Military Institute of Science & Technology

Digital Electronics Sessional-Open Ended Lab

Course code: EECE-304

Submitted To:

Wg Cdr Toyobur Rahman	Senior Instructor, EECE Dept
Nishat Tasnim	Lecturer, EECE Dept
Rifa Tasnim Rupoma	Lecturer, EECE Dept

Submitted By:

Name:	**Student ID:**
Imran Hossain	202116160
Md Nahin Un Nabi	202116138
Kazi Tabassum Suraiya	201916085
Noufel Ahmed Bhuiyan	201916082
Md Assadujjaman Shuvo	202116063
Saimum Mahmud	202116083
Tazwar Siddique	202116095
Md Shahinur Rahman	202116057
SM Afridi Joy	202116080
Mashrur Abrar	202016072

I. ***Objectives:***

- To implement a fully automated metro rail system.
- To implement a system which does not require manpower.

II. ***Theoretical Background:***

In the case of a metro system, a standard procedure is in place for station stops. By default, the metro will come to a halt at each station for a duration of 10 seconds. However, if the metro fills up completely with passengers before the scheduled stop time elapses, it will promptly resume its journey without waiting for the full 10 second. On the other hand, if the number of occupied seats falls below 50% of the metro's total capacity, an additional waiting time of 5 second will be observed before the metro departs. This flexible approach ensures an efficient balance between passenger convenience and operational optimization. By allowing immediate departures when the metro is at full capacity and providing an extra opportunity for passengers to board when there are available seats, the system aims to streamline the overall travel experience and maximize the utilization of seating capacity in the metro.

Main Features of Metro Rail Automation includes the following:

1. Efficient Passenger Movement: The metro system is designed to facilitate smooth passenger movement by implementing specific guidelines for station stops. The default 10-minute stop at each station allows passengers ample time to board and disembark. This ensures a comfortable and hassle-free experience for commuters.

2. Immediate Departure: When the metro reaches its maximum passenger capacity before the scheduled stop time, it departs immediately. This eliminates unnecessary waiting time for passengers and helps maintain the punctuality of the metro schedule. Passengers can board the metro with the assurance that it will start moving promptly once it reaches its capacity.

3. Additional Waiting Time: In situations where the number of occupied seats falls below 50% of the total capacity, the metro system incorporates a provision for an extra 5-minute waiting period. This allows for more passengers to board and fill up the vacant seats. By providing this additional time, the system maximizes seating utilization and ensures that a larger number of passengers can comfortably travel together.

4. Real-Time Monitoring: To effectively implement these operational procedures, the metro system utilizes real-time monitoring and communication technology. This allows for accurate tracking of passenger numbers and seat occupancy. The system can promptly determine whether the metro is full or if additional waiting time is required, ensuring efficient decision-making and minimizing delays.

5. Optimization of Service: The overall objective of these procedures is to optimize the metro service by striking a balance between passenger convenience and operational efficiency. By starting immediately when the metro is full and allowing extra time when seats are available, the system ensures that passengers experience minimal waiting time while maximizing the utilization of seating capacity

III. ***Equipment Required:***

1. 7 segment Binary coded decimal display x 2
2. 4 Bit magnitude Comparator (IC 7485)
3. 4 Bit Counter (IC 74393)
4. And Gate (IC 7408)
5. Inverter (IC 7404)
6. Buzzer
7. 3 Input OR gate (IC 4075)

IV. ***Procedure:***

1) The time counter will automatically start when the circuit is run (This is to simulate the real-life scenario in which the timer starts when the train reaches the station.)

2) We have selected the maximum seat capacity as 10.
   a) Each seat is occupied by manually inputting values to the seat counter.
   b) There are comparaters to check the value of seat count.
   c) The respective output is given by checking the seat count.
   d) If the seat count has reached maximum and further input is given, a buzzer is sounded to indicate that seats are full.

3) The output can either be 0(signalling that the train has not left the staion) or 1(signalling that train has left the station)

4)
   a) By default, the output will stay 0 for a minimum of 10 minutes.
   b) If the seat count has reached the maximum value of 10, then the output switches to 1.
   c) If however, the seat count is less than 5(which is half the max value) then even after 10 minutes an additional 5 minutes will be added to the time counter. After the 5 minutes is over output switches to 1.
   d) Else the output will switch to 1 after 10 minutes.

