Vietnam National University of Ho Chi Minh city

University of Technology

Presentation

Traffic Light Implementation

Jan, 2025

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By Group 2

Get Started

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1. Team Members

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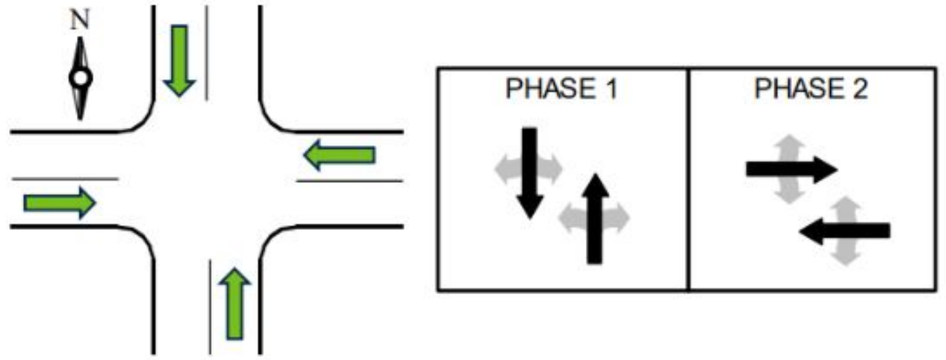
2. Introduction

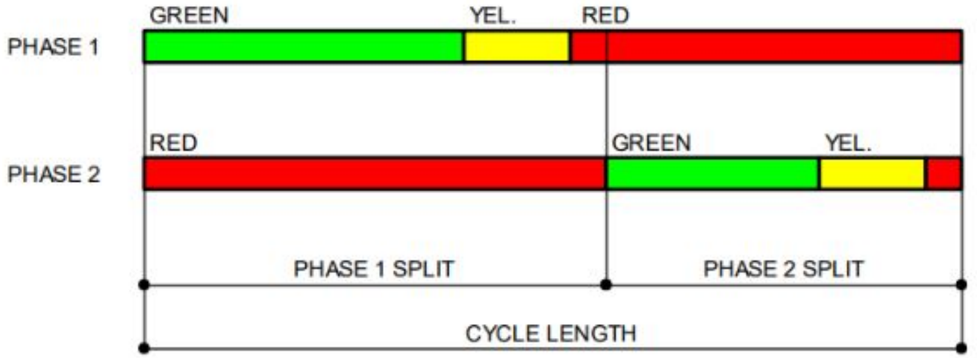
Traffic lights are fundamental to modern road safety, using the universally recognized red, yellow, and green system to direct traffic flow at intersections and pedestrian crossings. Their history dates back to 1868, when the first manually operated signal was installed to manage the traffic of horse-drawn vehicles, marking the beginning of a technology that is now vital for safe and efficient transportation systems worldwide.

2. Introduction

In our project, the system is based on a 4-way traffic light which is separated into 2 modes:

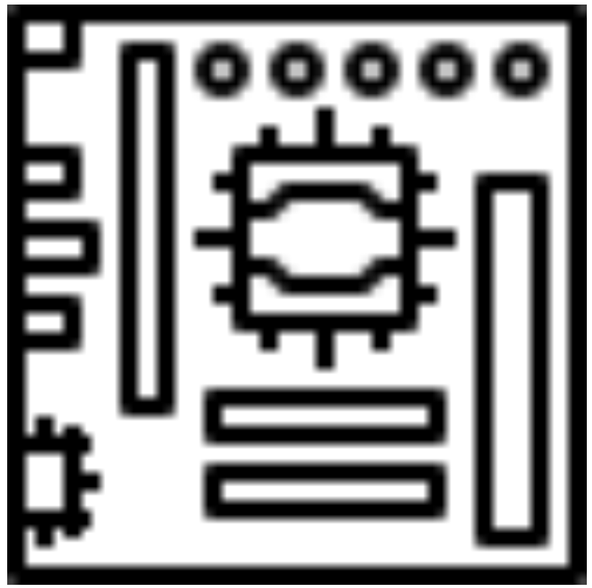
- Mode 1, the user can input the number of seconds for green and amber (in binary), red timer will be the addition of the twos. The maximum for any timer is 99 seconds.





- Mode 2 (manual), user will control lights for each intersections (independent from each other).

3. Parts



Key Electronic Components

ICs and Logic Gates

- IC 555: Timer and pulse generator.
- Logic Gates: AND, OR, NOT – Fundamental digital logic operations.

