**BZ214 Visual Programming – Project Report**

**Group No:** 49

**👥 Group Members and Contributions**

| **Student Number** | **Name Surname** | **Area of Contribution** |
| --- | --- | --- |
| 1030510069 | Erdal Gümüş | Project architecture, user interface design, timer logic, and system integration |
| 1030510536 | Beyzanur Delibaşo | Vehicle movement model, visual enhancements, validation of test scenarios |
| 1030510586 | Beyza Nur Taşkesen | Traffic light transition logic, cycle planning, and logical scenario implementation |

All team members fulfilled their responsibilities through clear task division. There are no members who failed to contribute.

**🎯 Abstract**

The aim of this project is to develop a smart traffic light simulation system that dynamically adjusts signal durations based on traffic density at urban intersections. According to the vehicle density input provided by the user, the system automatically calculates appropriate green light durations for each direction to optimize traffic flow. This real-time, visually interactive simulation reflects the core principles of traffic control systems within a software environment.

**🧱 Software Design**

**Technologies Used:**

* **Programming Language:** Java 21
* **Graphical Interface:** JavaFX
* **Build Tool:** Maven

**Layered Architecture:**The project is divided into three main software layers:

**🔧 Controller Layer:**This layer handles the timing of traffic lights, the transitions between yellow-green-red states, and the overall cyclic logic. It also calculates proportional green durations based on directional densities.

**📊 Model Layer:**This layer contains definitions of all traffic-related entities such as vehicles, directions, lights, and their states. Vehicle movement is controlled based on position, speed, and direction. Light state changes are synchronized with the system clock in this layer.

**🎨 View Layer:**The user interface includes a four-way intersection display with dynamic vehicles, traffic lights, and control buttons. Users can input density values, start/stop/reset the simulation, and monitor traffic light states, green light durations, and countdowns in real time.

**User Interaction:** The user manually inputs vehicle density for each direction. The simulation can be controlled via Start/Stop/Reset buttons. All directional light durations and statuses are visually presented for live monitoring.

**Class Structure (Summary):**

* TrafficLightController: Manages light transitions
* Vehicle: Handles vehicle direction, speed, and position
* IntersectionView: Represents the intersection and lights in the graphical interface
* MainApp: Main application entry point and initializer

**🧪 Usage Scenarios and Testing**

* Green light durations are correctly assigned based on input density values
* Vehicles only pass during green lights and wait during yellow/red
* The reset feature clears and restarts the simulation scene as expected
* All interface controls operate without error

**Conclusion**

This project successfully simulates a density-sensitive traffic control system through software. The JavaFX-based user interface allows real-time observation and interaction. The simulation accurately reflects the essential principles of traffic light management both visually and logically.Thanks to its modular structure, the system can easily be extended to support new intersection layouts, different vehicle types, or external data sources. Throughout the project, software development processes were practically applied, and the final product was achieved through effective teamwork.

