

Step 1: Exploring the Problem

Problem restated in my own words:

The task is to figure out a way to design a safe, reliable, and cost-effective railway crossing system. The system must detect when a train is approaching or occupying the crossing, lower the gates when a train is coming or a vehicle is still on the tracks, activate warnings lights and bells to alert on coming vehicles, and only raise the gates once it is safe for vehicles to cross again.

Inputs :

- Train approach sensor
 - Vehicle presence sensor (on crossing)
 - Gate position sensors (up / down)
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Outputs :

- Gate motor control (raise / lower)
 - Warning lights
 - Warning bell / buzzer
 - Contacting system to rail road operator in case of emergency
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Context and constraints:

- **Technical:** The design must include a fail safe (default to gates down on errors). It should tolerate noisy or failed sensors.
 - **Economic:** Should balance reliability with cost — avoid over-engineering while still ensuring a high level of safety .
 - **Social:** Noise and traffic delays affect local communities; must minimise disruption while maximising safety.
 - **Environmental:** Weather eg: rain, fog, flooding - may affect sensor accuracy.
 - **Legal:** Must comply with railway safety standards and traffic regulations.
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Stakeholders:

Stake holders that could be involved are : Rail operators, road users, pedestrians, emergency services, nearby residents, and maintenance staff.