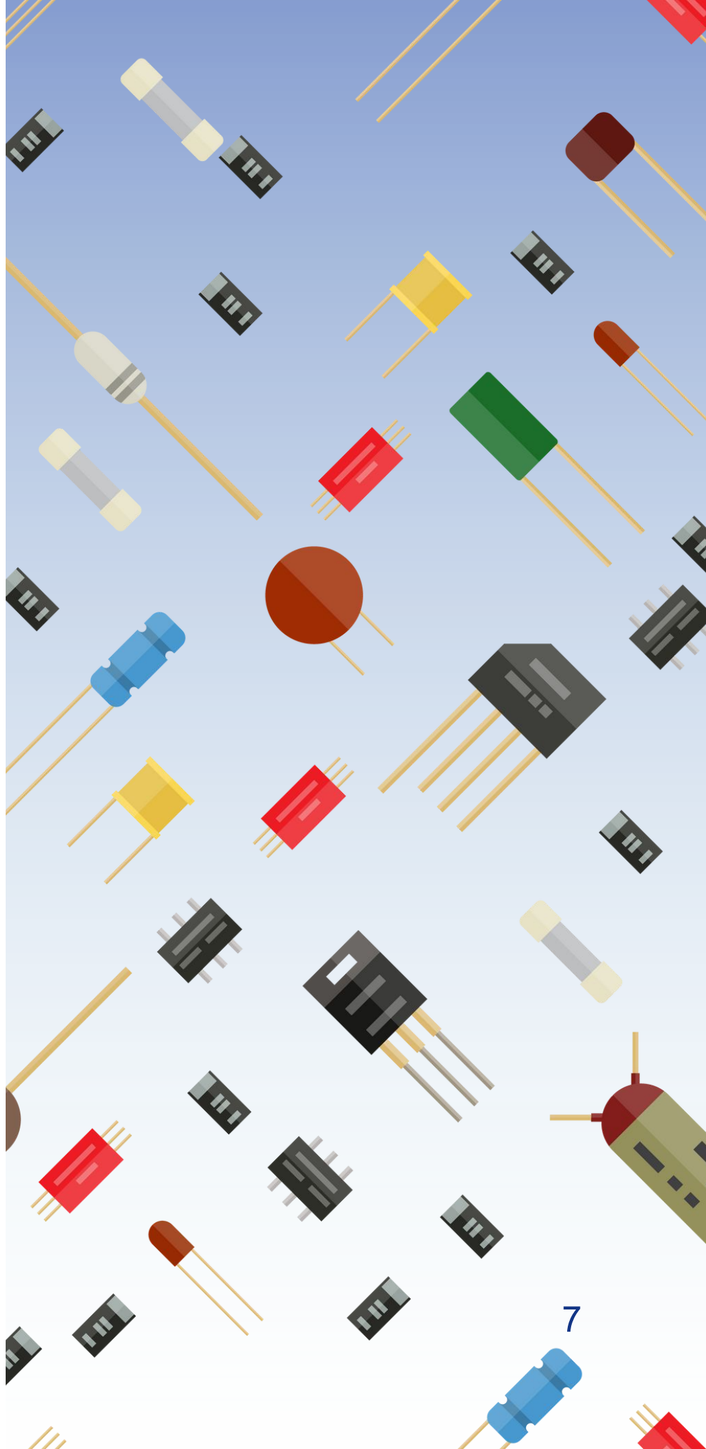
Display and Indicators

- 7-Segment Display: Numerical data representation.
- LED Lights: Indicators and visual output.

Capacitor: Used for energy storage and timing adjustments.

Integrated Circuits (ICs)

- 74LS247: BCD to 7-Segment Decoder – Drives the 7-segment display.
- 74LS273: Flip-Flop – Stores and processes binary data.
- 4008: Full Adder – Handles binary addition.
- 74192: BCD Decade Counter – Counts in Binary-Coded Decimal (BCD) format.
- 4017: Johnson Counter – Sequential counting for timing circuits.



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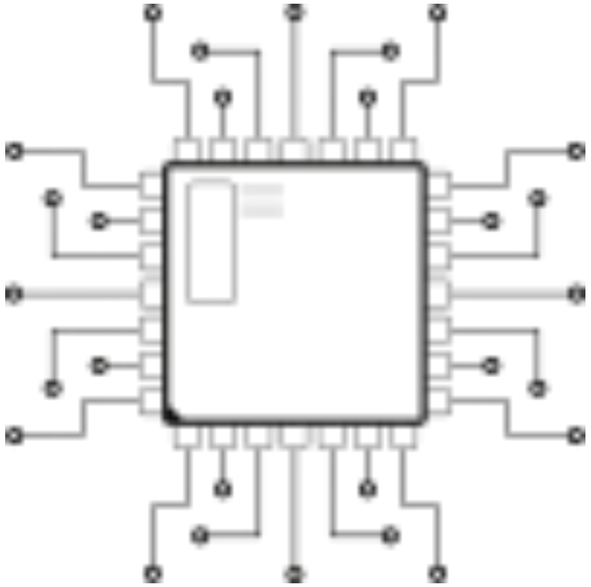
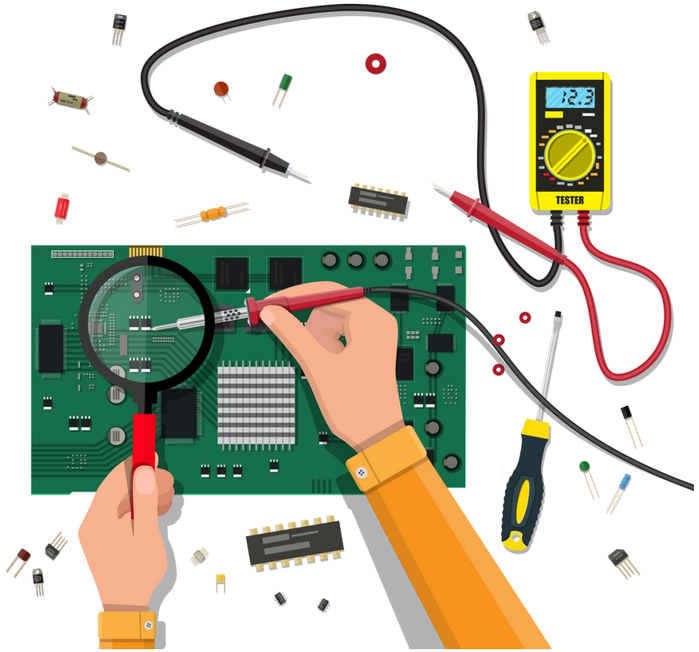
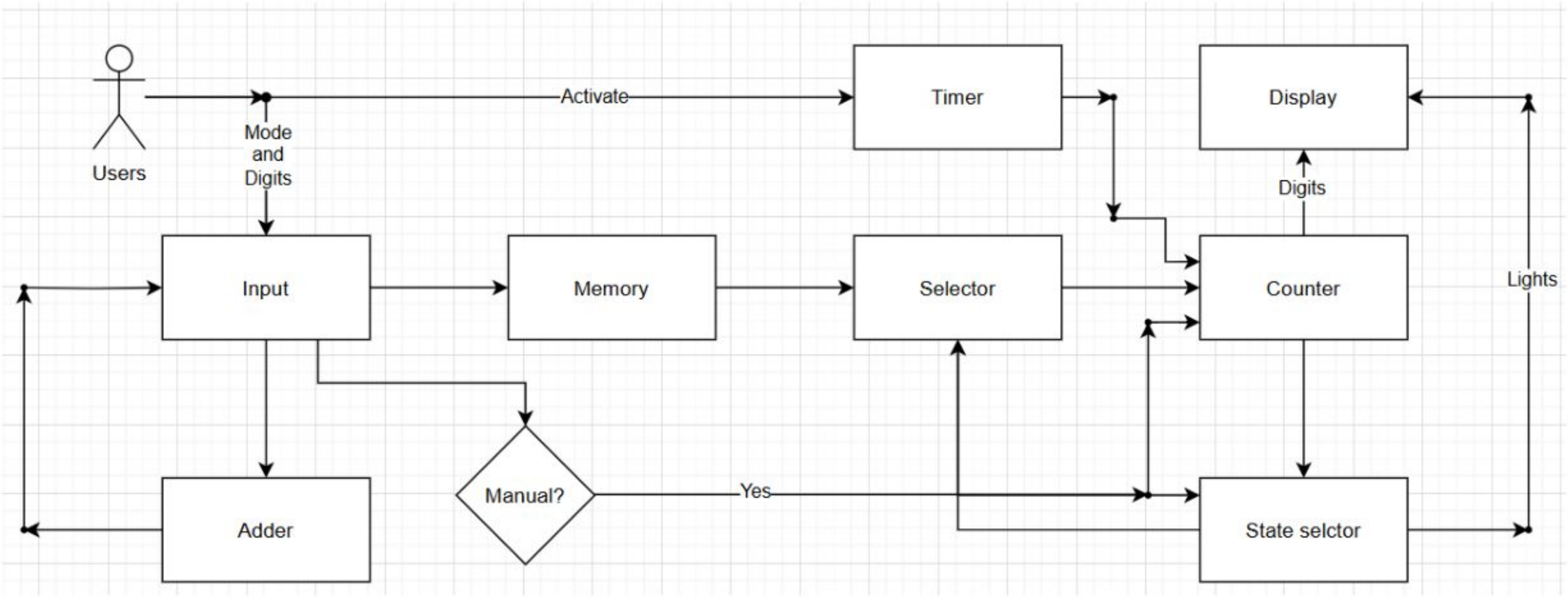
4. Blocks





