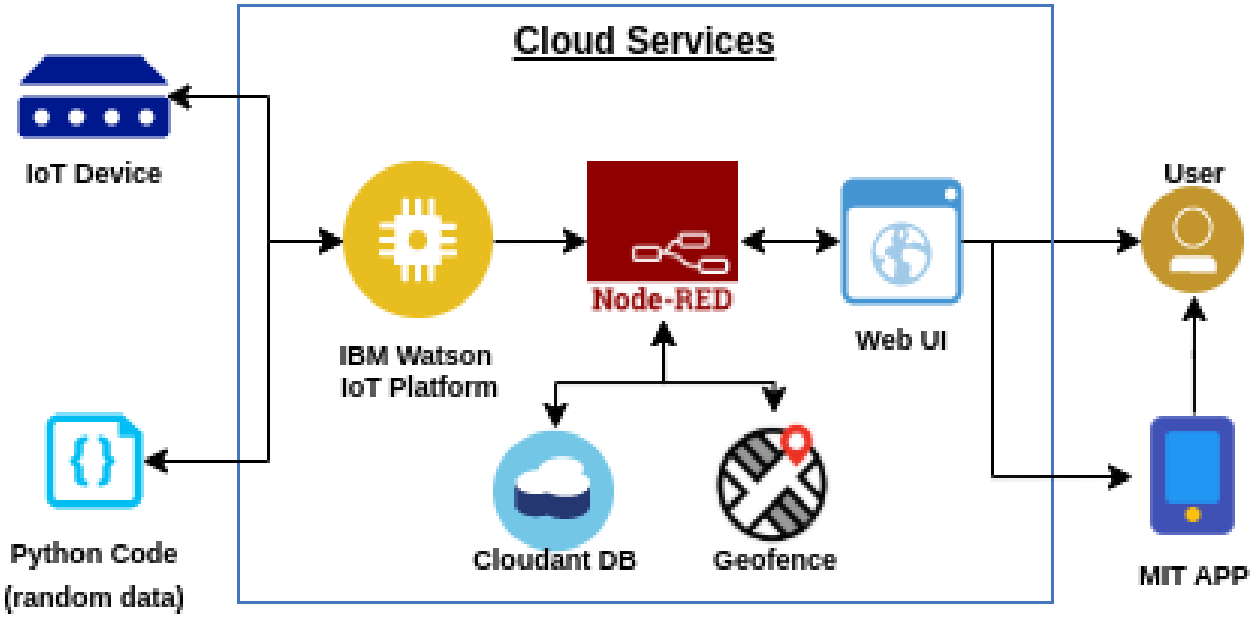
SOLUTION ARCHITECTURE FOR SMART SOLUTION FOR RAILWAYS



Digitisation of Railways Includes:

1. B-scan ultrasonic rail flaw detection (both non-stop and stop-and-verify systems) and track inspection with automated high-speed test trains.

2. Train control system levels 2 and 3 for high-density routes to increase network capacity and maintain the required safety standards.

3. Increased surveillance of personnel with both interior and exterior locomotive□mounted video surveillance to improve monitoring.

4. Track-laying machines for mechanisation of construction.

5. Electrification through machines such as self-propelled overhead electrification laying trains.

6. Complete train scanners for improved diagnostics and maintenance.

7. Use of distributed power to improve the efficiency of train operations with coordinated acceleration and deceleration.

8. Establishment of smart railway stations by implementing access control at entry points.

9. e-ticketing with services such as infotainment and app-based systems.

