Four-Way Intersection Traffic Signal – Logic Works Simulation

A Digital Logic Design Lab Course Project

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Tool Used: Logic Works 5

Project Overview

This project presents the digital simulation of a four-way traffic intersection using Logic Works 5. Designed as part of our Digital Logic Design coursework, the objective was to replicate the behavior of real-world traffic signals at a crossroad using digital logic principles. Our circuit design includes timer-controlled transitions, and LED indicators showcasing the practical application of FSMs (Finite State Machines), counters, and combinational logic.

Features

- **Finite State Machine (FSM) based Light Control**: Governs the transitions between different traffic signal states.
- **Timer Simulation**: Binary counters simulate green and yellow durations.
- **LED Indicators**: Represent signal states (Green, Yellow, Red) for North, South, East, and West directions.
- **Clock-Driven State Transitions**: A consistent clock pulse advances system states.

Logic Works Design Components

Component	Purpose
Flip-Flops	Store FSM states
Counters	Implement green and yellow light timers
LEDs	Indicate signal status (Green/Yellow/Red)
Clocks	Provide timed state transitions
Logic Gates	Implement next-state and output logic

Circuit Operation

1. **Initialization**: Upon reset, all directions are given a red signal briefly to ensure a stable start.
2. **Signal Cycle**:
    - The South direction is given a green signal, followed by yellow, then red.
    - East follows the same sequence afterward.
    - North follows the same sequence afterward.
    - West follows the same sequence afterward.
3. **Timers**: The length of each green and yellow phase is determined by binary counters synced with a clock pulse.
4. **Continuous Looping**: The FSM ensures that the cycle repeats indefinitely, simulating continuous real-world traffic control.

Conclusion

This project effectively demonstrates the application of core digital design principles to a real-world problem. Through Logic Works, we successfully created a functioning model of a four-way traffic light controller that incorporates timing, and state control. The simulation provides insight into how logic circuits manage time-sensitive, sequential decision-making in infrastructure systems.