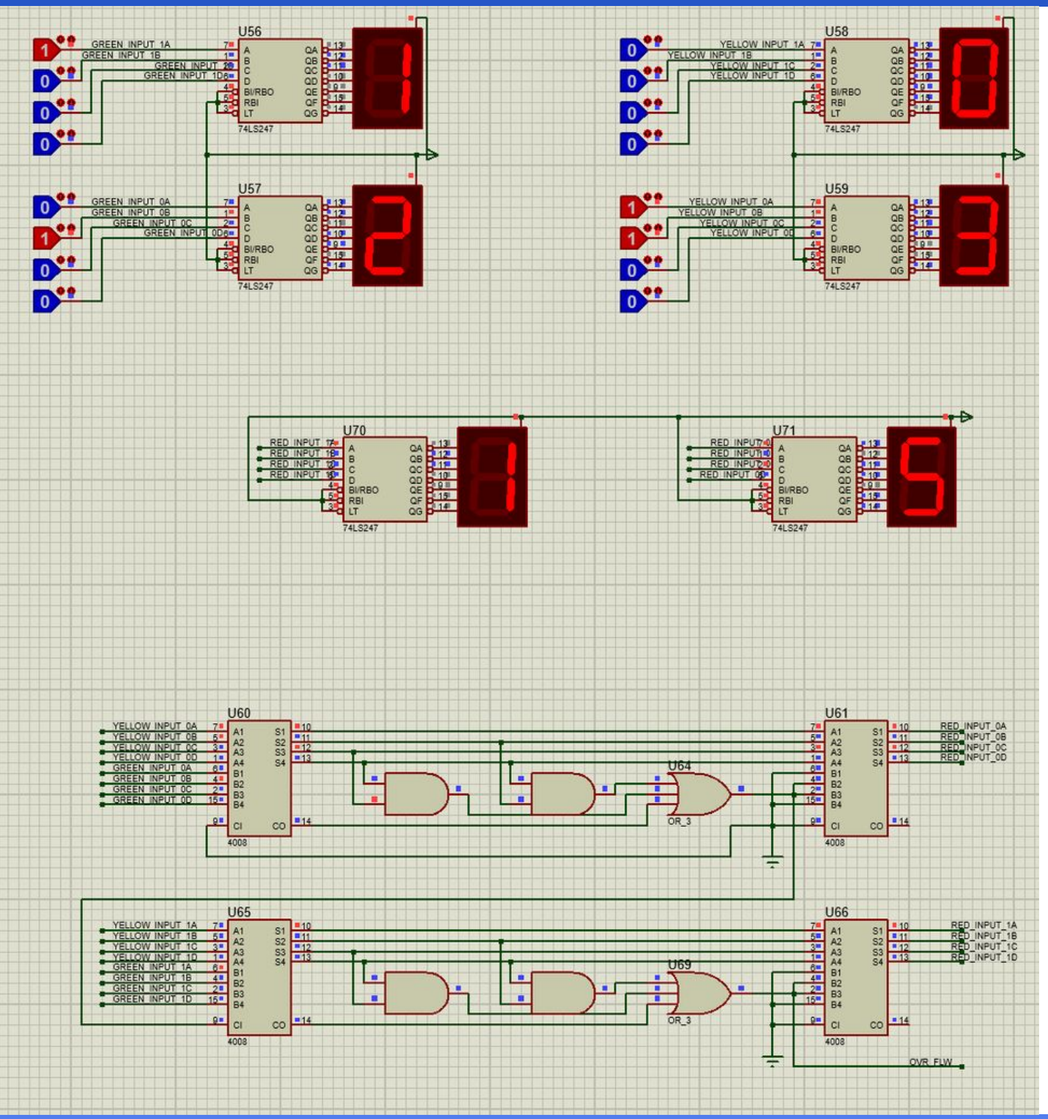
Overall System Design



Design

In this project, we split the circuit into multiple blocks to clarify their usage, comprises of different blocks:

- Input
- Adder
- Memory
- Selector
- Counter
- State Selector
- Timer and Mode Switch
- Display



Input + Adder Block (mode 1)

Input Block:

- Purpose:
  - Takes user input (green and yellow time) and displays values on 7-segment LEDs (also shows red time).
  - Example: Green = 12, Yellow = 3, Red = 15.
- Functionality:
  - Converts user input through BCD logic gates to display.
  - Passes green and yellow time to the adder block.

Adder Block:

- Purpose:
  - Calculates red time as the sum of green and yellow times.
- Functionality:
  - Returns red time to the input block for display.
  - Transfers overflow bit to the memory block.

