TUNNEL EQUIPMENT INSPECTION SYSTEM FOR UNDERGROUND RAILWAY

A groundbreaking automated system for asset management and alerting users to abnormalities in trackside equipment in underground railway tunnels using intelligent video analytics

OVERVIEW

This tunnel inspection system efficiently manages thousands of pieces of underground tunnel equipment. Using computer vision technologies, the system fully automates the generation of tunnel equipment maps and the identification of equipment location changes within the tunnel. It notifies users of detected abnormalities for early inspection.

ISSUES ADDRESSED

- This system automatically identifies, counts, and registers with location information of the countless pieces of equipment, assisting the client in managing the assets in the underground tunnel, saving time and human resources while achieving higher accuracy.
- It provides a 2D tunnel equipment map and precise chainage information for each piece of equipment, serving as an enhanced inventory management tool.
- The system is capable of fast and accurate detection of tunnel equipment from low-light tunnel videos, ranging from a small power socket to a large advertising panel.
- The system detects and monitors the changes in tunnel equipment accurately, precisely matching equipment maps captured at different times. The matching algorithm has overcome the following challenges:
  - Significant variations in tunnel lighting between videos, such as one video having only half the tunnel lights on while another has all lights fully on.
  - Substantial differences in train speeds between videos, including continuous acceleration and deceleration throughout the journey.
  - Tunnel environments often undergo significant changes over time, such as alterations in tunnel paint and other modifications.
- The system adopts an automated video editing algorithm to perform tasks such as speed estimation, image quality assessment, scene recognition, and site name detection. The objective is to generate well-edited, station-to-station videos.

KEYWORDS

Underground, tunnel, inspection, maintenance, asset management, inventory management, trackside equipment, object detection, object tracking, video alignment, movement detection, video editing, speed estimation, computer vision, artificial intelligence

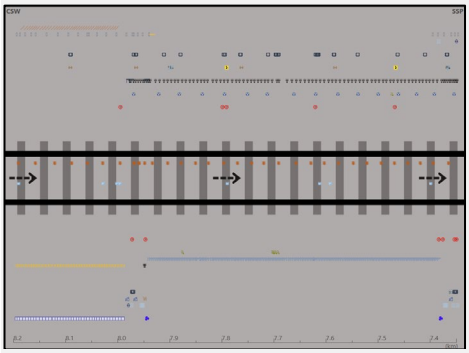
INNOVATIONS

- Advanced techniques, including speed estimation, tunnel scene parsing, and OCR, enable highly accurate video segmentation.
- Rapid detection and tracking of underground tunnel equipment in extremely low-light environments.
- Precise alignment between significantly different videos ensures high abnormality detection accuracy while minimising false alarms.

KEY IMPACT

- **Revolutionize railway maintenance**
  Transforming the traditional approach to maintaining railway infrastructure and equipment.
- **Promote safety travelling**
  Implementing a robust railway inspection and maintenance system ensures safe, reliable, and efficient railway services for the public.
- **Benefit whole world**
  This cost-effective solution can be easily adopted by underground railways worldwide.

INNOVATION SNAPSHOT



PROJECT COMPLETED

Dec 2024

APPLICATIONS

Underground Railway

PATENT(S)

COMMERCIALISATION OPPORTUNITIES

- IP licensing
- Technology co-development

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