

# AI Projects and Case Studies Snapshot

# Project I: Automated Rail Inspection Using Computer Vision & AI-Based Dimensional Analysis for Rail India Technical and Economic Service(RITES).

## 1.Description:

This use case outlines the implementation of an AI-based dimensional analysis system for automated rail inspection. The system captures high-resolution images of rails, compares them against a database of defect-free rails, and detects deviations using AI-powered image processing techniques. The process ensures precision in identifying rail defects, classifying deviations, and improving the efficiency of rail inspection workflows for RITES.

## 2. Unique Selling Proposition (USP):

- **AI-Driven Precision:** Utilizes pixel-by-pixel difference analysis and edge detection for accurate defect identification.
- **Automated Decision Support:** Reduces manual inspection errors with real-time classification of rail defects.
- **Scalable & Efficient:** Enhances inspection speed while maintaining consistency and compliance with industry standards.

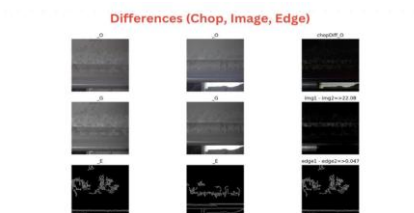
## 3. Core Features

- **High-Resolution Image Capture** from multiple angles for comprehensive rail analysis.
- **AI-Based Image Processing** to detect, classify, and measure dimensional deviations.
- **Automated Defect Classification** into pure, minor, and major deviations.
- **Edge Detection & Superimposition** for precise contour and alignment analysis.
- **Alert & Reporting System** for manual verification and documentation of defects.
- **Seamless Integration** with existing quality management and maintenance systems.



## 4. Return on Investment (ROI)

- **30-50% Reduction in Inspection Time:** Automates defect detection, reducing manual effort.
- **Improved Accuracy & Reliability:** Minimizes human errors, leading to better rail quality control.
- **Cost Savings on Maintenance & Repairs:** Early defect detection reduces long-term repair costs.
- **Regulatory Compliance & Safety Enhancement:** Ensures adherence to quality standards, enhancing rail safety.



## Key Functionalities

### 1. Database Management

Efficiently handles MongoDB and MySQL databases for real-time rail inspection data retrieval and storage.

### 2. Image Processing for Rail Defect Detection

Applies AI-powered edge detection, contour analysis, and pixel-wise comparison to identify rail defects accurately.

### 3. Defect Classification & Distance Calculation

Categorizes defects using predefined camera ID mappings and calculates dimensional deviations with a precise scaling factor.

### 4. Data Processing & Storage

Processes rail image data, extracts key measurements, and stores results in structured formats for easy retrieval and analysis.

### 5. Multi-threading for Performance Optimization

Utilizes parallel processing to accelerate data updates and image analysis, enhancing overall system efficiency.

### 6. Main Execution Flow

Automates the detection, classification, and storage of defect analysis, ensuring seamless real-time operation with minimal manual intervention.

The screenshot displays the RITES AI System interface, which includes a sidebar menu with options like Home, Duty, Record, AI System, Data Analysis, ISO Reports, and Admin. The main content area is divided into two sections:

**Dimensional Summary**

This section features a table with columns for Camera, Camera Name, Edge Diff, Image Diff, Dimension Deviation, and No of Dimension Variation. A 'Manage Columns' dropdown menu is open, showing options to toggle various columns. The table contains 10 rows of data, with the last row showing a 'bad' status and a 'pass' result.

**AI System Accuracy Dashboard**

This dashboard provides a summary of system performance metrics. It includes a 'Time Period' selector (Shift, Weekly, Monthly, Annually) and a 'Start Date' field. The dashboard displays six key metrics:

- Total Rail IDs: 10
- Avg. Precision Surface Defect: 0.91
- Avg. Recall Surface Defect: 0.87
- Avg. Precision Dim. Variation: 0.54
- Avg. Recall Dim. Variation: 0.45
- True OCR: 93%

The dashboard also includes a 'SEARCH' button and a table at the bottom with columns for Rail ID, Surface Defect Detection, Dimensional Variation Detection, and OCR.

