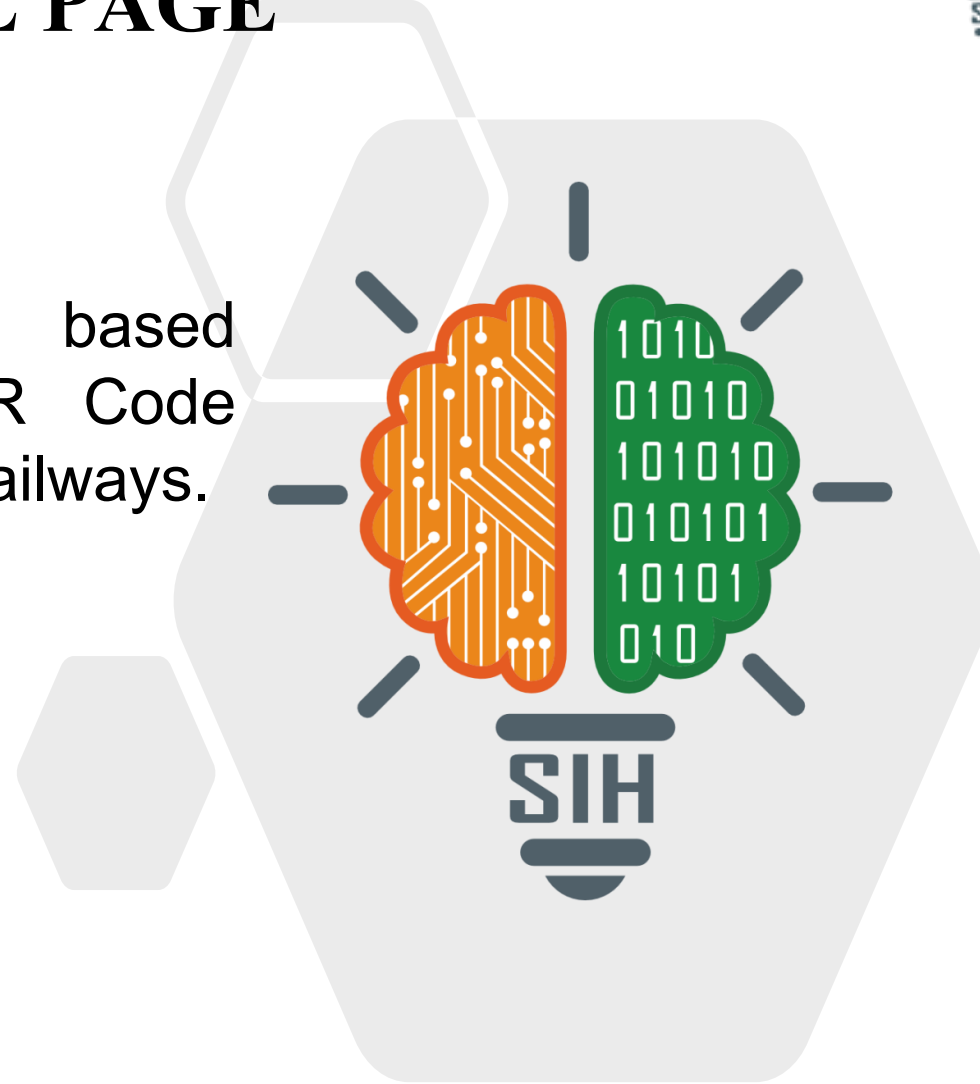


SMART INDIA HACKATHON 2025



TITLE PAGE

- **Problem Statement ID - SIH25021**
- **Problem Statement Title-** AI based development of Laser based QR Code marking on 'track fittings on Indian Railways.
- **Theme-** Transportation & Logistics
- **PS Category-** Hardware
- **Team ID-**
- **Team Name-**NextGenCoders



Proposed Solution:

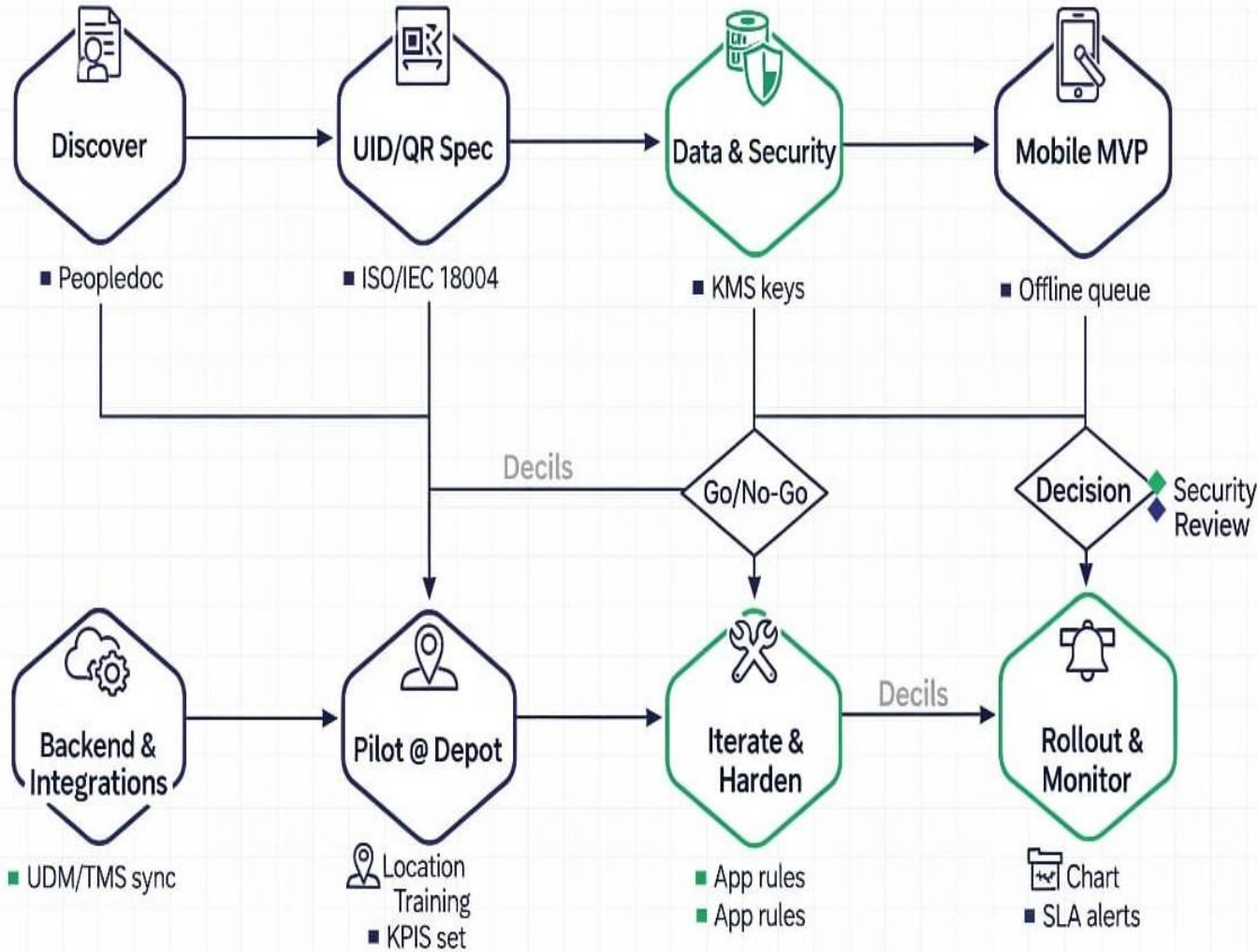
- **Hardware** – Laser-etched QR codes for permanent ID
- **Software** – Mobile app + platform for data access & tracking
- **AI Engine** – Predictive insights & automated quality control

How It Addresses the Problem:

- **Digital Traceability** – Identification & accountability
- **Proactive Safety** – AI predicts failures, preventive maintenance
- **Streamlined Operations** – Integration with UDM/TMS for automated management

Uniqueness & Innovation:

- **Digital Passport** – Permanent and unalterable tracking
- **Dynamic QR Codes** – Real-time data updates
- **Predictive AI** – Anticipates problems
- **Integrated System** – Scalable hardware + software



Technologies & Components:

- Hardware — Laser QR Marking (ERCs, Pads, Liners, Sleepers)
- Mobile App — Android (Flutter) QR Scanner (Offline)
- Database — Firebase Firestore
- Backend — Firebase Cloud Functions (QR verify, audits)
- Auth/Security — Firebase Auth (RBAC) + Signed QR Tokens
- Integrations — UDM/TMS (ireps/irecept)
- AI Reports — Vendor, Warranty, Inspection Exceptions
- Web Dashboard —Inventory & Traceability

→ Feasibility –

- Scalable technologies (QR codes, AI, mobile apps).
- Integration with UDM/TMS possible via APIs for real-time updates.

→ Challenges –

- QR code durability under extreme weather/handling.
- Training staff for adoption across regions.

→ Strategies –

- Tamper-proof laser marking, offline mobile app support.
- Phased rollouts with hands-on staff training.

→ Innovation –

- First-of-its-kind UDM/TMS integration for predictive maintenance.
- Combines AI + QR tracking for safety & efficiency.

Potential Impact on Target Audience:

- **Single-scan Verification & Proactive Safety –**
 - Real-time UDM/TMS + AI histories,
 - QR scanning for early defect/recall detection,
 - reducing risks and downtime.
- **Audit-ready & Secure Access –**
 - Digital traceability speeds GRN/approvals,
 - reduces disputes,
 - ensures only authorized staff can update records.

Benefits of the Solution:

- **Social & Economic –**
 - Safer journeys,
 - transparent vendor-to-track traceability,
 - lower maintenance/inventory costs,
 - faster GRN/payments.
- **Environmental –**
 - Longer part life,
 - paperless processes,
 - fewer field visits,
 - reducing waste and emissions.

- NIST SP 800-63 (Digital identity, 2-step verification): <https://pages.nist.gov/800-63-3/>
- GS1 EPCIS 2.0 (Event-based supply chain traceability): <https://www.gs1.org/standards/epcis>
- EN 50126 / IEC 62278 Railway RAMS – Safety, Reliability: https://en.wikipedia.org/wiki/EN_50126
- Indian Railways RDSO (Standards): <https://rdso.indianrailways.gov.in>
- CRIS (Centre for Railway Information Systems – IT/TMS): <https://cris.org.in>