5) All of the above conditions are controlled and monitored by the comparater ICs.

6) By configuring the comparaters to appropriate logic gates, the proper system can be successfully implemented.

v. <u>***Circuit Diagram:***</u>

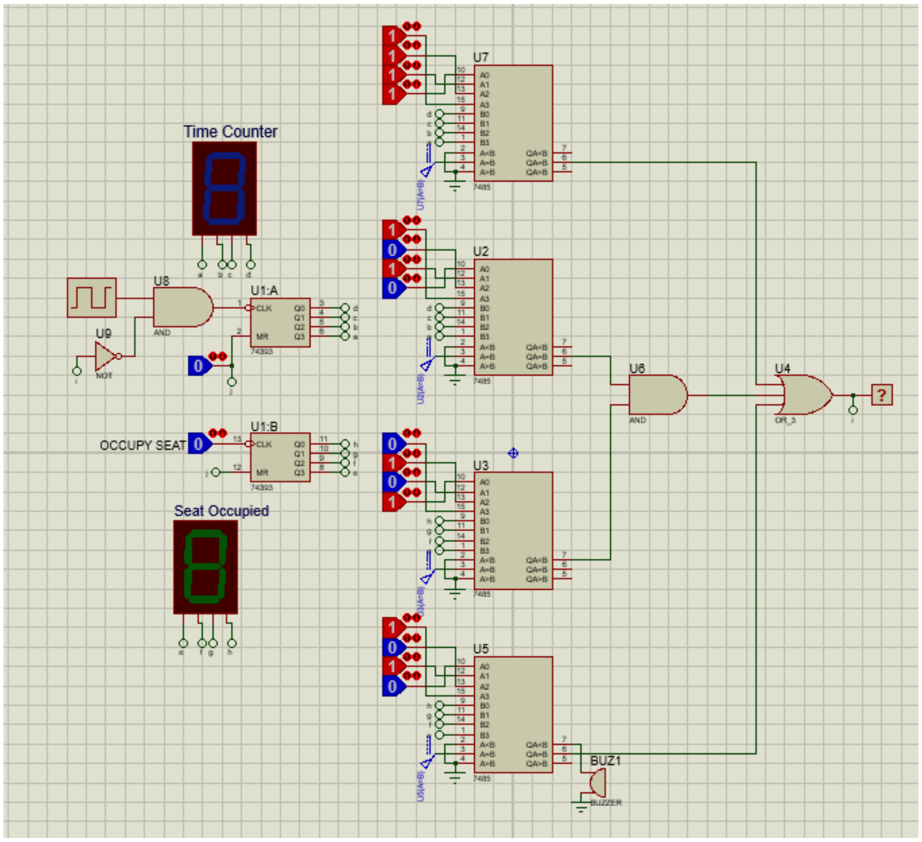

Fig 1: Circuit Diagram

vi. <u>***Experimental Data:***</u>

Time Count / Seat count	Immediate and before 10 mins	Exactly at 10 mins	Immediate and after 10 mins but before 15 mins	Exactly at 15 mins
0-4	0	0	0	1
5-9	0	1	0	1
10	1	-	1	-

The above table shows the correlation between the output and the seat count and time count.

vii. Result:

Let Total number of seats, N=10, Real time seat occupied = n, real time counted = t, T=10min.

