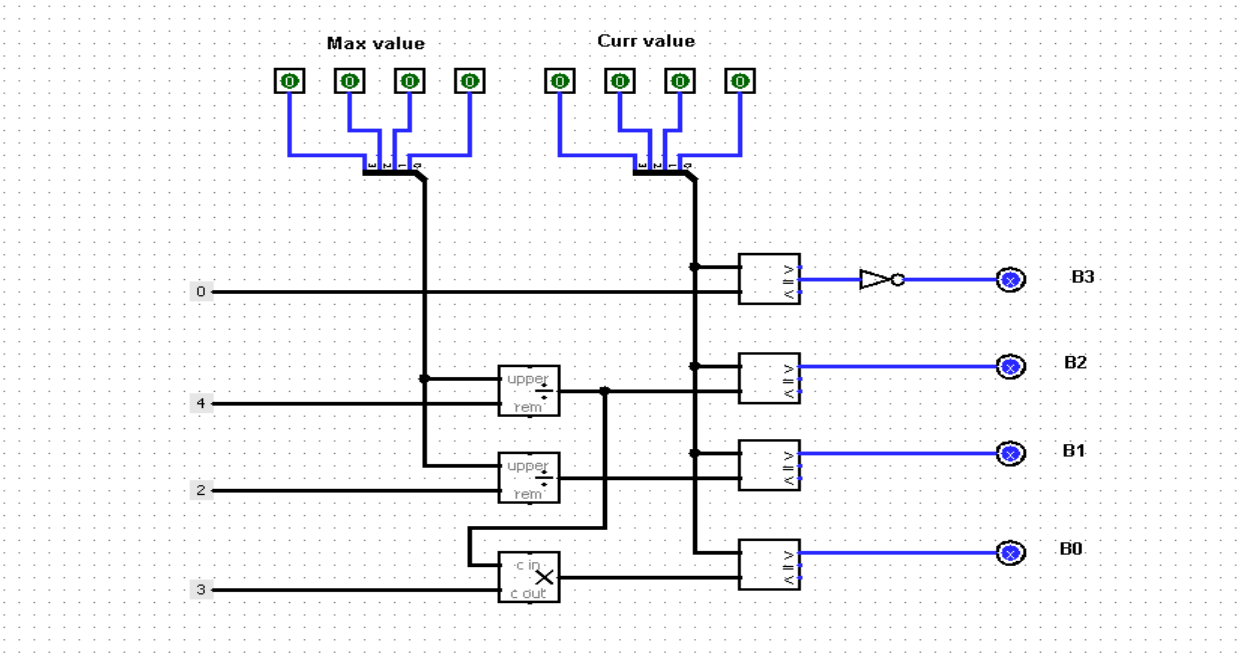
Person Enters or Exits	Updated Value
1	0001
1	0010
1	0011
1	0100
0	0011
1	0100
1	0101
1	0101
1	0101
0	0100
0	0011
0	0010
0	0001
0	0000
0	0000
0	0000

Logisim Circuit diagram :