## Project II: Defect detection and auto attribution of warranty for Automobile Major

### 1. Description

This case study details the implementation of an AI-driven defect detection and classification system for real-time warranty processing. The solution employs advanced computer vision and machine learning techniques to analyze defects in automotive components such as shock absorbers and water pumps, detecting anomalies like leakage, noise, and structural integrity issues. The system integrates seamlessly with mobile applications, allowing users to log vehicle details, initiate defect assessments, and receive automated judgments based on AI-powered analytics.

### 2. Unique Selling Proposition (USP)

#### • AI-Powered Real-Time Defect Detection:

Utilizes convolutional neural networks (CNNs) and signal processing techniques for precise anomaly detection in shock absorbers and water pumps.

#### • Automated Warranty Processing:

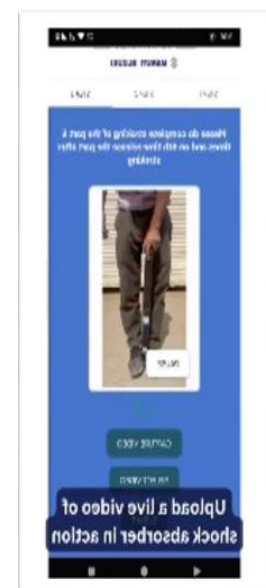
Reduces reliance on manual inspections through predictive analysis and data-driven decision-making.

#### • Scalable and Cloud-Integrated Architecture:

Ensures real-time defect assessment and seamless integration with existing warranty management systems.

### 3. Core Features

- **Mobile & IoT Sensor Integration:** Connects with mobile applications and edge devices for real-time data acquisition.
- **AI-Based Image & Acoustic Analysis:** Uses deep learning for defect detection in components such as shock absorbers and water pumps, identifying noise anomalies, pressure leaks, and mechanical wear.
- **Automated Decision Algorithms:** Implements machine learning classifiers to categorize defects based on severity.
- **Comprehensive Defect Classification:** Differentiates minor, moderate, and critical defects with probabilistic scoring models.
- **Instant Alert & Reporting System:** Provides real-time notifications and structured reports for maintenance teams.



### 4. Return on Investment (ROI) •

- 50-70% Reduction in Inspection Time:

AI-driven automation enables rapid defect identification in shock absorbers and water pumps.

- **Enhanced Diagnostic Accuracy:**  
Reduces false positives and negatives using multi-modal AI analysis.
- **Cost Reduction in Warranty Claims:**

Early anomaly detection prevents extensive damage, reducing long-term maintenance expenses.

- **Regulatory Compliance & Safety Enhancement:**  
Ensures adherence to automotive safety standards, improving product reliability and consumer satisfaction.

**Vehicle Details**

Model:

VIN:

Mileage:

Selected Part:

Selected Problem:

**Image Details**  
Part located at rear shock absorber

**Video Details**  
The energy of the model is 1.6-25.0M  
At this time, it may be defective.

**Defect Judgment**  
It is possible to detect.  
Please select the part.

Your claim is **Approved**

**Real Time Defect Judgement**

**Upload The Audio File**

Upload audio file

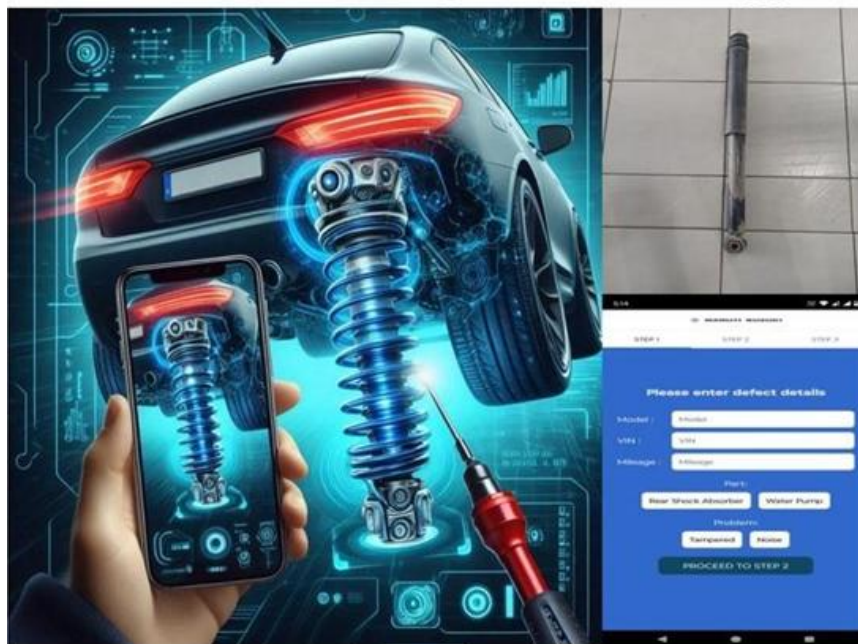
**Submit**

**Accuracy: 87%**

**Remark:**  
NOT\_OK\_Sound\_Water\_Pump

**Defect Judgement:** Your claim is approved

## Defect Detection using AI and Mobile App





# Project III: Quality Inspection for Machinery Parts Using Computer Vision & AI for **Manufacturing company**

## 1. Description

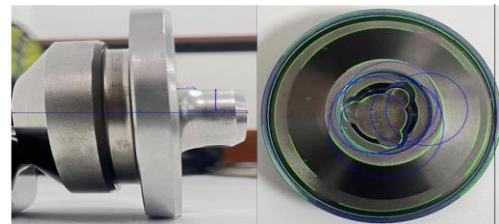
Dimensional analysis for machinery parts is an automated inspection process that uses high-resolution cameras and sensor-based measurement systems to ensure precision. By eliminating human intervention, this solution enhances accuracy, reduces processing time, and improves efficiency in manufacturing workflows.

## 2. Unique Selling Proposition (USP)

- **AI-Driven Precision:** Advanced imaging and AI algorithms provide highly accurate measurements.
- **End-to-End Automation:** Eliminates manual intervention, reducing errors and improving consistency.
- **Real-Time Quality Control:** Instant deviation detection and automated alerts ensure proactive quality management.
- **Scalable & Adaptable:** Supports various machinery parts with minimal system reconfiguration.

## 3. Core Features

- **Automated Image Capture & Measurement** using high-resolution cameras.
- **AI-Based Defect Detection & Tolerance Check** for quality assurance.
- **Customizable Measurement Parameters** (resolution, height, illumination).
- **Instant Reporting & Data Logging** for compliance and audits.
- **System Alerts & Corrective Action Triggers** in case of deviations.



## 4. Return on Investment (ROI)

- **30-50% Reduction in Inspection Time**, leading to higher production efficiency.
- **Minimized Rework & Scrap Costs** due to early defect detection.
- **Improved Product Quality**, reducing warranty claims and customer rejections.
- **Seamless Integration with Existing QC Systems**, lowering adoption costs.



## 5. Key Functionalities

### 1. AI-Powered Arc & Circle Detection

Utilizes OpenCV to identify arcs and circles with high precision, applying contour-based filtering for accurate measurements.

### 2. Comprehensive Dimensional Analysis:

Computes radii, diameters, and distances with real-world scaling, providing structured data for in-depth evaluation.