I. Whenever seat occupied fully (n=N), train starts (Final output 1).

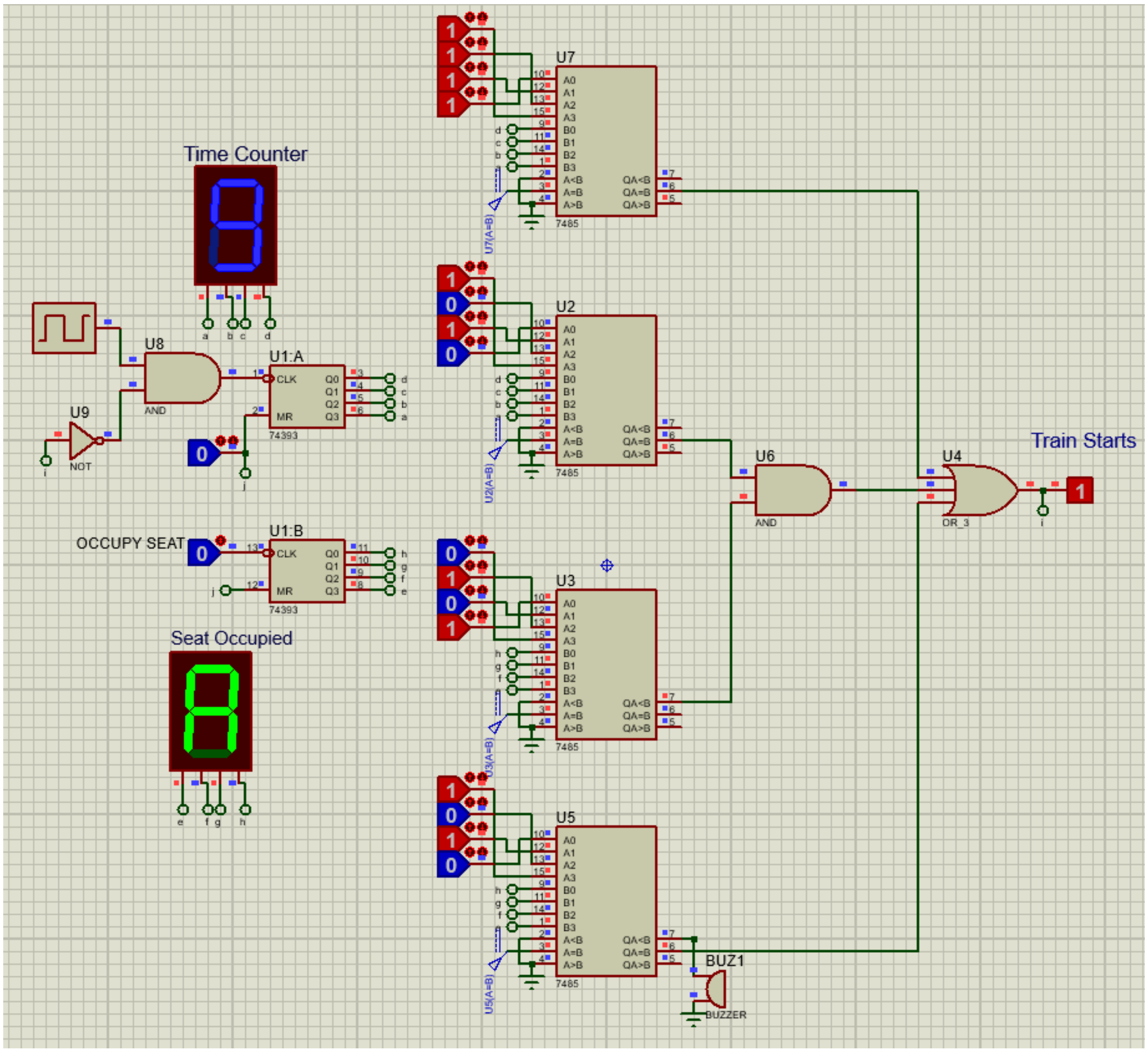

Fig 2: Output when seats are full

II. When seat occupied more than 50% but and 10 minutes passed (n!=N but n>N/2 and t=T), train starts.

