Mini-Project "Design and Implementation in Logisim and HDL"

TrainGuard: Empowering Ticket Collectors with Smart Passenger Monitoring

Team members:

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Abstract:

Idea-

To make a digital system which counts passenger entered in trains and warn us if no of passengers are over limit.

Objective:

This project introduces the development of a Train Passenger Counter system designed to efficiently monitor and manage passenger occupancy in train compartments. The primary objective is to ensure the safety and comfort of passengers by implementing a robust counting mechanism that utilizes modern technology.

The motivation behind this project stems from the critical need for passenger safety and compliance with occupancy regulations within public transportation systems. Ensuring that trains do not exceed safe passenger limits is paramount to avoid overcrowding and related safety hazards. Thus, this project serves as a valuable solution for both passengers and train operators.

Components Required-

1.Microcontroller (e.g., Arduino Uno)
2.Push Buttons (for manual input)
3.LED Display Module (e.g., 7-segment display)
4.Resistors (for pull-up/pull-down)

Circuit Connections:-

Here's how to connect the components on the breadboard:

Connect the common cathode of the 7-segment display to Arduino's ground (GND).

Connect the eight segments (a, b, c, d, e, f, g, dp) of the 7-segment display to digital pins on the Arduino (e.g., pins 4 to 11). Use current-limiting resistors (220-330 ohms) for each segment.

Connect the two push buttons to digital pins on the Arduino (e.g., pins 2 and 3). Use pull-down resistors (10k ohms) to connect one side of each button to ground.

Connect the other side of each push button to a separate digital pin on the Arduino.

Connect both common cathodes of the 7-segment display to separate digital pins on the Arduino (e.g., pins 12 and 13).

Connect the 7-segment display to a 5V power source (VCC) and ground (GND).

DESCRIPTION:

The Train Passenger Counter project aims to address the critical issue of monitoring and managing passenger occupancy in train compartments for the safety and comfort of commuters. With the ever-growing demand for public transportation, it has become imperative to ensure that trains do not exceed their designated passenger limits, as overcrowding can lead to safety hazards and discomfort for passengers. This project proposes a comprehensive solution that leverages modern technology to achieve efficient

passenger counting and provide timely warnings if the passenger count exceeds safe limits.

The project's primary objective is to introduce a reliable counting mechanism that not only enhances passenger safety but also facilitates the compliance with occupancy regulations within the public transportation system. This innovative approach benefits both passengers and train operators, contributing to a more secure and enjoyable travel experience for all.

The key components required for this project include a microcontroller (such as Arduino Uno), push buttons for manual input, a 7-segment LED display module, and resistors for pull-up/pull-down operations. The circuit connections involve connecting the 7-segment display to the microcontroller, configuring push buttons, and setting up the common cathodes, allowing the system to accurately count passengers.

In operation, passengers can manually input their entry or exit into the train compartment using the push buttons. The 7-segment display provides a real-time count of the number of passengers in the compartment. If the passenger count exceeds a predefined limit, the system triggers a warning, indicating that the occupancy threshold is approaching or has been breached. This proactive approach ensures the safety of

passengers and assists train operators in making informed decisions regarding compartment occupancy.

The Train Passenger Counter project represents a valuable addition to the realm of public transportation, making travel safer and more convenient for passengers while aiding train operators in managing their services efficiently. It demonstrates the power of technology in addressing real-world challenges and emphasizes the importance of innovation in modern transportation systems.

Working

The Train Passenger Counter project functions by employing a microcontroller, such as an Arduino Uno, to efficiently monitor and manage passenger occupancy within train compartments. Here's a simplified explanation of its working:

1. **Initialization**: The system initializes when passengers board the train. The 7-segment LED display starts at zero, indicating an empty compartment.

2. **Manual Input**: Passengers interact with the system by using push buttons to signify their entry or exit from the compartment. When someone boards the train, they press

the "entry" button, and when they disembark, they press the "exit" button.

