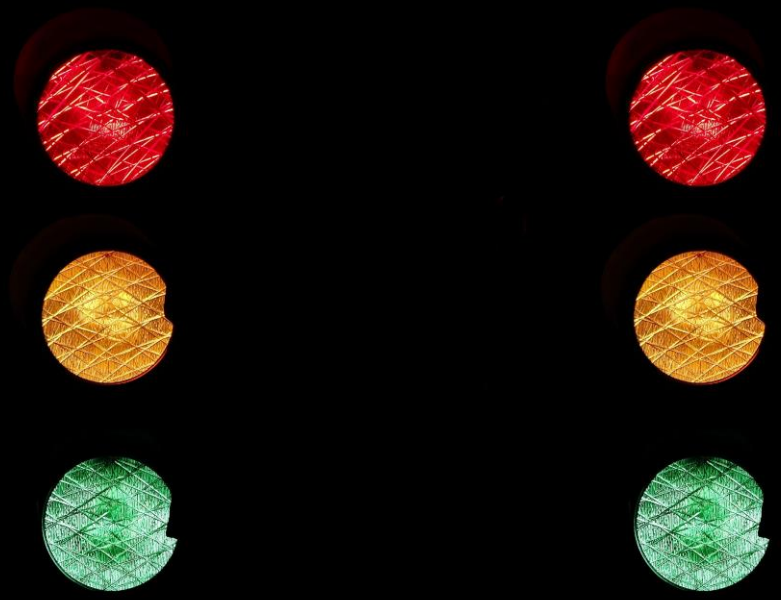
Four-Way Traffic Controller

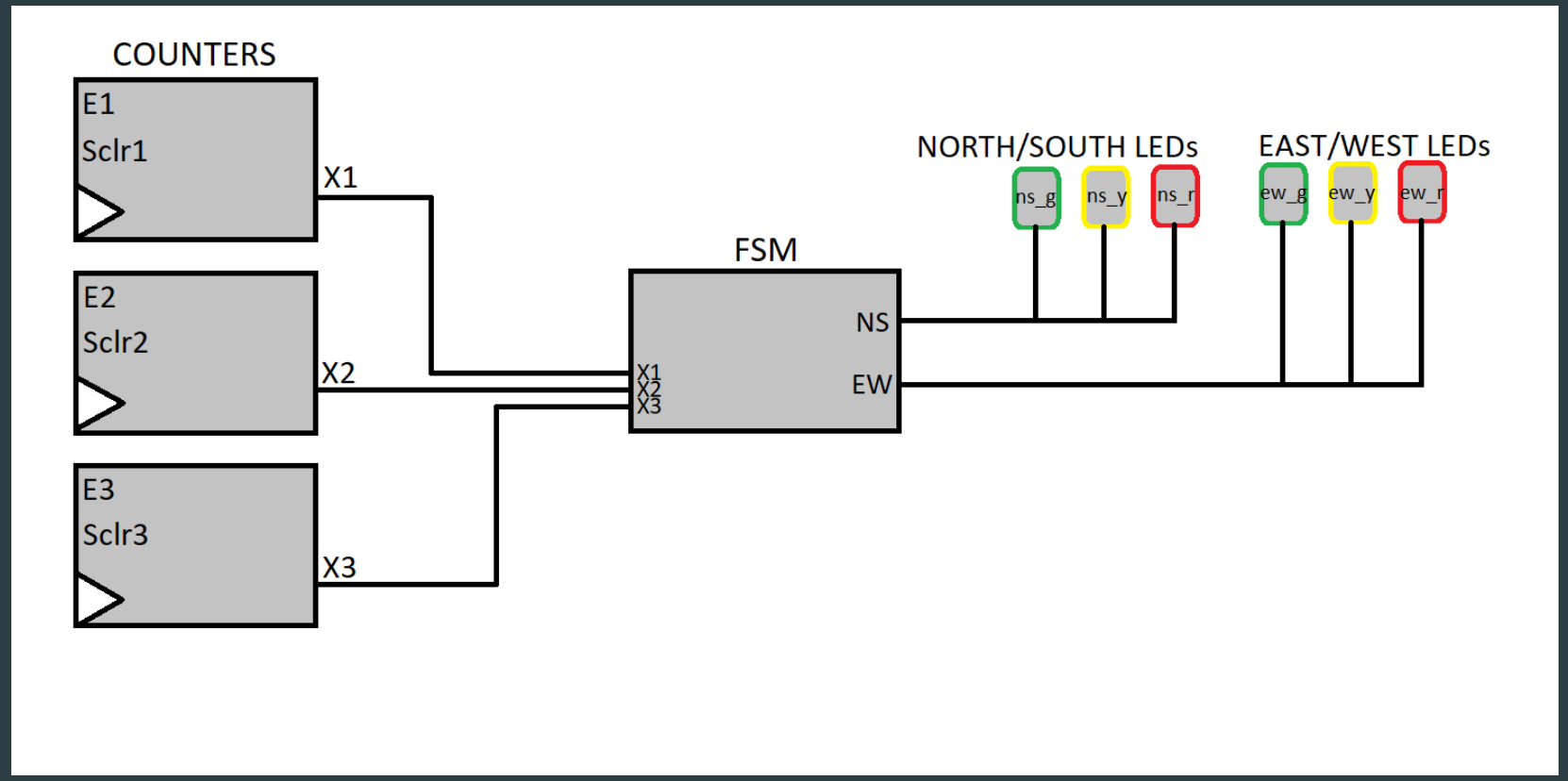


- Implementation
  - Hardware: Nexys-A7 Board
  - Programmed In VHDL
  - Designed and Developed by Emanuel Shabo, Nick Legato, Caleb Iott.

Circuit Description & Function

- Circuit designed consists of one finite state machine and three counters.
  - Each counter component provides a record (memory) of the number of times a previous event occurs. In this circumstance, which LEDs were previously activated. This, too, is in synchronization with the clock.