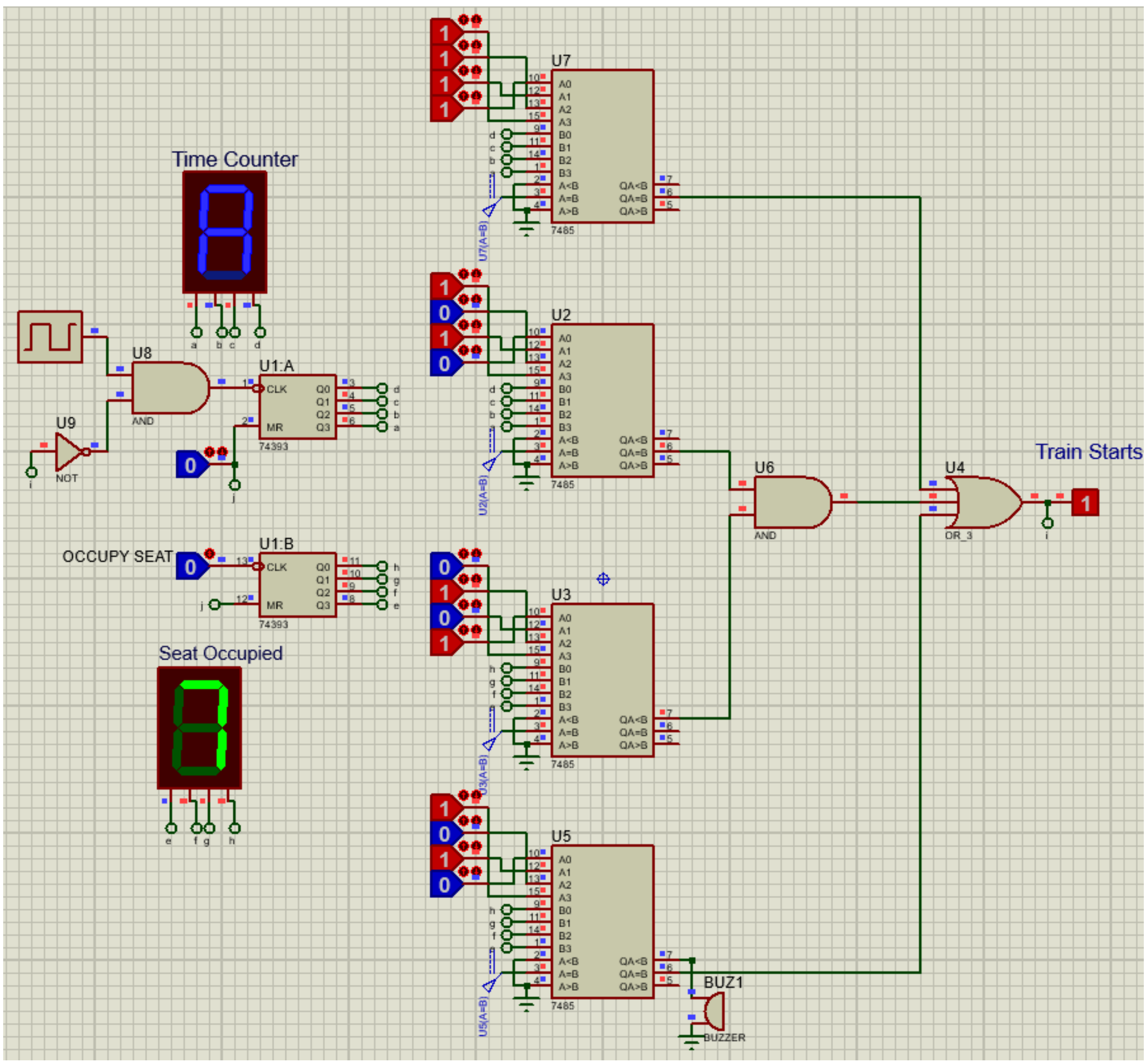

Fig 3: Output when 10 mins have passed

III. When seat occupied less than 50% but 10 min passed, train will wait extra 5 min and starts after overall 15 minutes (n<N/2 and t=T).