### 3. Automated Data Processing & Storage:

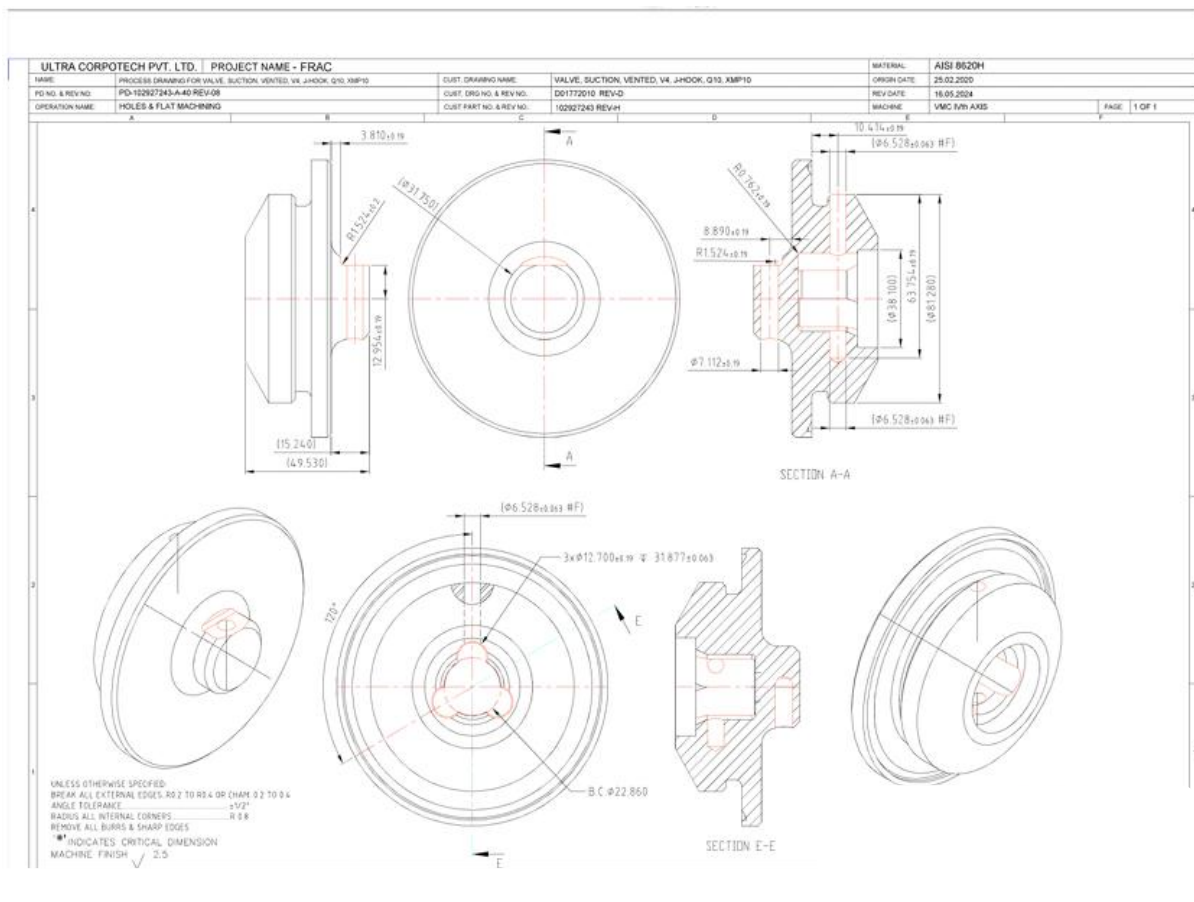
Extracts key measurements, annotates images, and stores results in structured CSV files for seamless analysis.

### 4. Interactive & Real-Time Measurement

Enables dynamic measurement using mouse clicks, with auto-alignment for precision and live feedback display.

### 5. Optimized Performance & Scalability

Implements multi-threaded contour processing and adaptive scaling factors to handle large image datasets efficiently



## Project IV: IoT Platform for Enterprises

**Description:** The Dashboard v2 is a modern, responsive web-based application designed to provide real-time insights and control over connected telematics and IoT devices using the Flespi platform.

The application serves as a centralized monitoring hub where users can:

- Track device status and metrics.
- Manage multiple projects and data streams.
- Leverage dynamic routing for efficient navigation.

