# **Problem Exploration**

## **Problem restatement**

We are working towards a logic-based safety control system for a railway level crossing. The main purpose is to eliminate accidents between trains and vehicles by knowing that it is not safe to leave the gates on the ground. Presumed that the gates on the railway crossings close automatically when a train is coming or when a car is stuck on a railway track. It must only open the gates when it has received the signal that there is no train in the distance and that the track is clear. This system should be able to perform without manual intervention, 24 hours per day and should be safety and reliability conscious, and should be responsive to real world situations and circumstances.

## **Inputs and Outputs**

The system employs two input signals and three output actions. The sensors used to detect either a train close by or a vehicle on the crossing collect the inputs. Based on this data, the system decides whether to close or open the gates, and whether to activate a warning signal

| **Type** | **Signal Name** | **Data Type** | **Purpose** |
| --- | --- | --- | --- |
| Input | Train\_Detected | Boolean | TRUE if a train is within the danger detection zone |
| Input | Track\_Occupied | Boolean | TRUE if a vehicle is detected on the crossing area |
| Output | Activate\_Gates | Boolean | Set to TRUE to close the gates |
| Output | Deactivate\_Gates | Boolean | Set to TRUE to open the gates |
| Output | Warning\_Signal | On / Off | Optional alert for unsafe condition (flashing lights/sound) |

## **Context, Constraints, and Stakeholders**

**CONSTRAINTS**

| **Constraint Type** | **Description** |
| --- | --- |
| **Technical** | Sensors must detect trains and vehicles with high accuracy and low delay. |
| **Economic** | The system must be low-cost and require minimal maintenance or recalibration. |
| **Environmental** | It must remain operational in heat, rain, fog, dust, or poor lighting conditions. |
| **Operational** | Should include a manual override for emergencies or technician access. |
| **Social** | Must reduce risk for all road users and maintain public trust in safety systems. |
| **Legal/Ethical** | The System must comply with national railway and road safety regulations. |

**STAKEHOLDERS**

| **Stakeholder** | **Why They Matter** |
| --- | --- |
| **Drivers and Pedestrians** | Their safety depends on reliable gate timing and clear warning signals. |
| **Train Operators** | Must be confident that tracks are clear to proceed safely at crossings. |
| **Infrastructure Engineers** | Responsible for designing, testing, and maintaining the system hardware. |
| **Transport Authorities** | Oversee deployment, funding, and legal compliance of public safety systems. |
| **Emergency Services** | May require the ability to override the system in specific urgent cases. |