Project Task 2 — Traffic Light System with Pedestrian Crossing

Overview

This project extends Task 1 (Car Traffic Light System) by adding a pedestrian crossing.
When a pedestrian presses a button, the lights transition to allow safe crossing while maintaining realistic timing and strict traffic rules.

Prerequisites

- Completion and upload of Task 1 (car traffic light system) to your Git repository.
- Basic understanding of:
    - SysML (Class, Sequence, and State Machine diagrams)
    - Arduino programming
    - Tinkercad simulation environment

Task Description

Enhance the existing system to include a pedestrian feature with the following behavior:

Pedestrian Light Extension

- Add Red and Green LEDs for pedestrians.
- Safety rules:
    - If the traffic light is green, the pedestrian light must be red.
    - If the pedestrian light is green, the traffic light must be red.

Pedestrian Button Logic

- When the button is pressed, the pedestrian light should switch to green as soon as possible.
- The traffic light must complete its yellow phase before turning red.

Timing Requirements

Phase	Minimum Duration
Car Green	10 time units
Car Yellow	5 time units

Modeling Tasks

Before writing the Arduino code, model the system using SysML.

1. **Class Diagram**
   Extend the existing class diagram to include classes for the pedestrian light and button.

2. **Sequence Diagram**
   Show the interaction sequence between the pedestrian, button, and traffic light controller.

3. **State Machine Diagram**
   Update the states and transitions to include the pedestrian lights and button logic.

Implementation Tasks

1. **Arduino Code**

   o Implement the state machine logic using a switch-case pattern.

   o Control the timing and synchronization between the car and pedestrian signals.

2. **Tinkercad Simulation**

   o Add a pedestrian button and red/green pedestrian LEDs.

   o Verify that pressing the button triggers the correct sequence of state changes.

3. **Testing**

   o Confirm that the system:

      ▪ Meets all timing constraints.

      ▪ Prevents both signals from being green at the same time.

Expected Outcome

- A functional traffic and pedestrian light system.

- Safe and synchronized light transitions between car and pedestrian states.

- Accurate SysML diagrams (Class, Sequence, and State Machine).

- A working Tinkercad simulation demonstrating the system behavior.