Traffic Light System Project Report

Student Details

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Submission Date: 23/06/2025

Problem Statement

Create a traffic light system for a four-way intersection using Arduino. Each direction (North, South, East, West) should operate in a proper traffic signal sequence. Each green light should remain ON for 15 seconds, followed by a yellow light for 2 seconds, and then red for the rest of the cycle.

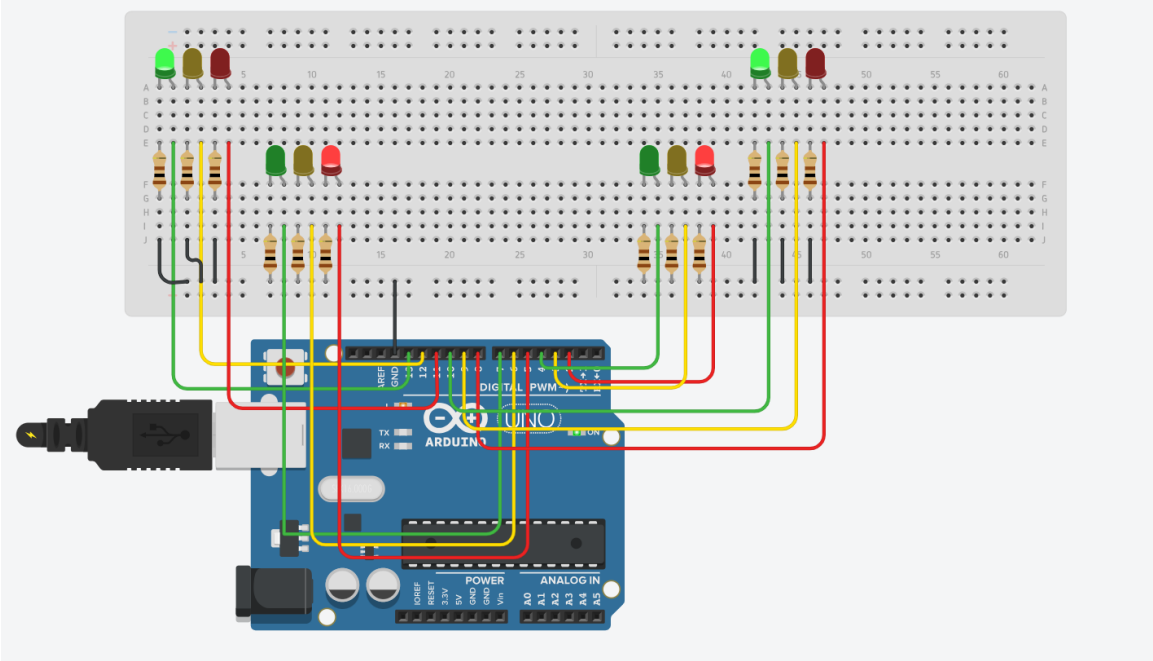
Hardware Components Used

- Arduino Uno R3
- Breadboard
- 12 LEDs (Red, Yellow, Green for each direction)
- 12 Resistors (220 ohms)
- Jumper wires
- USB Cable

Circuit Diagram and Working

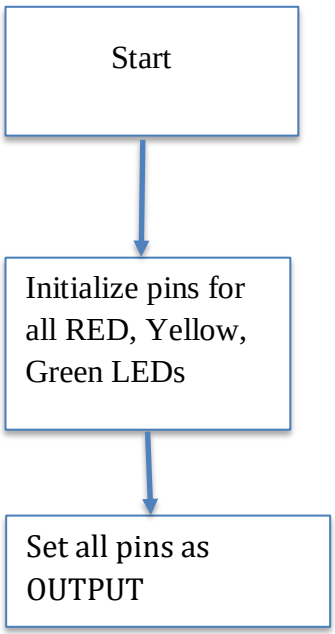
- The circuit uses **12 LEDs**, divided into four groups for each direction: **North, South, East, and West**.
- Each group contains **three LEDs**: **Red, Yellow, and Green**.
- **Each LED** is connected to an **Arduino digital pin** through a **220-ohm resistor**.
- The **anode** of each LED is connected to a **digital pin**, and the **cathode** is connected to **ground via the resistor**.
- The LEDs are controlled using **digitalWrite() functions** in the Arduino code.
- At any time, **only one direction** is allowed a **green light**, while the others remain **red**.

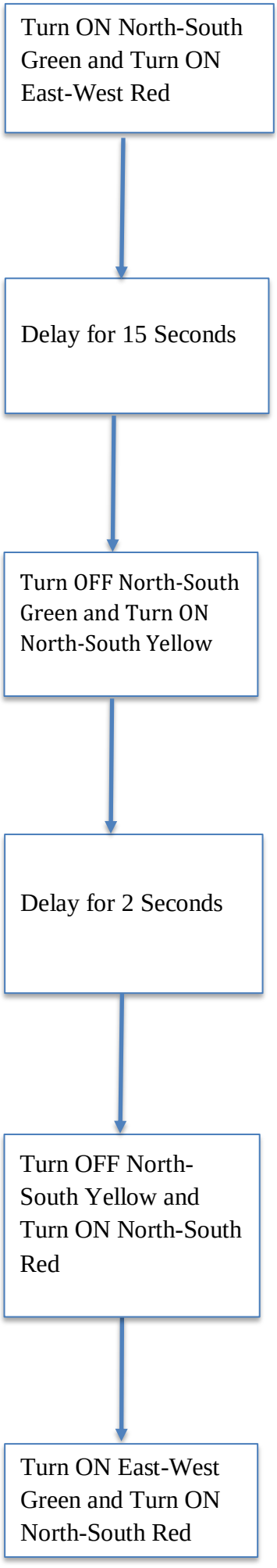
- The **green light** stays ON for **15 seconds** to allow vehicle passage.
- After that, the **yellow light** turns ON for **2 seconds** to signal an upcoming change.
- Then, the direction switches to **red**, and the **next direction's green light** is activated.
- This cycle continues to **simulate real-world traffic signal behaviour** at a four-way intersection.