  - The finite state machine (FSM) takes the previous states of the LEDs and determines, from a prior programmed configuration, which LEDs will be activated given input from the counter components.
- Function
  - Overall function is to simulate behavior of a traffic light at a 4-way intersection.
    - Includes timing of lights.
    - Light reacts to idealized traffic flow: cars stopping, queuing, and moving through the intersection for the given output of the light.

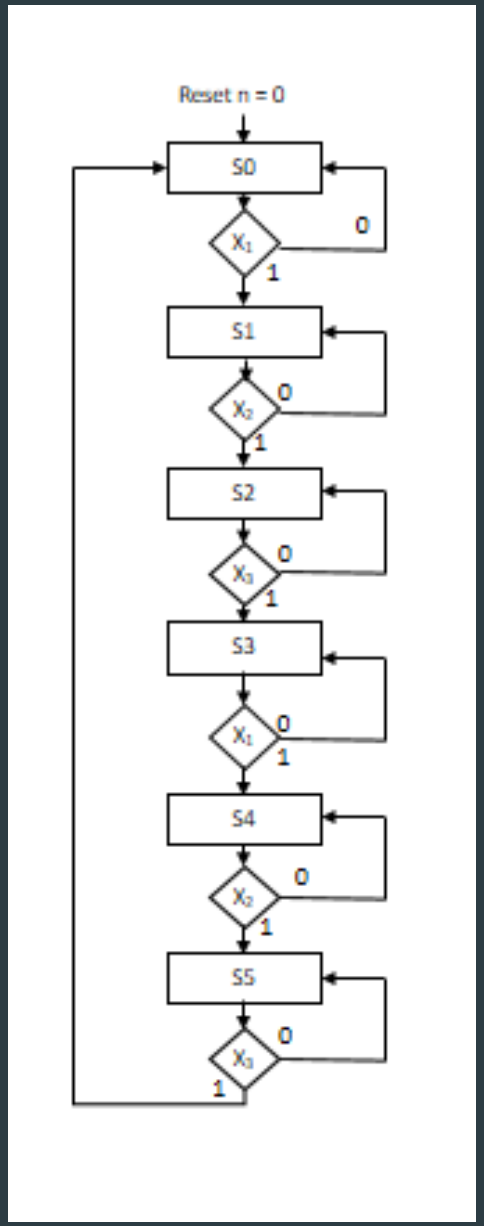
Block Diagram



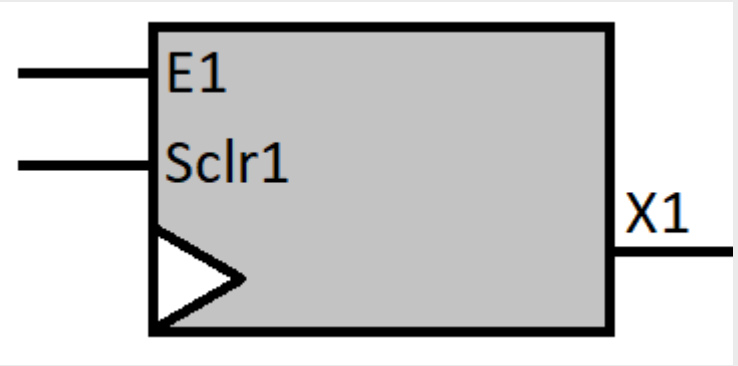
State	N/S LED Color	E/W LED Color
0	Green	Red
1	Yellow	Red
2	Red	Red
3	Red	Green
4	Red	Yellow
5	Red	Red

Table 1: Table of each state.