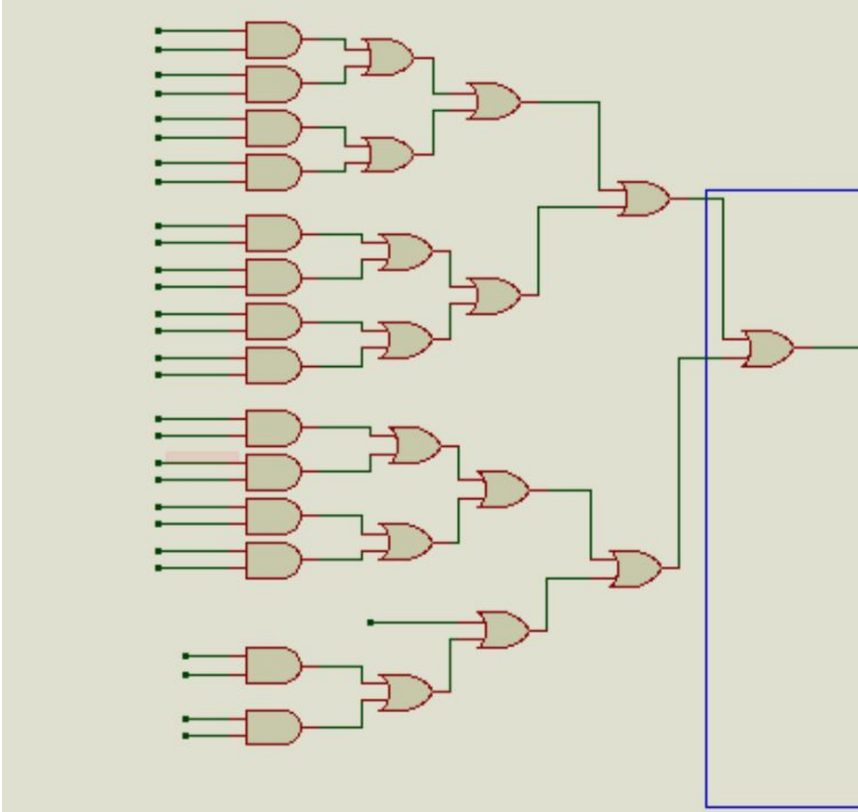
Memory Block

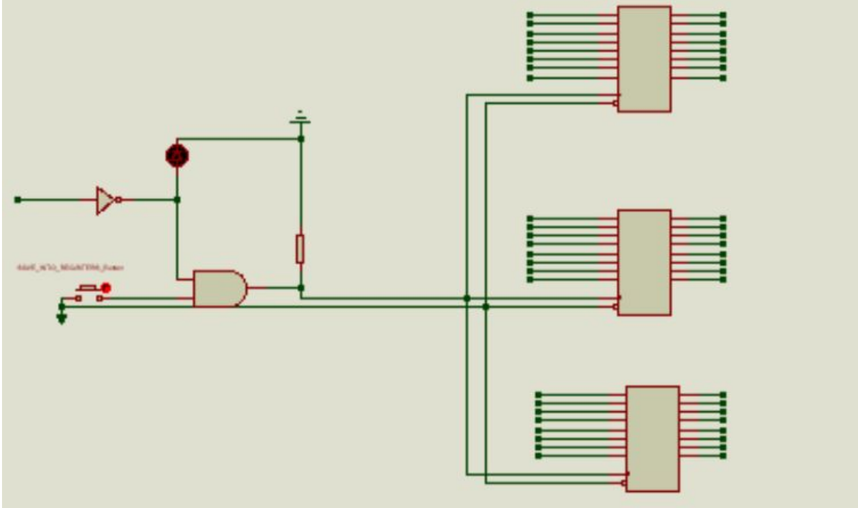
Purpose:

- Stores user inputs for red, yellow, and green light times.
- Activates storage only when the user presses a button and the corresponding light is lit.

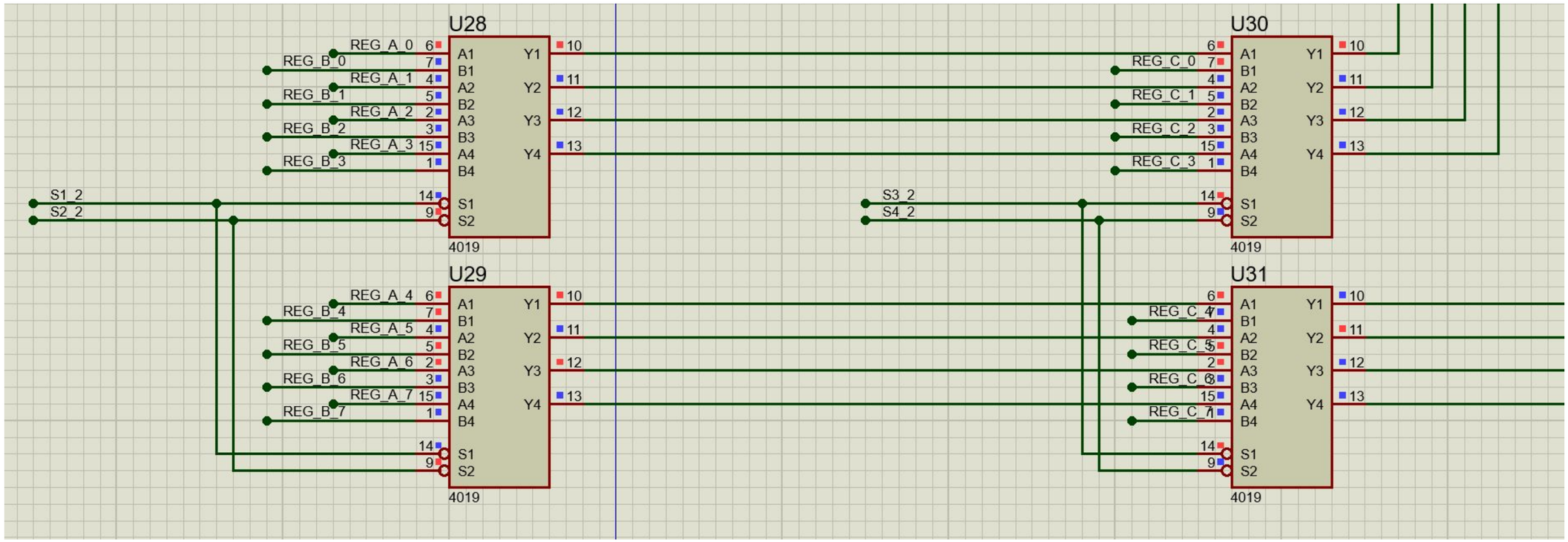
Functionality:

- Accepts user and saves it into memory.
- Updates stored data only when the button is pressed and the light is active.