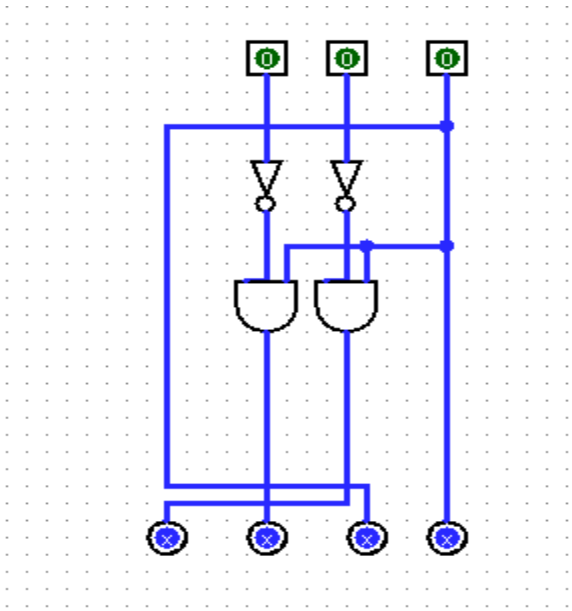
Main->



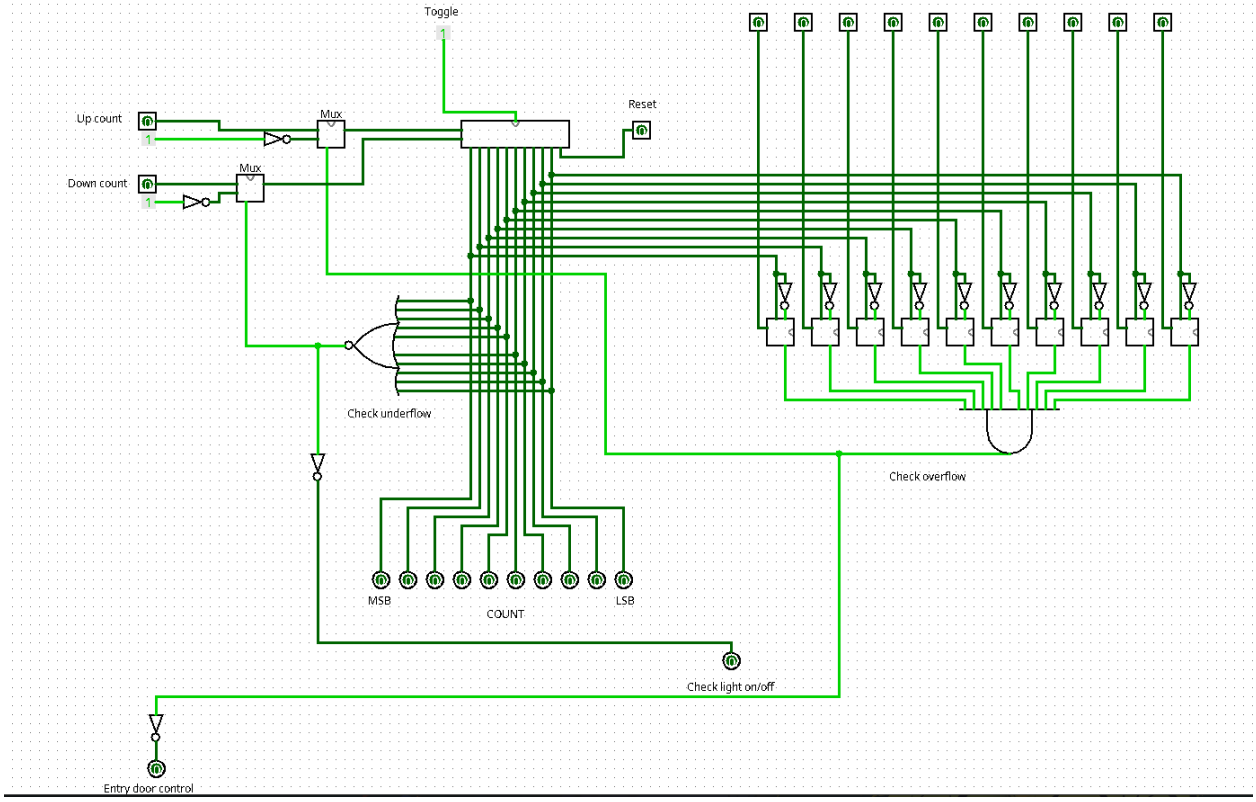