State Diagram



Counter

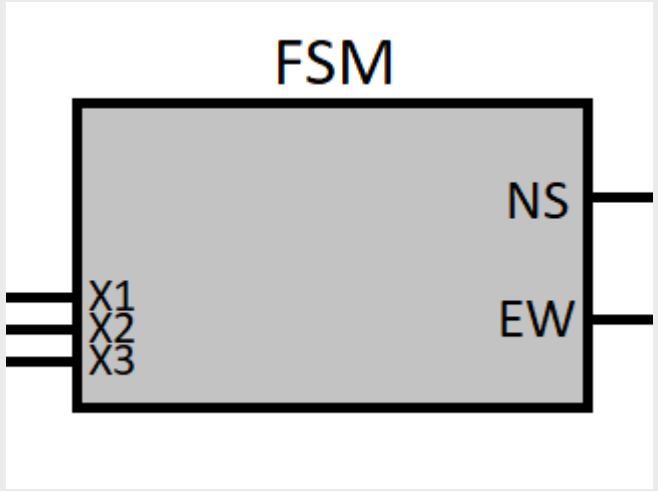


- Reasons for Implementation
  - Needed to make a way to easily change states with timing. It pairs well with the clock.

Architecture

- Enable (E): Allows the counter to function when it is high (1). Otherwise, nothing will happen.
- Clear (sclr): Makes sure that once a process of the counter is done, it will clear so it doesn't overlap with another counter.
- Clock (clk): Gives the component a way to be on time with the functions.
- Output (C): Once the counter counts, it will output to the FSM.

Finite State Machine

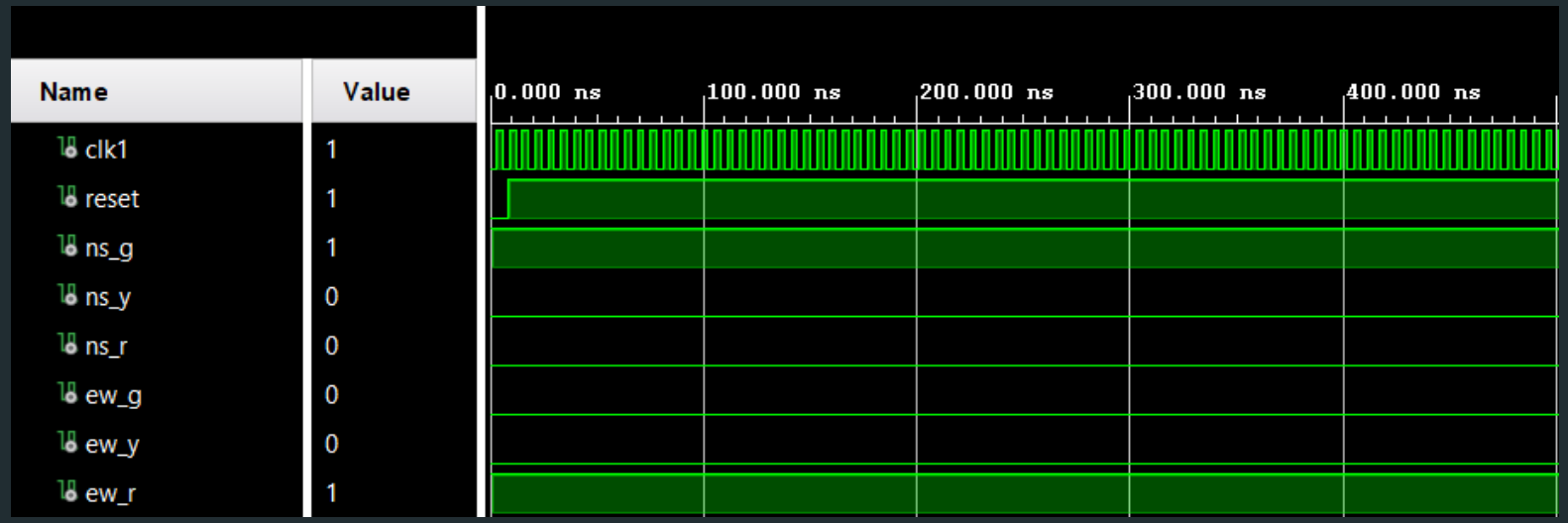


- Reasons for Implementation
  - Needed a way to transition between states to change the color of the LEDs in a proper manner. This includes proper timing.

