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CA2- Assignment 2: Design of IOT application
Railway track monitoring system

Railway track monitoring system :
A railway track monitoring system is designed to enhance the safety, reliability, and efficiency of railway operations by continuously monitoring the condition of railway tracks. It involves the use of various sensors, data processing techniques, and communication systems to ensure the tracks are in optimal working condition.

Features	**Edge Layer**	**Fog Layer**	**Cloud Layer**
Activities	Sensor data collection from track sensors (e.g., temperature, strain, humidity, vibration). Local data processing for immediate anomaly detection (e.g., detecting cracks or overheating). Actuation for immediate response	Aggregating data from multiple edge devices. Performing intermediate data processing and analytics (e.g., predictive maintenance). Generating detailed anomaly reports.	Centralized data storage and analysis. Long-term predictive maintenance planning. Generating performance and maintenance reports.
Prevention of accidents	**Action :** Collect information about tracks,trains,parts,passengers **Response:** Pass information to the fog layer.	**Action :** Analyze data and extract relevant information **Response :** Pass information to cloud layers , send alerts.	**Action :** Store information **Response :** Generate alerts and preventive measures.
Monitoring	**Action :** Examine sensors, hardware,software,	**Action :** Extract important information related to	**Action :** Store all the acquired

	actuators **Response :** Forward collected information to the fog layer.	security. **Response :** Pass data to the cloud layer , generate documentation.	**Response :** Generate report.
Navigation	**Action :** Collect data through sensors related to directions **Response :** Pass data to the fog layer	**Action :** Filter relevant data. **Response :** Make decisions regarding direction (left,right turn)	**Action:** Store data. **Response :** Save decisions related to path followed for future use , generate report
Sensors/Actuators	Temperature sensors, Strain sensors, Humidity sensors, Vibration sensors, Emergency stop actuators.	Edge device communication interfaces. Local processing units (e.g., edge servers or gateways).	Cloud server infrastructure. Storage and database systems.
Best suited protocols	MQTT (Message Queuing Telemetry Transport) for lightweight data transfer. CoAP (Constrained Application Protocol) for resource-constrained devices.	MQTT, CoAP, or HTTP for communication with edge devices. AMQP (Advanced Message Queuing Protocol) for more reliable messaging.	HTTP/HTTPS for secure communication. WebSockets for real-time data streaming.
Architecture	Decentralized architecture for real-time local monitoring and control.	Fog computing architecture with edge devices connecting to local processing units.	Cloud-based architecture for centralized data analysis and storage.

Information Needed at the Higher Level (e.g. Railway Authorities):

- Real-time status of the tracks, including temperature, strain, and vibration data.
- Alerts and notifications of critical anomalies, such as track damage or safety concerns.
- Predictive maintenance reports, suggesting when maintenance activities are required.
- Historical data for performance analysis and decision-making.

- Emergency response data in case of accidents or emergencies.

Conclusion :

The selection of appropriate sensors, protocols, and architecture depending on the specific requirements,layers, scale, and budget of the railway track monitoring system have been studied and thus A railway track monitoring system has been designed.