Power Control



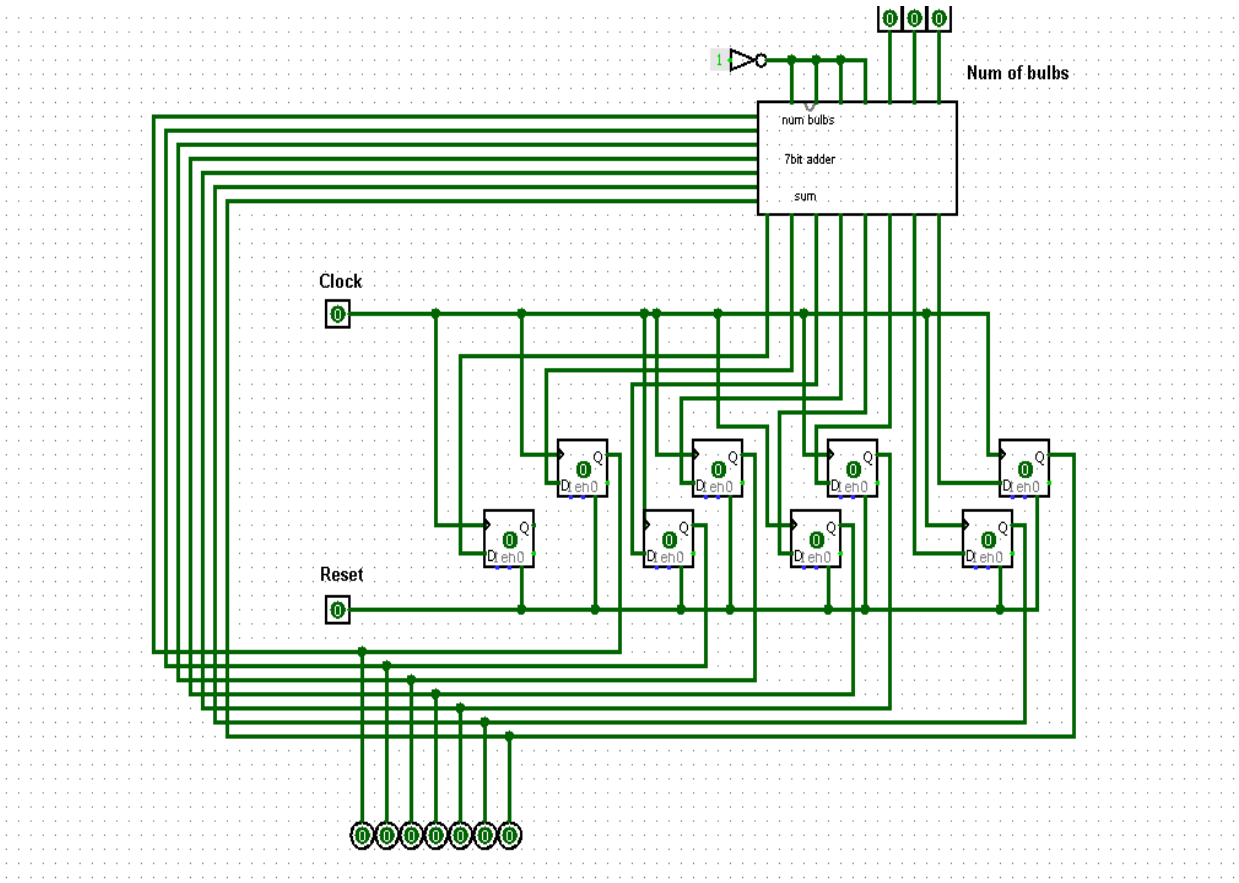
AC Control



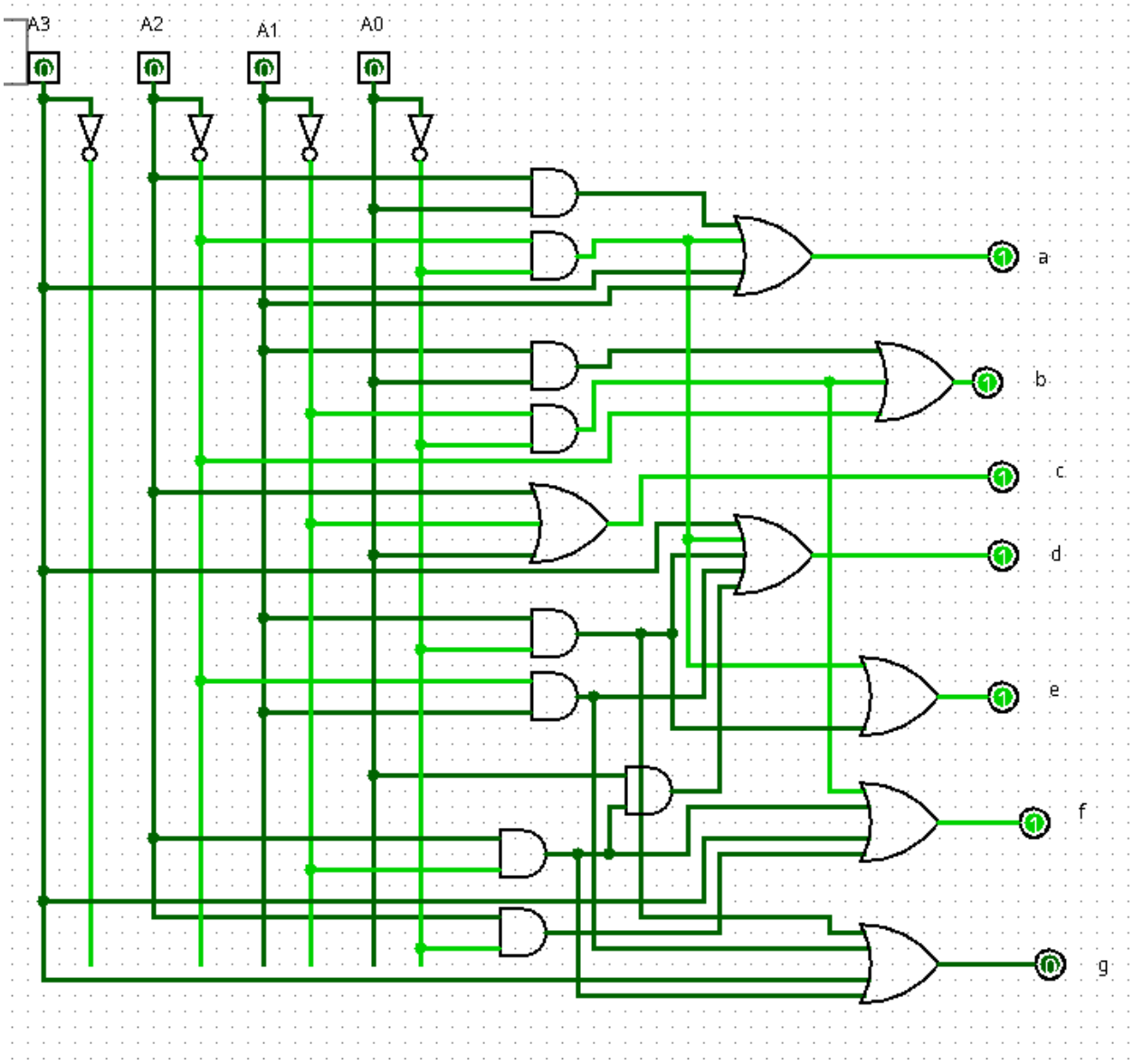