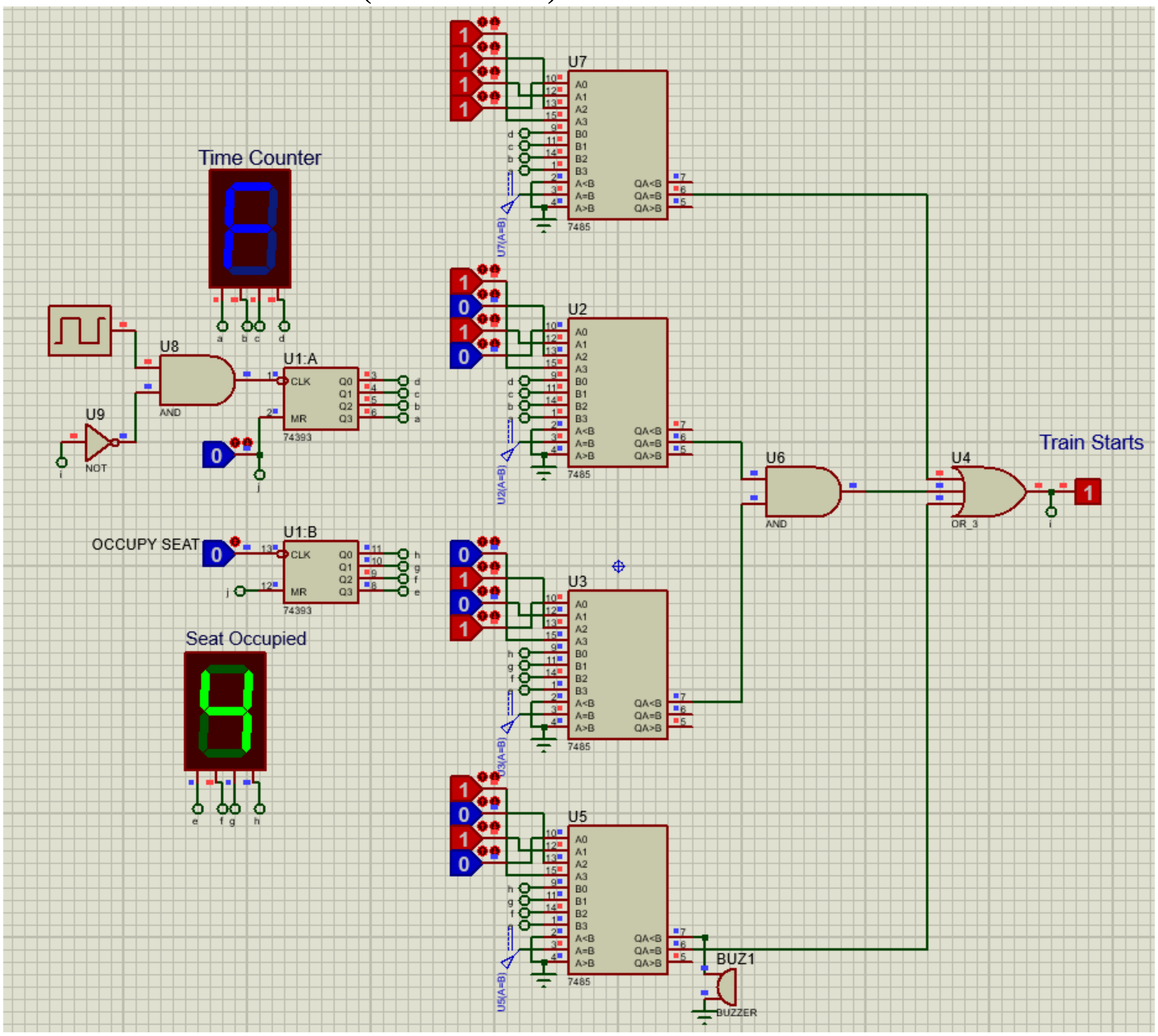

Fig 4: Output when less than 50% seats filled.

Meanwhile that extra 5 minutes, even if seats occupied exceeds 50%, train will wait whole 5 minutes then starts.

