Railway Project Report

**Project Title:** Railway Crossing Control System  
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**Course:** Digital Logic Design  
**Instructor:** Abdullah Yaqoob  
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**1. Executive Summary**

**Project Overview:**

This project focuses on the design and simulation of an automated railway crossing control system using digital logic principles. It aims to improve safety by automatically controlling gate operation based on train detection, utilizing sensors, flip-flops, and logic circuits developed in Logisim.

**2. Introduction**

**Background:**

Railway crossings are high-risk zones, especially where manual systems are in use. Accidents due to human error and lack of timely gate control are common. This project leverages digital logic design to build a cost-effective, automatic system for managing railway crossings.

**Objectives of the Project:**

- Automate railway crossing gate control.  
- Use sensors to detect approaching trains.  
- Implement timing mechanisms for gate operation.  
- Activate warning signals for vehicles and pedestrians.  
- Simulate the entire system in Flip Flop and Logisim.

**3. System Description**

**Current Problem:**

Manual railway crossing systems are inefficient and pose safety hazards. Fully automated hardware solutions are costly and complex.

**Proposed System Features:**

- Train Detection: Via digital input from simulated sensors.  
- Gate Control: Automatic lowering and raising of gates.  
- Timing Mechanism: Ensures appropriate response delay using sequential circuits.  
- Warning Signals: Lights and sirens for safety.  
- Emergency Alerts: Triggered if obstacles are detected.

**4. Design Methodology**

**Logic Design Approach:**

- Use of combinational circuits for decision-making.  
- Use of flip-flops and timing circuits to implement sequential logic.  
- Simulation Tools: Logisim and Flip Flop simulator.

**Logic Components Used:**

* AND, OR, NOT gates
* D Flip-Flops, Tunnels
* Multiplexers, Hex Digit Display
* Timers, Counters, Clock
* Sensors (LED lights, Output probe- sound, Push buttons)

**5. System Operation and Rules**

**Operational Flow:**

1. Sensor detects a train.  
2. System initiates gate-closing sequence.  
3. Warning lights and sirens activate.  
4. Gates stay closed until the train passes.  
5. After a delay, gates reopen, and signals deactivate.

**Rules and Conditions:**

- Gates must remain closed during the train's passage.  
- All signals activate before gate closure.  
- System should reset after each train passes.

**6. Implementation and Development**

**Development Stages:**

- Circuit design (Week 2)  
- Implementation in Flip Flop and Logisim (Week 4)  
- Signal integration and timing mechanism (Week 5)  
- Simulation, testing, and debugging (Week 6)

**Tools Used:**

- Software: Logisim, Flip Flop Simulator  
- Components: Logic gates, Flip-Flops, LEDs (for signals), and input buttons (for sensors)  
• Additional Tool: VS Code (Used to implement warning alarm sounds using C language)

**Challenges Faced:**

**-** Synchronization of timing and gate operations  
- Ensuring logic consistency across simulations  
- Simulating emergency scenarios effectively

**7. Team Contributions**

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| Member | Task | Description |
| Ahmed Raza | Digital Logic Design | Designed and implemented the complete traffic signal system for the project. |
| Simal Hassan | Signal & Timing | Implementation warning signals and timing mechanisms for gate control. |
| Laiba Jamil | Testing & Documentation | Develop circuits for train detection and gate operation using Flip Flop and Logism. |

**8. Results and Evaluation**

- Successful simulation of train detection and automatic gate control.  
- Realistic timing of gate operations aligned with signal activation.  
- Reliable functioning across multiple simulated scenarios.

**9. References**

- Course slides and textbooks on digital logic design  
- Logisim documentation and tutorials