Architecture

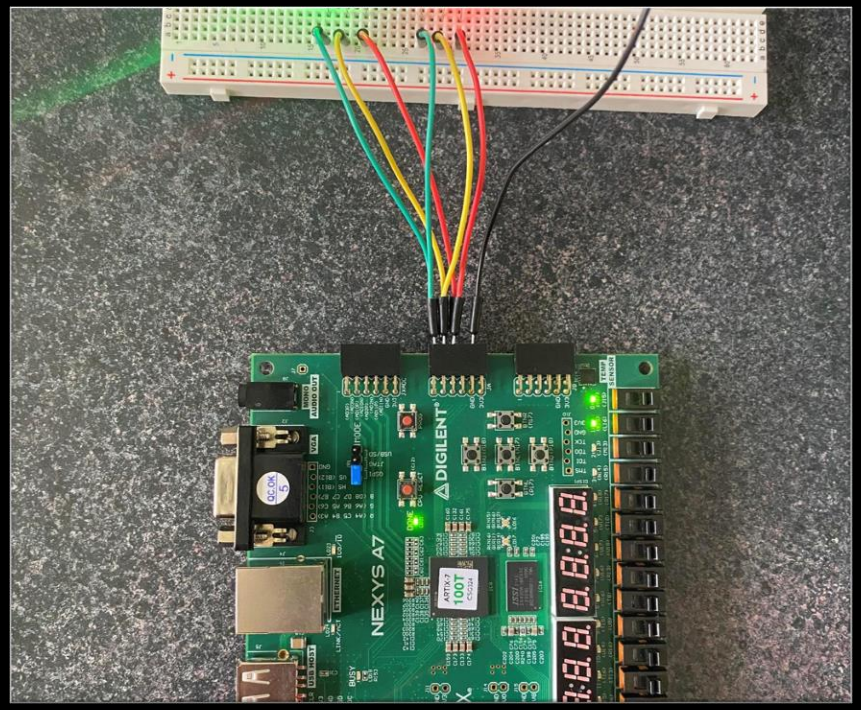
- Inputs (x): Connects to each counter. Needs a way to connect each component.
- Outputs (NS & EW): Connects to the two sets of LEDs. LEDs include green, yellow, and red for each set.

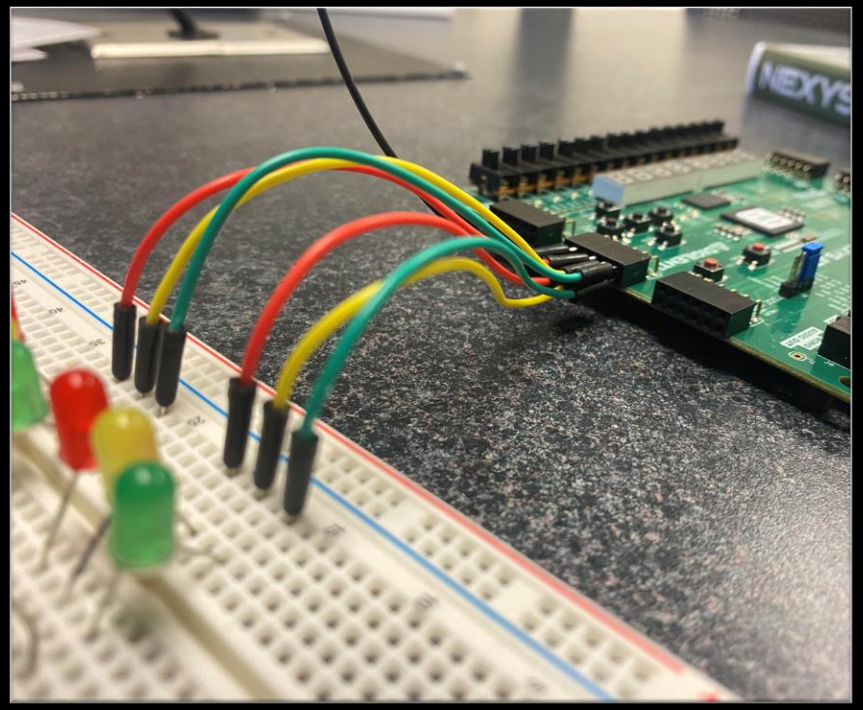
Simulation Results



- Changes are uniform.
- Note the clock ticks.
- State 1
  - North-South Green is ON (1).
  - East-West Red is ON (1).
  - All else if OFF (0).