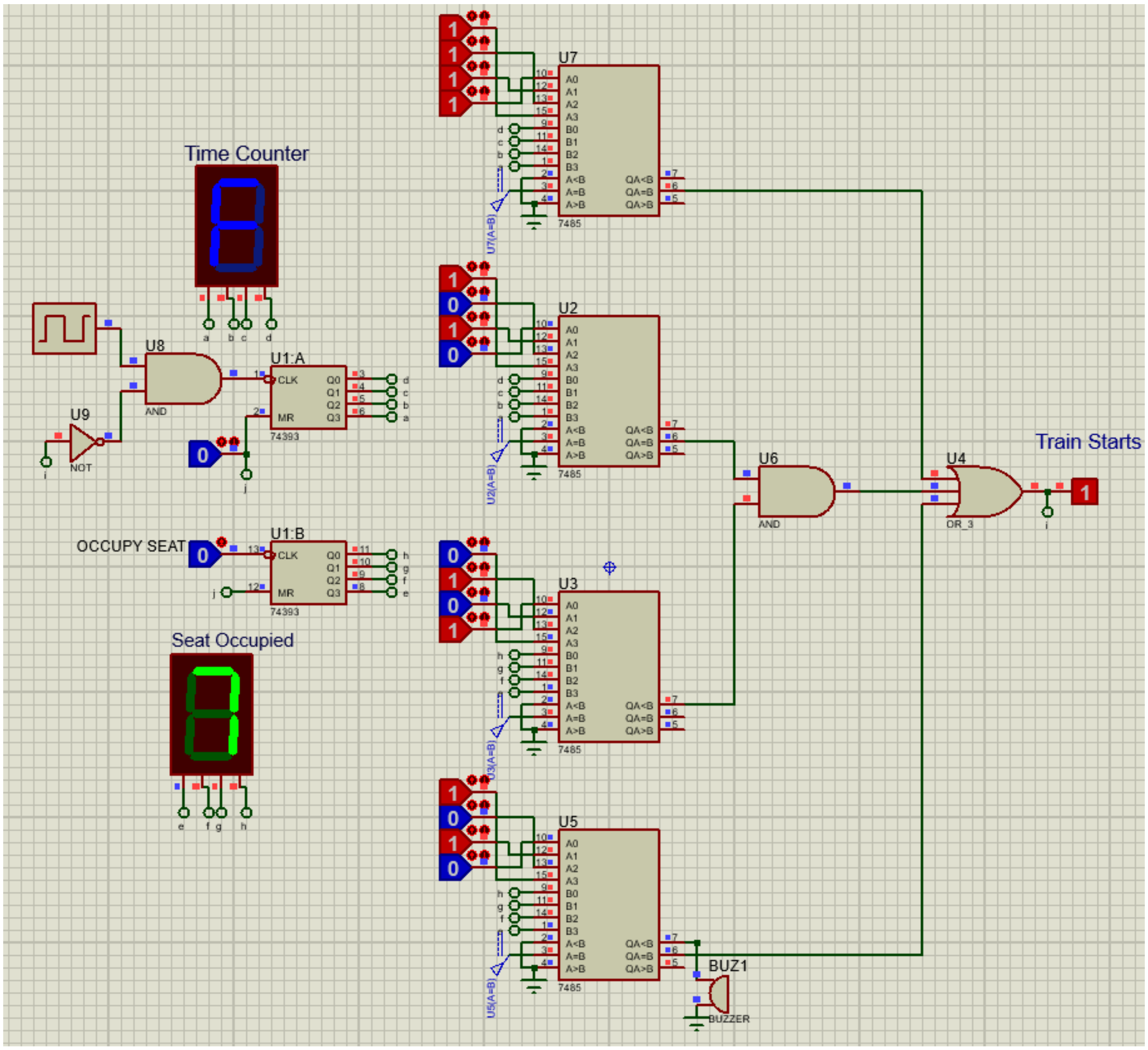

Fig 5: Output when seats less than 50% full during extra 5 mins.

But if in that extra time, seat fully occupied, train starts immediately.