## 2. Unique Selling Proposition (USP):

**Real-Time Integration with Device APIs:** Seamless data fetching and display with minimal latency.

**Customizable Dashboard:** Users can tailor their views and components according to operational needs.

**Modular Codebase:** Easily extensible, the architecture supports rapid addition of new features.

**Branded & Scalable:** Easily adaptable for companies needing white-label or customized branding.

**Developer Friendly:** Clean, well-structured React codebase using modern practices.

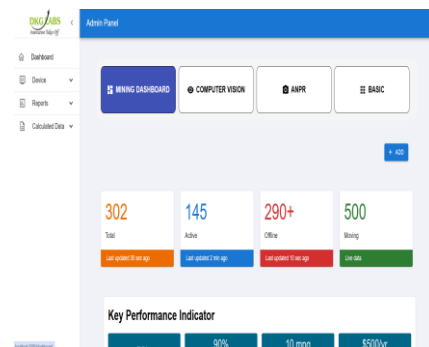
## 3. Core Features:

**Device Monitoring:** Track telemetry devices and their live status.

**Navigation Panel:** Intuitive routing and navigation between dashboard views.

**Data Visualization:** Integration-ready components for charts and metrics.

**Settings & Configs:** Manage API endpoints and tokenized access.



## 4. Return on Investment (ROI):

**Time Savings:** Faster access to device data reduces manual checks and delays.

**Reduced Operational Costs:** Centralized dashboard eliminates the need for multiple third-party platforms.

**Better Decision Making:** Real-time data helps in proactive maintenance and informed decisions.

**Customization Advantage:** Open-source modularity allows integration into existing systems with low development overhead.





## 5. Key Functionalities:

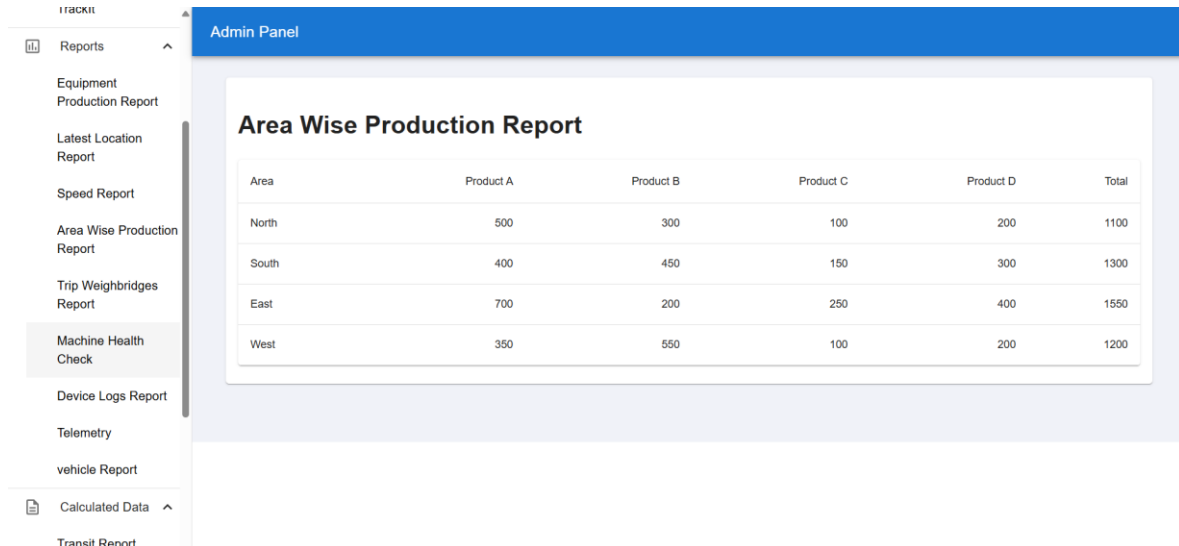
**Device Status Page:** Shows current connectivity and activity status of each device.