ns_g	North-South Green
ns_y	North-South Yellow
ns_r	North-South Red
ew_g	East-West Green
ew_y	East-West Yellow
ew_r	East-West Red

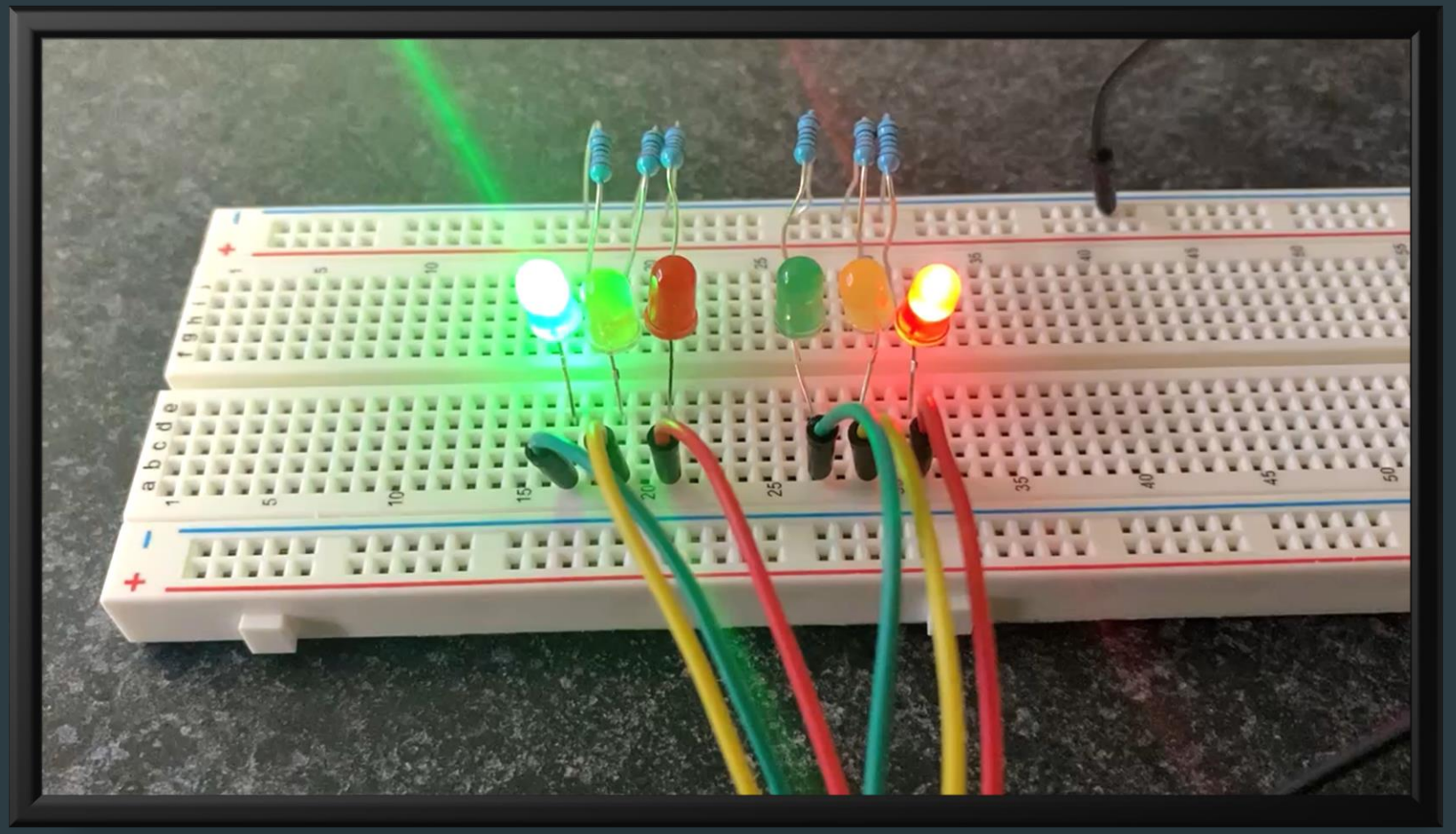




Demonstration Setup

Additional Hardware: Bread Board, Wiring, LEDs, Transistors.

Live Demo



https://www.youtube.com/watch?v=uNnRW8VPhPs