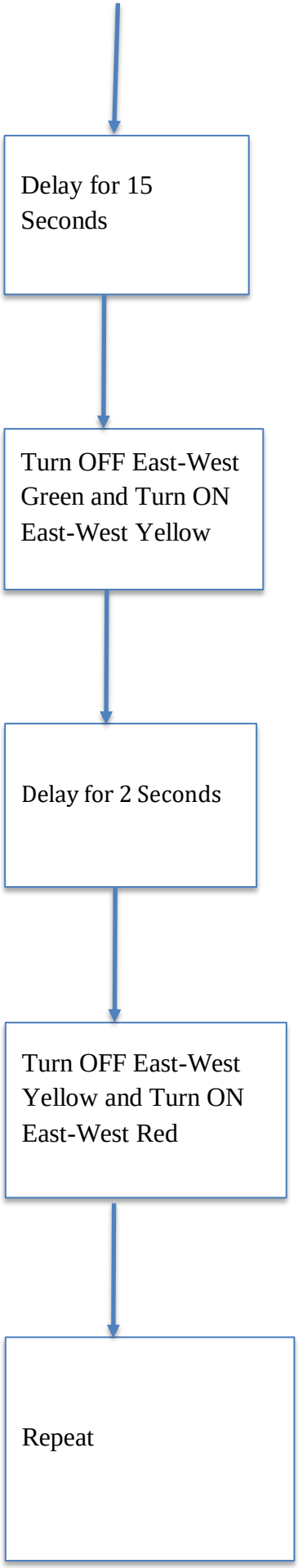


Code Logic and Explanation

Flow chart




Turn ON North-South Green and Turn ON East-West Red
Delay for 15 Seconds
Turn OFF North-South Green and Turn ON North-South Yellow
Delay for 2 Seconds
Turn OFF North-South Yellow and Turn ON North-South Red
Turn ON East-West Green and Turn ON North-South Red


Delay for 15 Seconds
Turn OFF East-West Green and Turn ON East-West Yellow
Delay for 2 Seconds
Turn OFF East-West Yellow and Turn ON East-West Red
Repeat

Arduino Code Used (.ino)

```
// Define output pins for the traffic lights
// Format: GREEN, YELLOW, RED for NORTH (1), SOUTH (2), EAST (3), WEST (4)

int green1 = 13, yellow1 = 12, red1 = 11;  // North
int green2 = 10, yellow2 = 9, red2 = 8;    // South
int green3 = 7,  yellow3 = 6, red3 = 5;    // East
int green4 = 4,  yellow4 = 3, red4 = 2;    // West

void setup() {
  // Set all the light pins as OUTPUT
  int pins[] = {green1, yellow1, red1, green2, yellow2, red2,
                green3, yellow3, red3, green4, yellow4, red4};
  for (int i = 0; i < 12; i++) {
    pinMode(pins[i], OUTPUT);
  }
}

void loop() {
  // === Phase 1: North-South Green, East-West Red ===
  digitalWrite(green1, HIGH);  // North Green
  digitalWrite(red1, LOW);
  digitalWrite(green2, HIGH);  // South Green
  digitalWrite(red2, LOW);

  digitalWrite(red3, HIGH);   // East Red
  digitalWrite(red4, HIGH);   // West Red

  delay(15000); // Green time

  // === Yellow for North-South ===
  digitalWrite(green1, LOW);
  digitalWrite(green2, LOW);
  digitalWrite(yellow1, HIGH);
  digitalWrite(yellow2, HIGH);
  delay(2000); // Yellow time

  // Set North-South to Red
  digitalWrite(yellow1, LOW);
```

```
  digitalWrite(yellow2, LOW);
  digitalWrite(red1, HIGH);
  digitalWrite(red2, HIGH);

  // === Phase 2: East-West Green, North-South Red ===
  digitalWrite(green3, HIGH);  // East Green
  digitalWrite(red3, LOW);
  digitalWrite(green4, HIGH);  // West Green
  digitalWrite(red4, LOW);

  delay(15000); // Green time

  // === Yellow for East-West ===
  digitalWrite(green3, LOW);
  digitalWrite(green4, LOW);
  digitalWrite(yellow3, HIGH);
  digitalWrite(yellow4, HIGH);
  delay(2000); // Yellow time

  // Set East-West to Red
  digitalWrite(yellow3, LOW);
  digitalWrite(yellow4, LOW);
  digitalWrite(red3, HIGH);
  digitalWrite(red4, HIGH);
}
```

Conclusion

The Traffic Light System project successfully demonstrates the implementation of a four-way traffic control mechanism using Arduino. By efficiently utilizing digital output pins to control LED lights representing traffic signals, the system ensures that only one direction receives a green light at a time while the others remain red, thereby simulating real-world intersection behaviour. The integration of timed delays for green and yellow lights enhances the realism and functionality of the system.

This project not only reinforces foundational concepts in embedded systems and digital electronics but also provides practical insights into real-life traffic management solutions. It serves as a scalable prototype that can be extended to include sensors, timers, or even wireless control for smarter applications in urban traffic regulation.