**(8223) INTRODUCTION TO COMPUTER ENGINEERING**

**ASSIGNMENT 1**

**SHOMIT BASU**

**STUDENT ID: 3294488**

**STEPS 3 & 4**

**EVALUATING ALTERNATIVES:**

Each potential solution is evaluated against technical and contextual factors. The table below summarizes the findings:

|  |  |  |  |
| --- | --- | --- | --- |
| **Criteria** | **Solution A: Two Sensor** | **Solution B: Four Sensor (Vehicle Priority)** | **Solution C: Four Sensor (Modified)** |
| **Simplicity** | Very simple; easy to implement and maintain. | More complex due to dual train/vehicle logic. | Similar complexity to Solution B. |
| **Safety** | High safety; directly linked to train detection and vehicle status. | Moderate safety; risk due to variable vehicle speeds affecting train signals. | High safety; emergency alarm for stuck vehicles improves safety. |
| **Reliability** | Highly reliable; fewer sensors reduce points of failure. | Lower reliability; more sensors and interlinked signals increase complexity. | Moderate reliability; additional logic for emergency alarm adds robustness. |
| **Cost** | Low Cost; only two sensors and one motion detector camera. | Higher cost; four sensors plus integration for two-way signal control. | Higher cost; similar to Solution B with extra alarm integration. |
| **Feasibility** | Highly feasible for urban or rural crossings. | Less feasible due to dependence on consistent vehicle sensor accuracy. | Feasible but requires fine-tuned timing and system calibration. |

**ENGINEERING DECISION:**

Solutions B and C introduce more complexity and cost (with four sensors each), with B having a notable risk of failure in variable-speed vehicle situations, and C mitigating that risk but at the expense of additional logic and hardware.

After careful evaluation, **Solution A – The Two Sensor Solution** is chosen for implementation. This decision is based on several factors:

1. **Simplicity** – The logic is straightforward and easy to maintain, reducing operational errors.
2. **Safety** – Direct train detection ensures gates are lowered whenever a train is approaching, while a motion detector ensures vehicles stuck on the track are detected promptly.
3. **Reliability** – Fewer sensors mean fewer failure points and more predictable system performance.
4. **Cost-effectiveness** – Lower hardware requirements make it affordable to deploy in multiple locations, including rural or remote crossings.
5. **Feasibility** – The design can be implemented with currently available, proven technology without requiring major infrastructure changes.

This approach aligns with the primary objective of the assignment — to create a **logic-based, safe, and reliable crossing system** using intuitive methods without complex circuitry.