Overflow and Underflow control logic ->



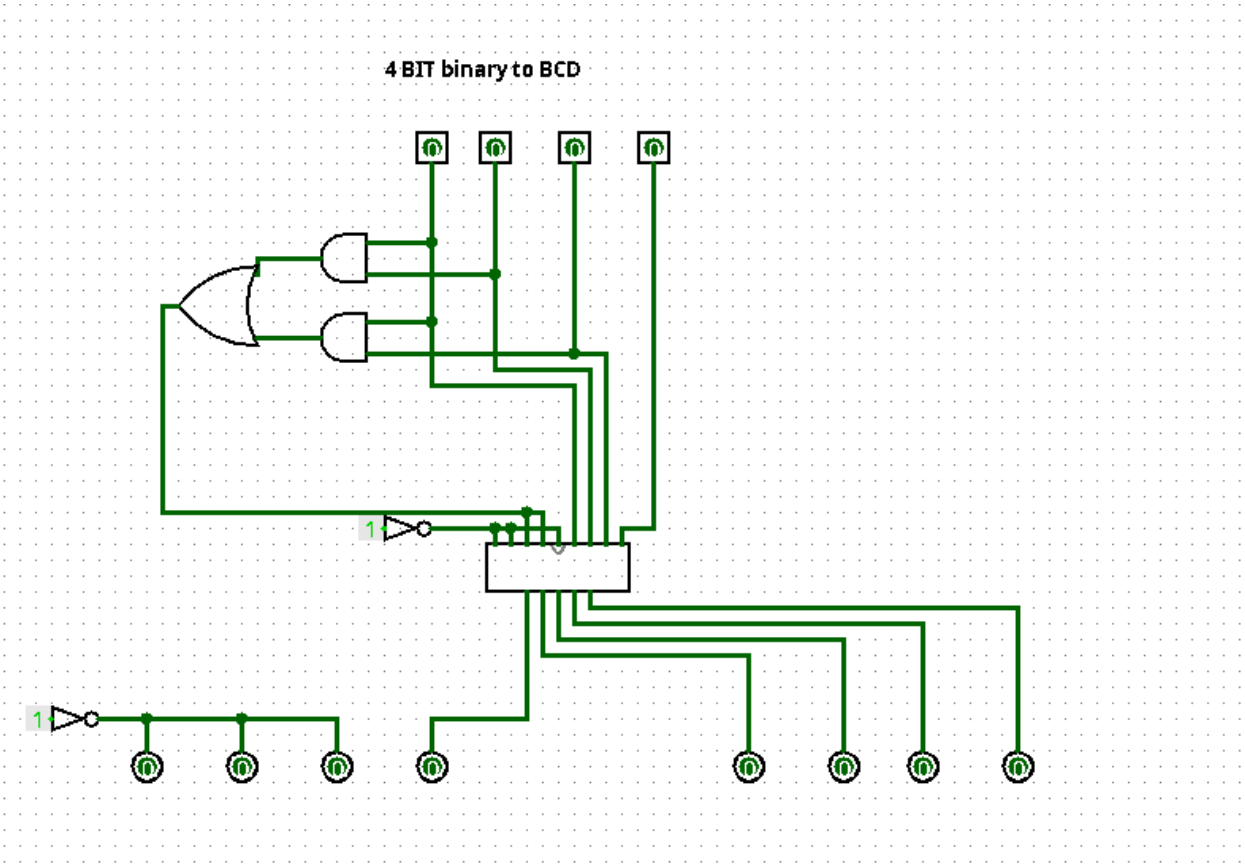
Electricity Bill



BCD to 7 segment display :



4 bit binary to BCD :



Verilog Code :