Selector Block



Purpose:

- Receives inputs from the memory block and block selector, then outputs to the counter block.

Functionality:

- Operates based on a multiplexer. In this project, four multiplexers are used, grouped into two pairs sharing the same selector inputs.
- Selector inputs (S1, S2) are designed to be exclusively different (valid combinations: S1=1 & S2=0 or S1=0 & S2=1).

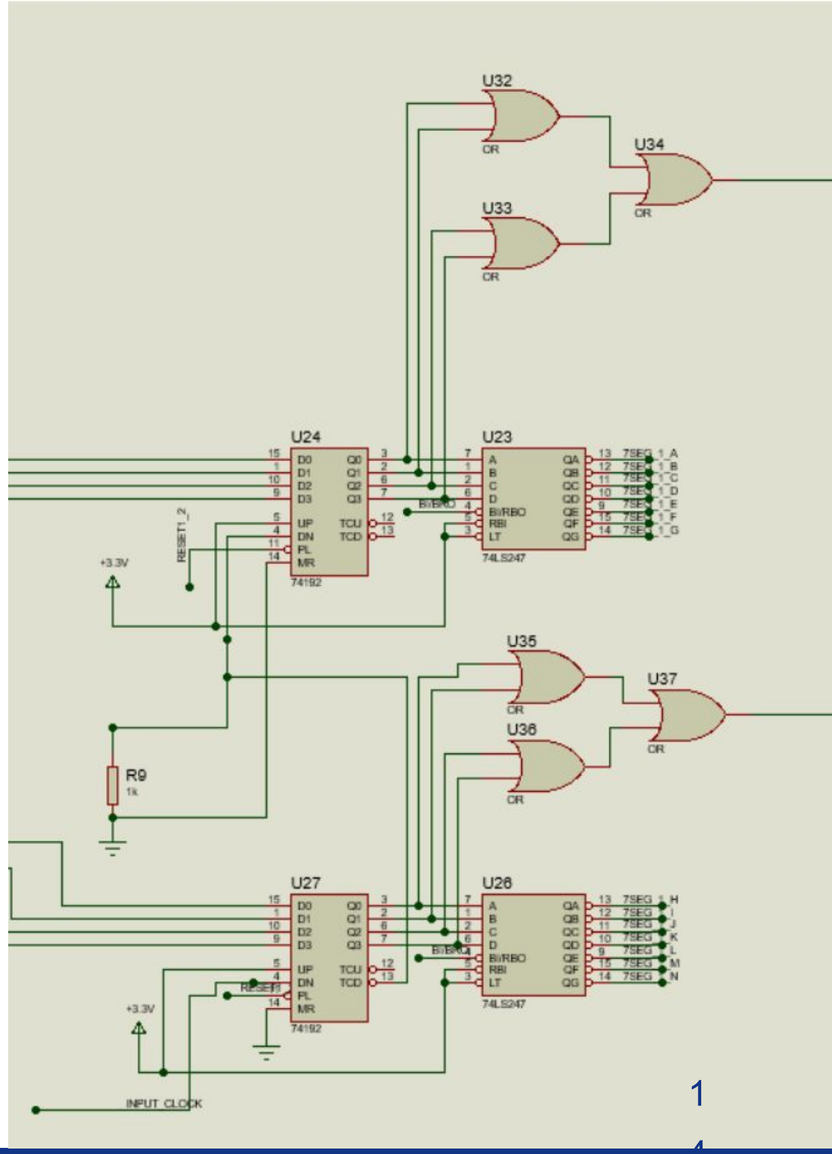
Counter Block

Purpose:

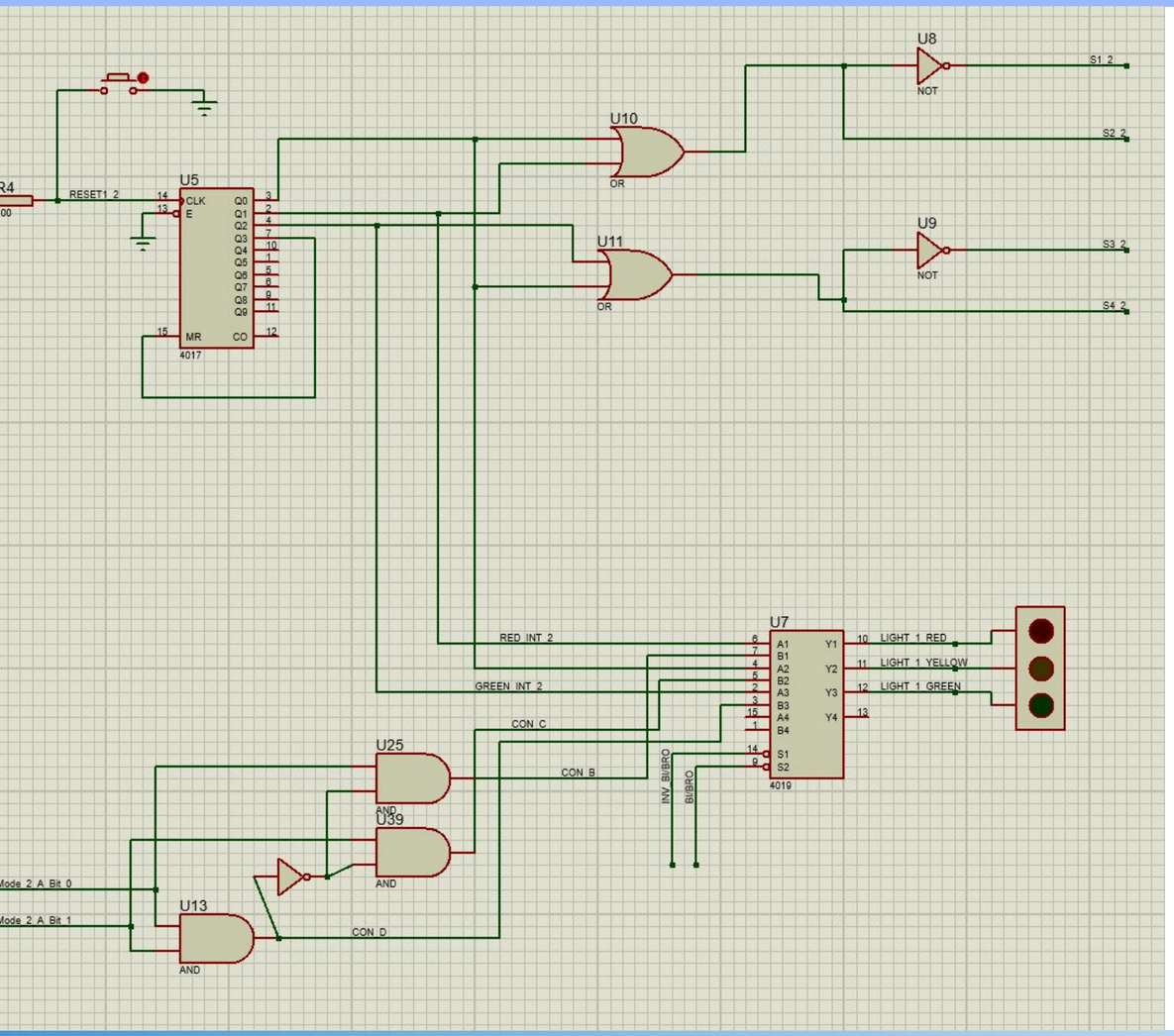
- Receives a value from the selector block and counts down to 00. Resets automatically with the next value.