10. Use of training simulators and virtual reality (VR) training systems to improve personnel capabilities.

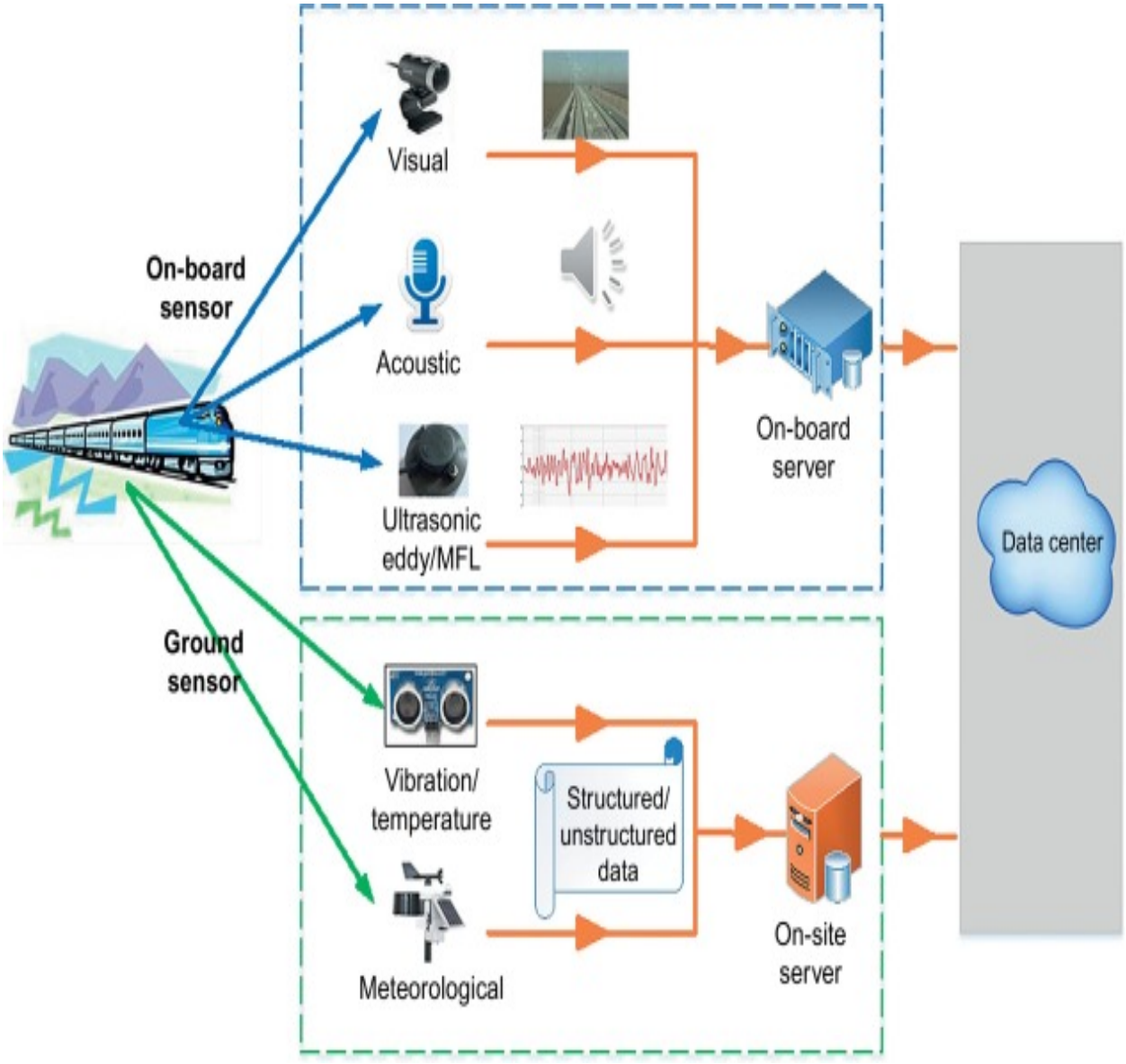
There are three major systems within railroads that automation and the IoT can bring significant benefits: signalling, interlocking and level crossings control.

1. Signalling systems control the movement of a train by remotely adjusting train speed and braking. More traditional signalling

systems are based on radio-frequency identification along the train track, but wireless train to ground signalling is getting more and more common in both railroad and metro systems.

2. Interlocking avoids conflicting movements on the tracks at junctions and crossings by using red and green light signals. The interlocking system works in conjunction with the signalling system to prevent a train from getting a signal to proceed if the route is proven to be unsafe. The IoT can further improve the system's level of automation and its integration with the signalling system

3. Level crossings control is the third system that impacts safety on railroads. Accidents related to level crossings represent 30% of all railway fatalities in the EU. IoT can help decrease those statistics by deploying cameras and sensors for increased safety.



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