Part 1 : Module

```
module BinaryCounter4BitWithColors (
input wire clk, // Clock input
input wire reset, // Reset input
input wire inc_enable, // Increment enable input
input wire dec_enable, // Decrement enable input
input wire [3:0] max_value, // Maximum value for the counter
output reg [3:0] count, // 4-bit binary counter output
output reg [1:0] bulbs, // 2-bit output for bulbs indication (00:
green, 01: blue, 10: yellow, 11: red)
output reg [4:0] temperature, // 5-bit output for controlling
temperature
output reg [6:0] elec // electricity bill
);

reg [7:0] percentage; // 8-bit register to hold the percentage of the
count

always @* begin
// Calculate the percentage of the count based on the current count
value
percentage = (count * 100) / max_value;
end

always @(posedge clk or posedge reset) begin
elec = elec + bulbs;

if (reset) begin
count <= 4'b0000; // Reset the counter to 0 when the reset signal is
asserted
elec = 6'b000000;
end else begin
if (inc_enable && (count < max_value)) begin
```

```
count <= count + 4'b0001; // Increment the counter if enabled and
below the maximum value
end
if (dec_enable && (count > 4'b0000)) begin
count <= count - 4'b0001; // Decrement the counter if enabled and
above 0
end
end
end

always @* begin
if (percentage <= 25) begin
bulbs = 2'b00; // Green (0-25%)
temperature = 5'b11100; // Set the temperature to 28 degrees
end else if (percentage <= 50) begin
bulbs = 2'b01; // Blue (26-50%)
temperature = 5'b11000; // Set the temperature to 24 degrees
end else if (percentage <= 75) begin
bulbs = 2'b10; // Yellow (51-75%)
temperature = 5'b10100; // Set the temperature to 20 degrees
end else if (percentage >= 76 && percentage < 100) begin
bulbs = 2'b10; // Yellow (76-99%)
temperature = 5'b10000;
end else if(percentage == 100) begin
bulbs = 2'b11; // Red (100%)
temperature = 5'b10000; // Set the temperature to 16 degrees
end
end

endmodule
```

Part 2 : Test bench

```
`include "project.v"

module BinaryCounter4BitWithColors_TB;
reg clk;
reg reset;
reg inc_enable;
reg dec_enable;
wire [3:0] count;
wire [1:0] bulbs; // Color indication output
wire [4:0] temperature; // Temperature control
wire [6:0] elec;
reg [3:0] max_value;

// Clock generation
always begin
#5 clk = ~clk;
end

initial begin
clk = 0;
reset = 0;
inc_enable = 0;
dec_enable = 0;
max_value = 4'b1000; // Set your desired max value here (9 in binary)

$display("-----------------------------------------------------------------
----");
$display(" Team - 8");
$display("-----------------------------------------------------------------
----");
$display("Number of bulbs");
$display("-----------------------------------------------------------------
----");
$display("one (0-25) -----> 00 ");
$display("two (26-50) -----> 01 ");
$display("three (51-99) -----> 10 ");
$display("four (100) -----> 11 ");
$display("-----------------------------------------------------------------
----");
$display("Temperature according to Occupancy of auditorium");
$display("-----------------------------------------------------------------
```

```
----");
$display("(0-25) -----> 11100(28 degrees)");
$display("(26-50) -----> 11000(24 degrees)");
$display("(51-75) -----> 10100(20 degrees)");
$display("(76-100) -----> 10000(16 degrees)");
$display("-----------------------------------------------------------------
----");

// Test sequence
$display("Time | Count | Color | Temperature | elec bill |");
$display("-----------------------------------------------------------------
----");

// Increase count to max_value
reset = 1;
#10 reset = 0;
inc_enable = 1;
repeat (20) begin
#10;
$display("%3t | %b | %b | %b | %b |", $time, count, bulbs, temperature ,
elec);
end

inc_enable = 0;

// Decrease count, but it should not go below 0
dec_enable = 1;
repeat (20) begin
#10;
$display("%3t | %b | %b | %b | %b ", $time, count, bulbs, temperature,
elec);
end

dec_enable = 0;

// Increase count, but it should not go above max_value
inc_enable = 1;
repeat (5) begin
#10;
$display("%3t | %b | %b | %b | %b ", $time, count, bulbs, temperature,
elec);
end
```

```
inc_enable = 0;

// Finish simulation
$finish;
end

BinaryCounter4BitWithColors uut (
.clk(clk),
.reset(reset),
.inc_enable(inc_enable),
.dec_enable(dec_enable),
.max_value(max_value),
.count(count),
.bulbs(bulbs),
.temperature(temperature),
.elec(elec)
);

endmodule
```

References :

Wiki on counters
7-segment Display
Counters – Definition, IC & Application
Class PPTs (Combinational Circuits)
Delay circuits