Functionality:

- Inputs:
  - Value from selector block.
  - Clock signal from the clock block.
- Outputs:
  - Counting value to the intersection.
  - Six OR gates ensure that when the count reaches 00, a reset signal is triggered via PL pins to load the next

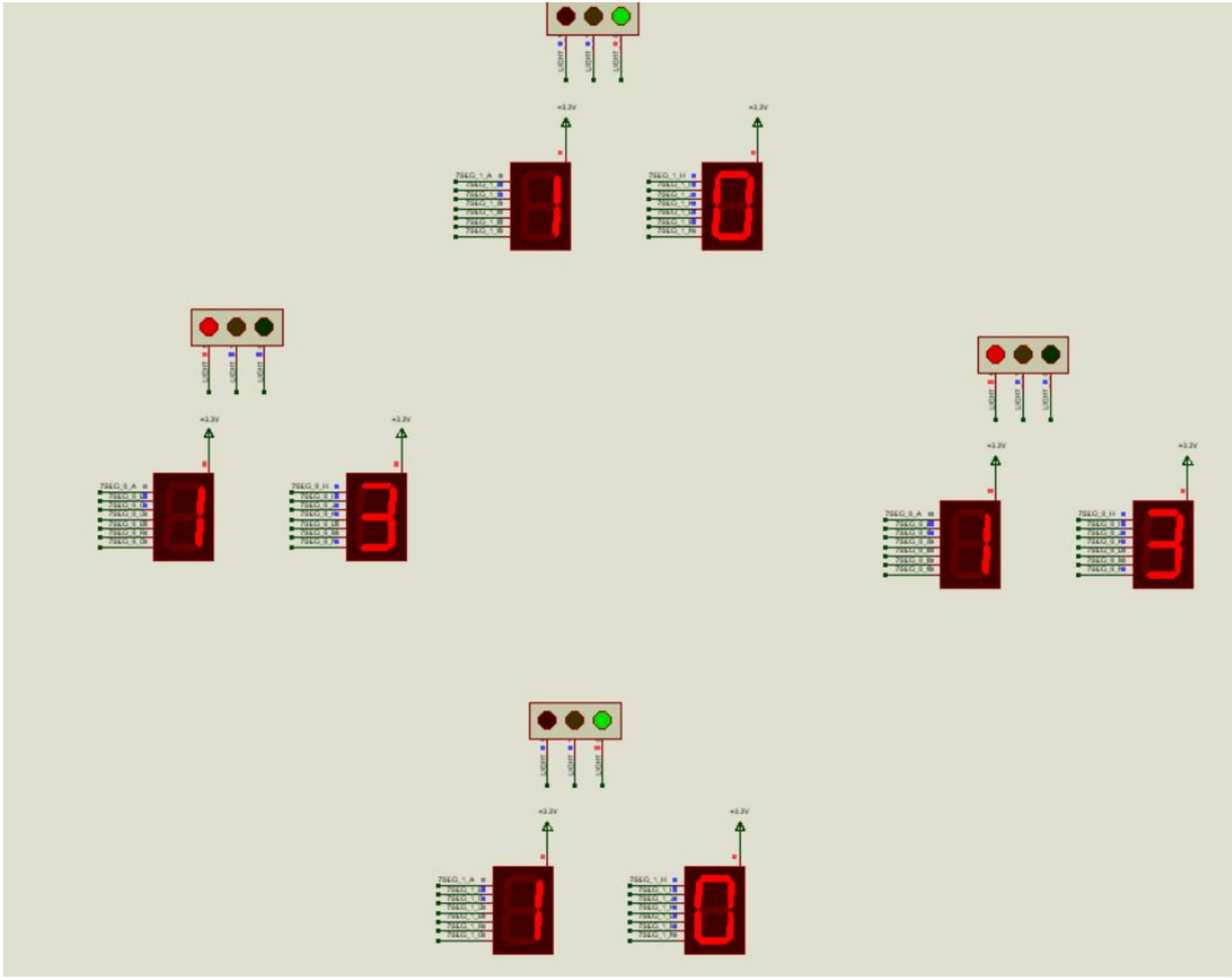


State Selector Block

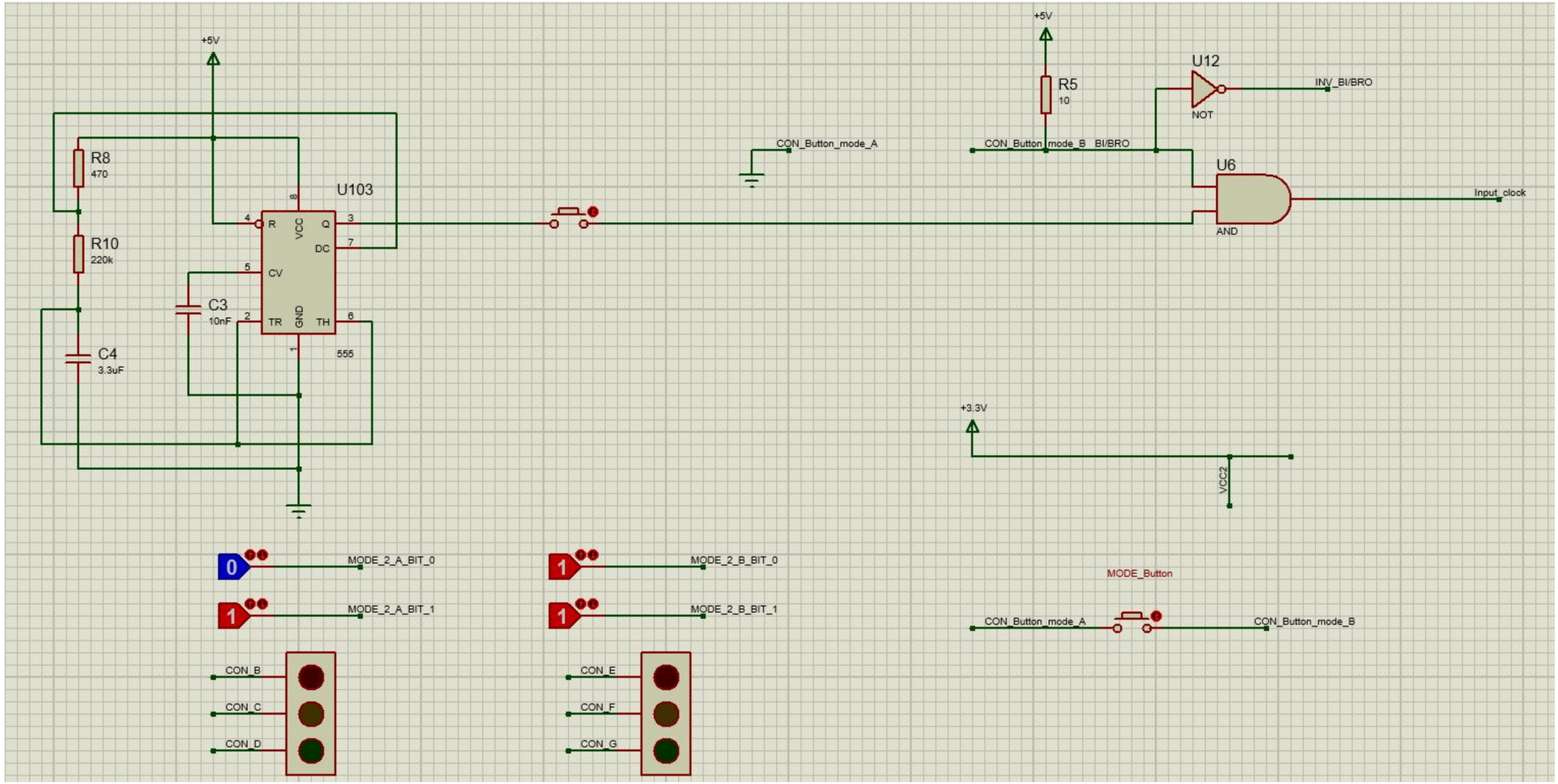


- **Purpose:**