3. **Counting Mechanism**: The microcontroller processes these inputs and adjusts the passenger count accordingly. For each entry, the count increases, and for each exit, it decreases.
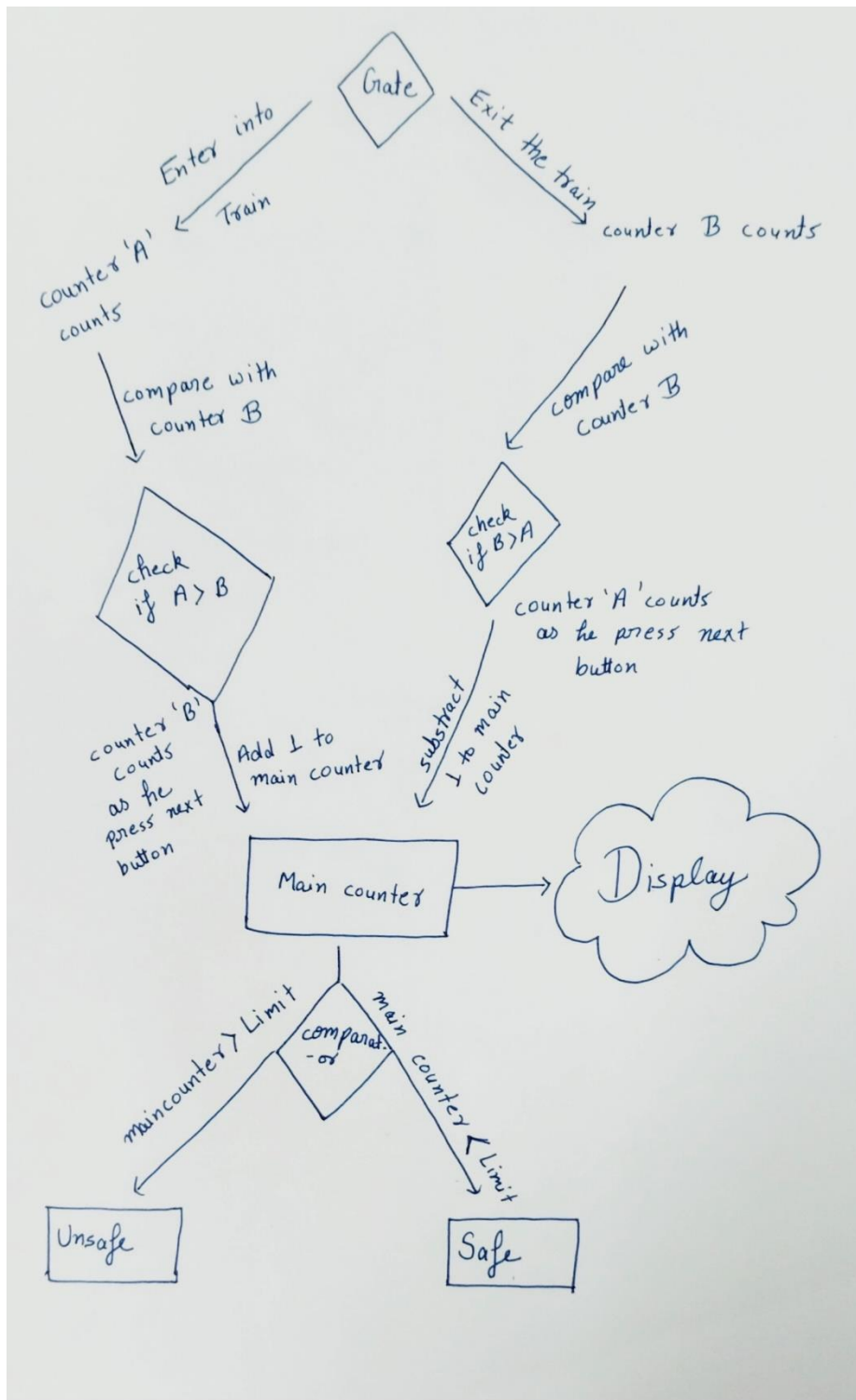
4. **Real-time Display**: The updated passenger count is displayed on the 7-segment LED display in real-time, allowing passengers and train staff to keep track of the compartment's occupancy.

5. **Warning System**: The system continuously checks the passenger count against a predefined limit. If the count exceeds this limit, it triggers a warning, typically using visual or audible signals. This serves as an alert to both passengers and train operators that the compartment is nearing its safe occupancy limit.

6. **Safety and Efficiency**: By proactively monitoring passenger counts and providing warnings, the project ensures the safety and comfort of passengers, preventing overcrowding, and assisting train operators in maintaining compliance with occupancy regulations.

In summary, the Train Passenger Counter system is a responsive and efficient solution that combines technology with manual input to monitor and manage passenger counts in real-time, prioritizing passenger safety and travel convenience within train compartments.