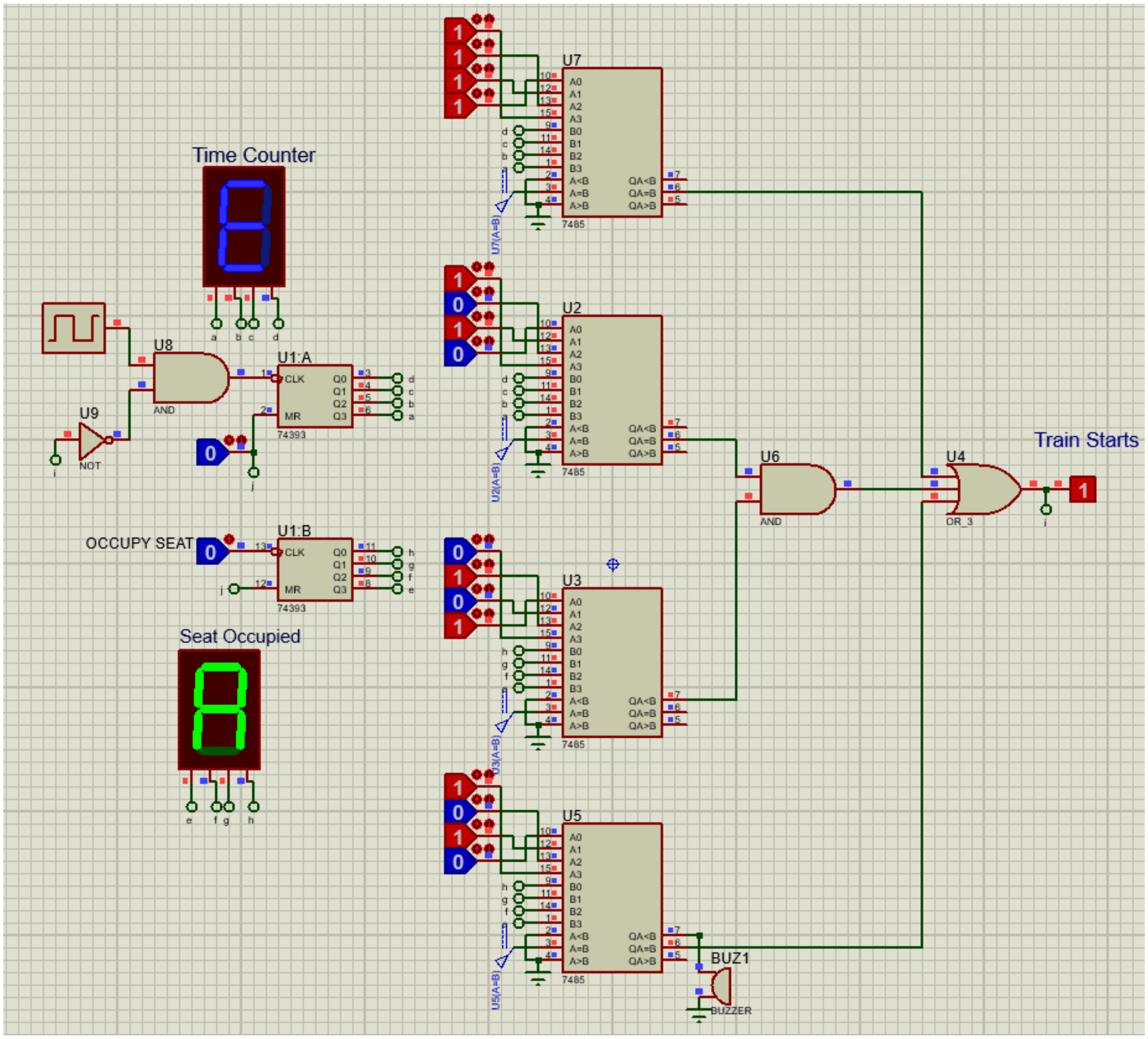

Fig 6: Output when seats filled during extra 5 mins.

