T-Junction Traffic Controller Design

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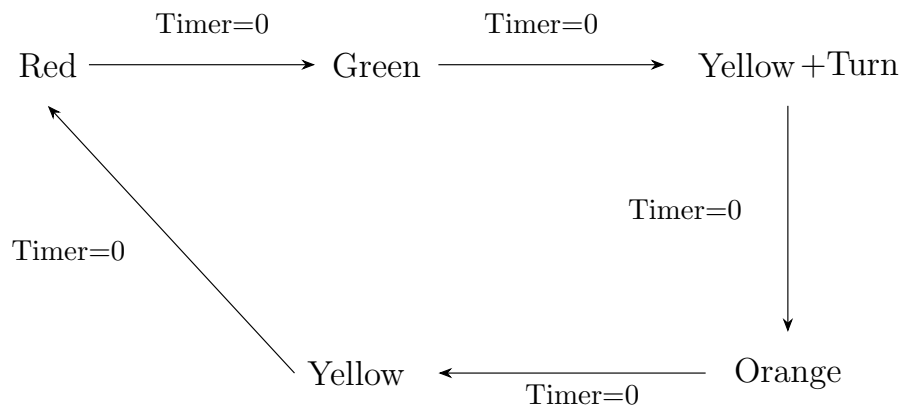Shivam Shilvant EE24BTECH11057

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1 Introduction

Design of an intelligent traffic control system for T-junctions with:

- Independent traffic light control for two directions (T1 and T2)

- Pedestrian walk signals with warning buzzer

- Emergency vehicle priority

- Turn signal management

2 Design Architecture

2.1 State Machines

2.2 Key Features

2.2.1 Turn Signal Management

- Added special state (GREEN_WITH_TURN)

- T1 gets right turn signal, T2 gets left turn signal

- Turn phase occurs after main green phase

- Ensures no green light conflicts between T1 and T2

2.2.2 Emergency Handling

- Asynchronous detection (immediate response)

- 10-time unit hold period

- Left emergency stops T1 only

- Right emergency stops both T1 and T2

2.2.3 Safety Interlocks

- T2 checks T1 state before turning green

- Minimum yellow/orange times for safe transitions

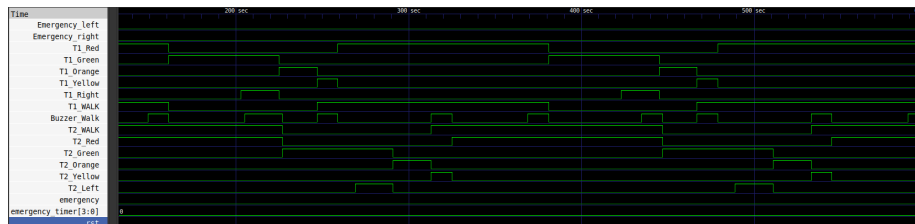- Physical impossibility for conflicting green lights

3 Timing Diagram

Figure 1: Example timing sequence showing normal signal phases

4 Implementation Details

4.1 Parameters

Parameter	Value (time units)
Red Time	60
Green Time	20
Turn Time	10
Yellow Time	5
Orange Time	10
Emergency Time	10
Buzzer Time	5

4.2 Verilog Module Breakdown

- Two independent but synchronized state machines
- Asynchronous emergency override
- Combinational output logic
- Configurable timing parameters

5 Conclusion

The design meets all requirements while ensuring:

- Safe operation through state machine interlocks
- Responsive emergency handling
- Clear turn signal indication
- Predictable timing behavior

For codes refer to `https://github.com/ArnavYadnopavit/FinalProjectDSLab`

Thank You