### Smart India Hackathon - Intelligent Deep Neural Network Technology for AI-Based Rail road inspection

**Title:**  Intelligent Deep Neural Network Technology for AI-Based Rail road inspection

**Tentative Date of the Event** : August 2025 to December 2025

**Idea:**

Railroad inspection has traditionally involved manual methods, where inspectors either walk along the tracks or slowly drive a high-rail vehicle to visually identify issues. This approach is expensive, time-intensive, disrupts scheduling due to the need for track access, and exposes staff to safety risks. Recent efforts to modernize the inspection process have introduced machine-vision technologies; however, these often still depend on human inspectors manually reviewing images to detect defects. This reliance on manual image review inherits many of the challenges of traditional inspections: it is labor-intensive, subjective rather than objective, and time-consuming. Building on prior research, this method employs a Deep Neural Network to automate the identification of critical railway components, aiming to address the shortcomings of conventional approaches. This study further advances the field by incorporating the detection of additional components, such as Tie Plates, and enabling the automated evaluation of their condition.

A Deep Neural Network (DNN) has been developed to automatically identify key railway components as part of the effort to automate rail inspection. This includes identifying new railway components, such as Tie Plates, and assessing their condition automatically. The DNN is designed to inspect 3D Laser Triangulation images, which provide both high-resolution 2D images and a 3D point cloud of the entire track area. This technology can operate at revenue speeds, regardless of whether it is day or night. DNNs, a type of machine learning, enable computers to solve complex problems by mimicking the way humans learn through neural networks. Deep Learning, particularly well-suited for image analysis, has demonstrated its capability to enhance accuracy in various applications, such as improving cancer detection by assisting oncologists in analyzing lymph node images.

**Category:** Hardware.

**Theme:** Transportation & Logistics.

**Organization:** Ministry of Housing and Urban Affairs.

**Location :** Proposed at IIT Roorkee.

**Current Challenges:**

* Inspection Challenges in the Railway Industry.
* Artificial Intelligence Background.
* Identifying Cancer Cells in Lymph Nodes.
* Applying Deep Learning to Railway Inspection.

1. Inspection Challenges in the Railway Industry.
2. Prior Research Performed by the Project Team.