IV. If seat occupied exceeds total seat capacity, buzzer will be active.

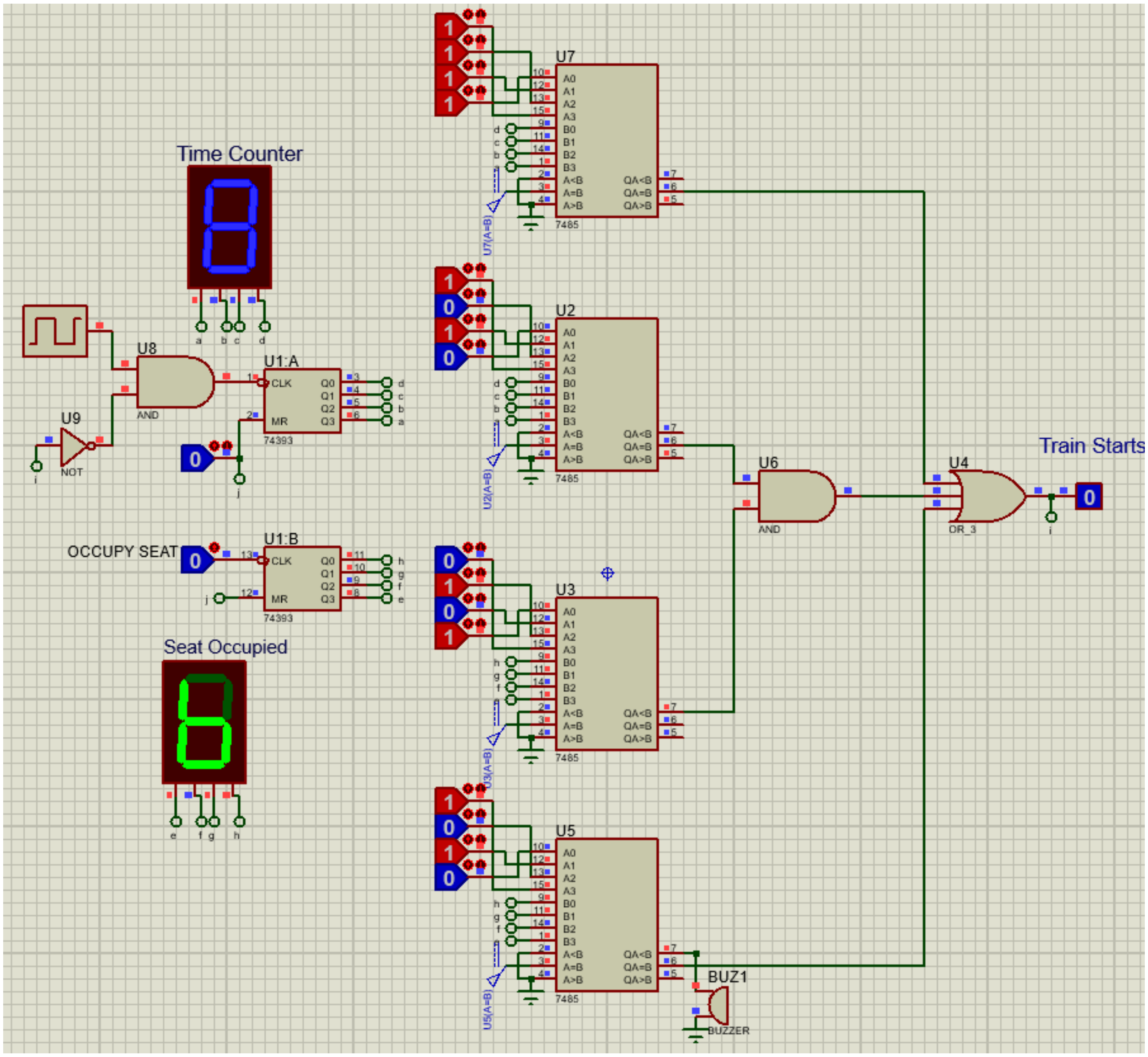

Fig 7: Output when seats are filled and extra customer tries to enter(buzzer).

viii. ***Discussion:***

Introduction:

The aim of this project was to incorporate automation system in the metro rail system using Digital Logic Design. The automation of metro rail systems has become increasingly important in modern transportation, aiming to enhance passenger convenience, safety, and operational efficiency. This report discusses a proposed system for automating seat management and departure control in a metro rail environment. By leveraging various components such as timers, comparators, and logic gates, the system ensures efficient seat occupancy tracking and timely departure signal generation.

Methods:

To replicate real-life scenarios, the system incorporates an automatic timer that starts when the train circuit is activated. This feature allows the timer to begin counting when the train reaches the station, ensuring accurate tracking of seat occupancy and departure timing.

The maximum seat capacity is set to 10 in this system. Occupancy of each seat is manually inputted to the seat counter. Comparators are utilized to monitor the seat count, comparing it against the maximum capacity. Based on the seat count, the system generates appropriate outputs to indicate the status of seat availability. The system provides outputs based on the seat count, allowing passengers to be informed about seat availability. When the seat count reaches the maximum value of 10, a buzzer is sounded to indicate that all seats are occupied.

The system generates an output signal indicating whether the train has left the station or not. The departure signal is determined by the following conditions:

By default, the departure output remains 0 for a minimum of 10 minutes, providing a buffer time for passenger boarding. If the seat count reaches the maximum value of 10, the departure output switches to 1, signaling that the train has left the station. If the seat count is less than 5 (half the maximum capacity), an additional 5 minutes are added to the default 10 minutes. After this extended period, the departure output switches to 1, even if the seat count remains below the maximum capacity. In all other cases, the departure output switches to 1 after the default 10 minutes have elapsed, indicating that the train has left the station.

By configuring the comparators to appropriate logic gates, the system successfully manages seat occupancy and departure control. The logic gates process input signals and generate desired output signals based on predefined logical operations.

Conclusion:

The proposed metro rail automation system offers an effective solution for managing seat occupancy and departure control. By incorporating timers, comparators, and logic gates, the system ensures accurate tracking of seat availability and timely signaling of train departure. This automation not only enhances passenger convenience but also optimizes operational efficiency within the metro rail system. With further development and integration, this system has the potential to revolutionize metro rail transportation by improving passenger experiences and streamlining operations.