Previous Count	Passenger Enter (1) or Exit (0)	Current Count	Passenger Limit	Safe (1) or Unsafe (0)
0000	1	0001	0101	1
0001	1	0010	0101	1
0010	1	0011	0101	1
0011	1	0100	0101	1
0100	1	0101	0101	1
0101	1	0110	0101	0
0110	0	0101	0101	1
0101	1	0110	0101	0
0110	0	0101	0101	1

Gate

Enter into Train → counter 'A' counts

Exit the train → counter B counts

compare with counter B ↓

compare with Counter B ↓

check if A > B

check if B > A

counter 'B' counts as he press next button

Add 1 to main counter

subtract 1 to main counter

counter 'A' counts as he press next button

Main counter → Display

maincounter > Limit

comparator

main counter < Limit

Unsafe

Safe

Verilog code

```verilog
module up_counter(
    input wire clk,        // Clock input
    input wire rst,        // Reset input
    output reg [3:0] count // 4-bit counter output
);

always @(posedge clk or posedge rst) begin
    if (rst) begin
        count <= 4'b0000; // Reset the count to 0 when the reset signal is
active
    end else begin
        count <= count + 1; // Increment the count on each rising clock edge
    end
end

endmodule
```

# Test bench

```verilog
module up_counter_tb;

reg clk;                // Clock signal
reg rst;                // Reset signal
wire [3:0] count;       // Counter output

// Instantiate the up_counter module
up_counter counter(
    .clk(clk),
    .rst(rst),
    .count(count)
);

initial begin
    // Initialize signals
    clk = 0;
    rst = 0;
```

```verilog
        // Reset the counter
        rst = 1;
        #5 rst = 0;

        // Simulate clock and observe counter values
        $display("Time\tCount");
        $monitor("%d\t%d", $time, count);


        // Generate clock signal (oscillate between 0 and 1)
        repeat(4) begin
            #5 clk = ~clk;
        end
    end

endmodule
```
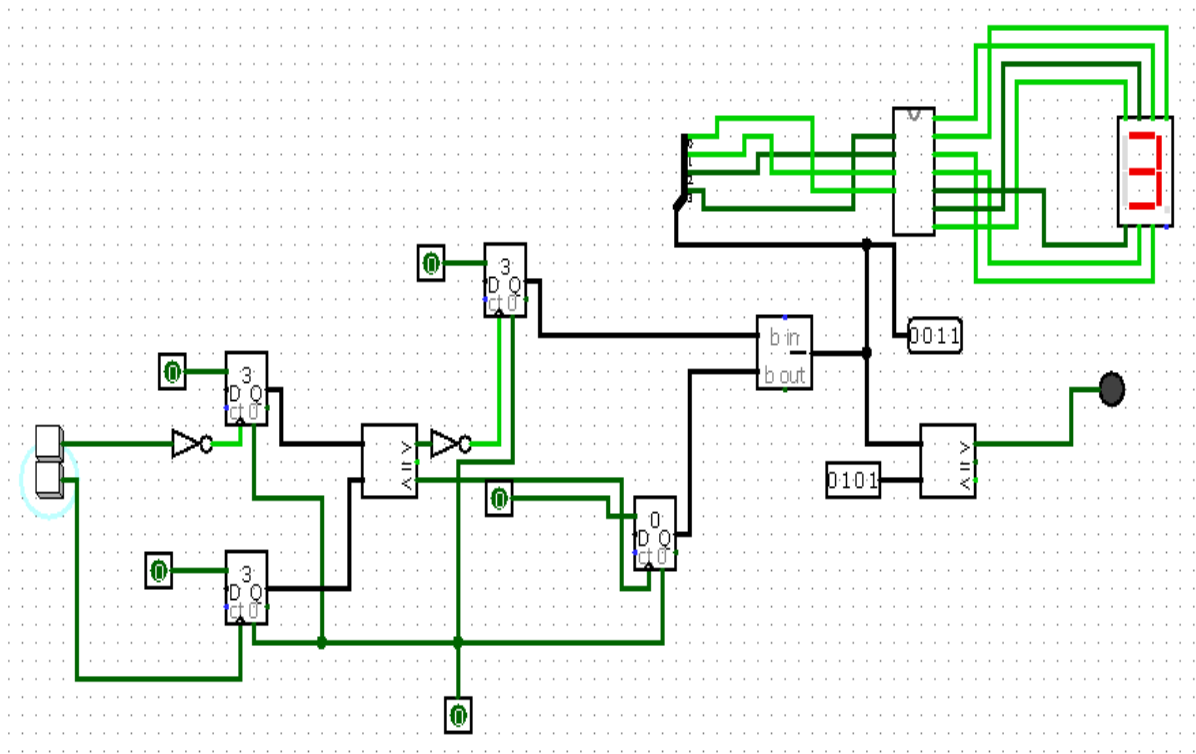
Logisim Circuit

Reference:

1. [Digital Counter Project | Detailed Circuit Diagram Available (electronicsforu.com)](#)
2. [IRCTC Next Generation eTicketing System](#)
3. [Electrical Engineering Stack Exchange](#)
4. [Arduino - Home](#)
5. Morris Mano Design of Digital Systems