  - Updates outputs from the counter block and mode selector button for the selector block and display lights.
- **Functionality:**
  - Manual Mode: Outputs controlled by manual input via multiplexer.
  - Automatic Mode: Ring counter IC updates outputs, resetting after the fourth output.

Display Block



Timer and Mode Switch



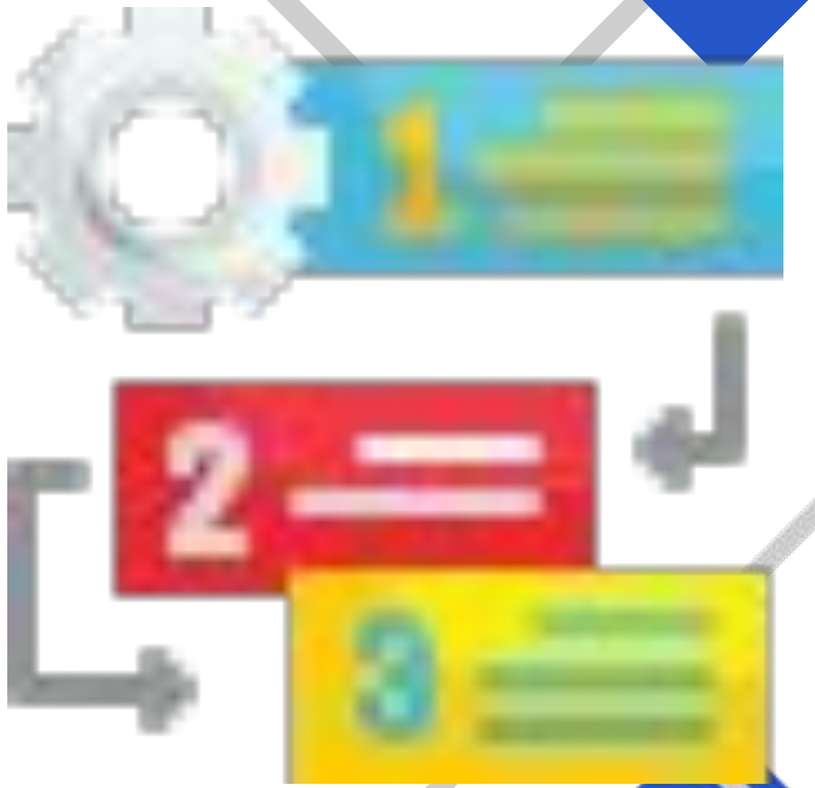
Timer and Mode Switch

Purpose:

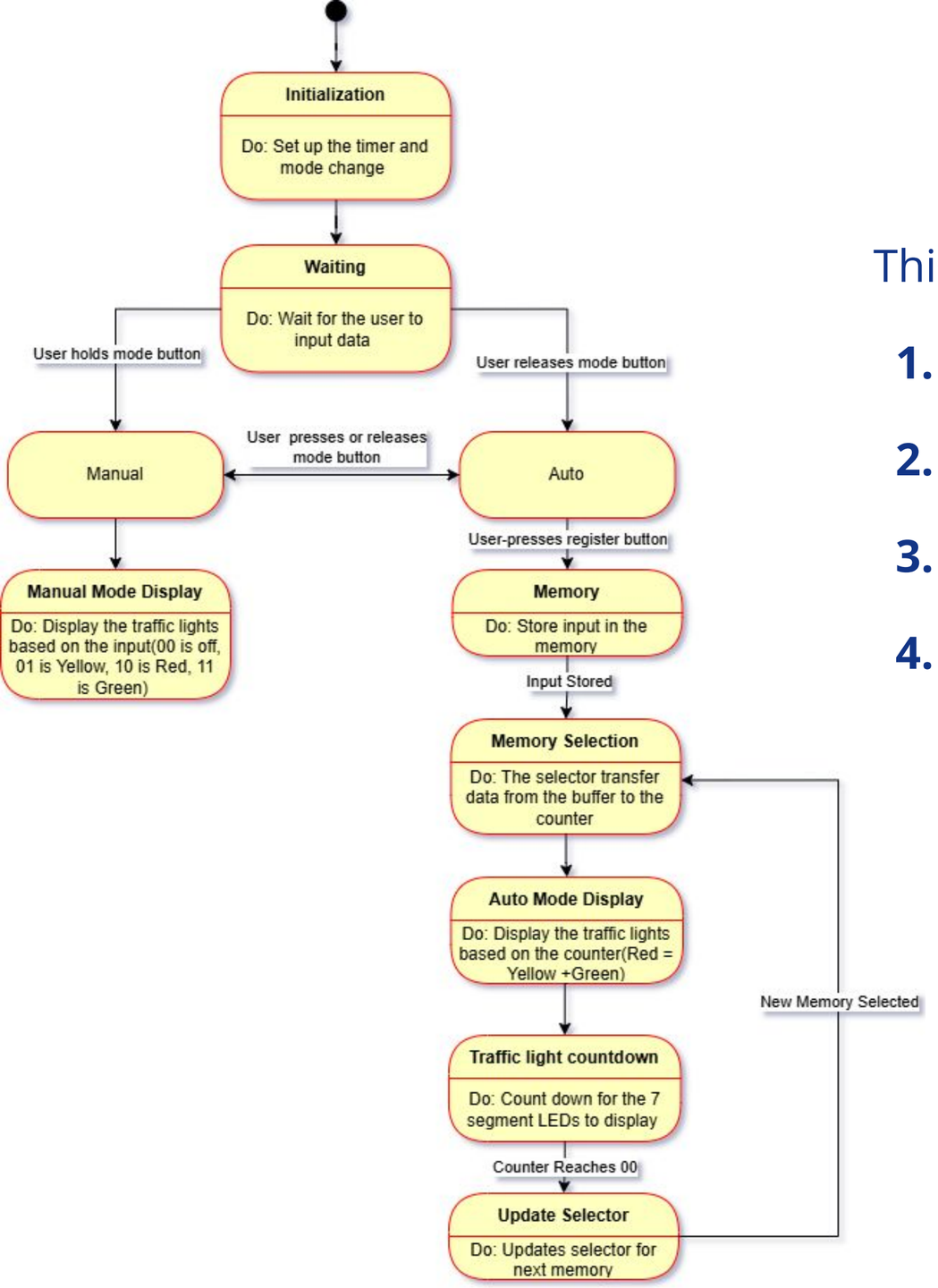
- Acts as the timing engine for traffic light transitions and allows switching between counting and non-counting light modes.

Functionality:

- Signal Generation:
  - 555 Timer IC in astable mode produces a square wave, with timing determined by resistors and capacitors.
- Mode Selection:
  - Mode switches enable different operational modes, with NOT and AND gates ensuring proper signal control.
- Conditional Timing Control:
  - Timer output is activated or disabled based on selected mode, adding flexibility.
- Output:
  - Drives traffic light LEDs, enabling transitions between



System State Diagram



This diagram shows the flow of the traffic light system:

1. **Initialization:** System setup.
2. **Waiting:** Awaits user input for manual or auto mode.
3. **Manual Mode:** Lights operate based on manual section's input.
4. **Auto Mode:**
   - Memory: Stores user data in auto section's input.
   - Display & Countdown: Lights run automatically based on counter values.
   - Update: Prepares for the next cycle.

Conclusion

- The project was thoroughly tested and meets real-world traffic system requirements.
- Key features: adaptable to various road scenarios, includes safety-enhancing caution lights, and supports customizable configurations.
- A reliable prototype providing a foundation for future intelligent transportation systems.
- Built with modern components like IC555 timers and logic gates, aligning with urban traffic management trends.

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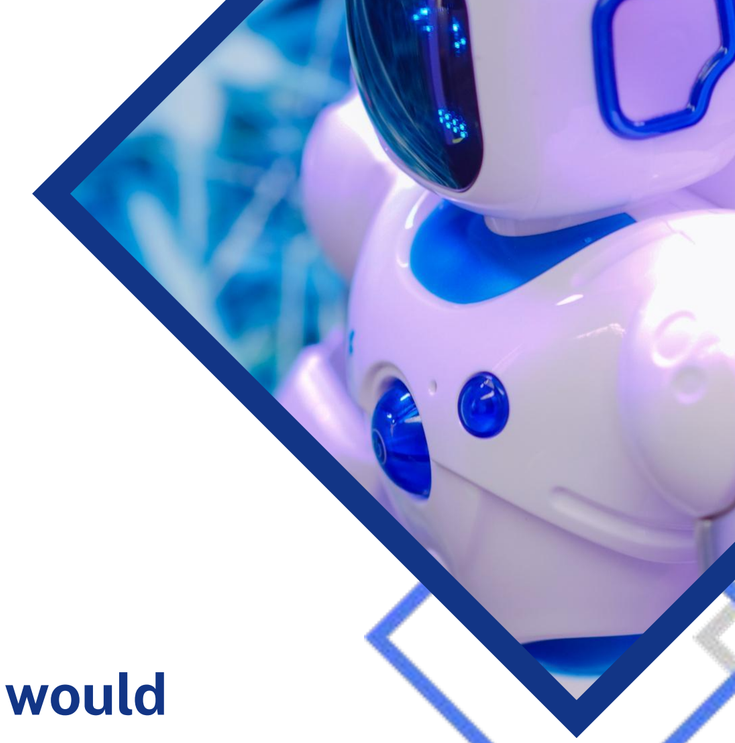

Thank You

For your attention! If you have any questions or would like to discuss further, please feel free to reach out.

By Group 2