**Navigation Routes:** Implemented using Routes.js for dynamic page rendering.

**Real-Time Sync:** APIs provide live device data with minimal delay.

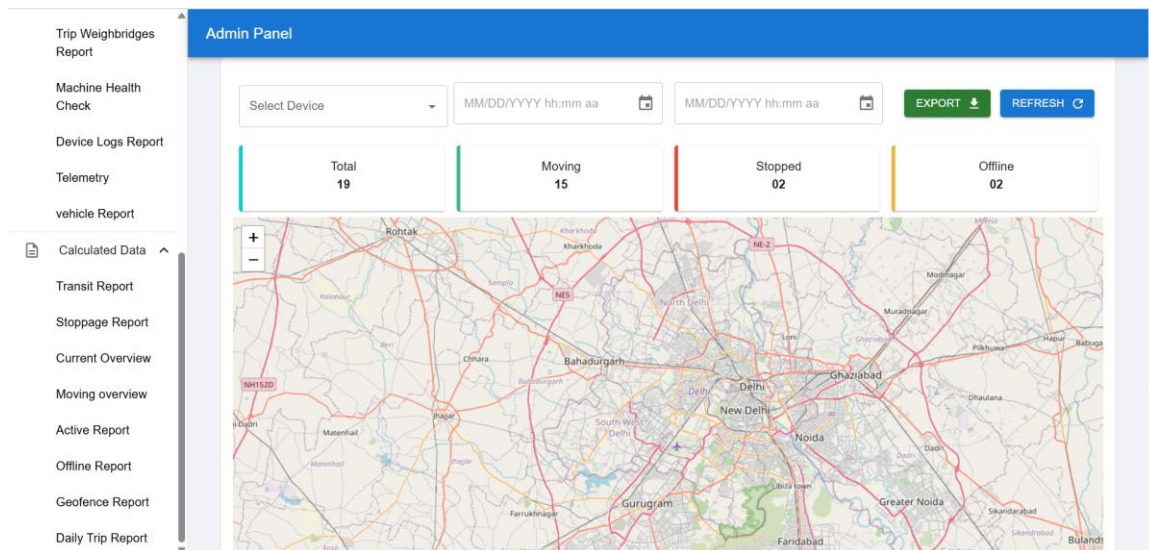
**Branded UI :** Easy replacement of logos and styles for company-specific branding.

**API Configuration:** baseUrl.js allows quick endpoint configuration and deployment changes.



The screenshot displays the 'Admin Panel' interface. On the left is a sidebar menu with options: Reports (expanded), Equipment Production Report, Latest Location Report, Speed Report, Area Wise Production Report, Trip Weighbridges Report, Machine Health Check (highlighted), Device Logs Report, Telemetry, and vehicle Report. Below this is a 'Calculated Data' section with a 'Transit Report' link. The main content area is titled 'Area Wise Production Report' and contains a table with the following data:

Area	Product A	Product B	Product C	Product D	Total
North	500	300	100	200	1100
South	400	450	150	300	1300
East	700	200	250	400	1550
West	350	550	100	200	1200



The screenshot displays the 'Admin Panel' interface for the 'Device Status Page'. The left sidebar menu is identical to the previous screenshot, with 'Machine Health Check' highlighted. The main content area features a header with a 'Select Device' dropdown, two date/time pickers (MM/DD/YYYY hh:mm aa), and 'EXPORT' and 'REFRESH' buttons. Below the header are four status summary cards: Total (19), Moving (15), Stopped (02), and Offline (02). The bottom section is a map of the Delhi region, showing various locations and roads. The map includes labels for areas like Rohtak, Bahadurgarh, Delhi, Noida, and Greater Noida.

## Project V: FinTech Platform for Lending and NBFC

**Description:** The Intelligent Financial Services Backend is a modern, scalable, and secure backend platform developed using Spring Boot, Java, and RESTful APIs, tailored for managing complex financial workflows. This system automates several key business operations such as account creation, transaction handling, user authentication, and real-time data reporting.

### 2. Unique Selling Proposition (USP):

- **Modular Architecture:** Supports multiple microservices and modular features for different financial functions.
- **Real-Time REST APIs:** Enables instant data exchange with frontend interfaces and third-party systems.
- **Secure Token-Based Authentication:** Implements JWT for secure user sessions and API access.
- **Database-Driven Configuration:** Easily adaptable for custom data models using JPA with MySQL/PostgreSQL.
- **Developer Friendly:** Clean Java code with industry-standard structure, easy to maintain and extend.

### 3. Core Features:

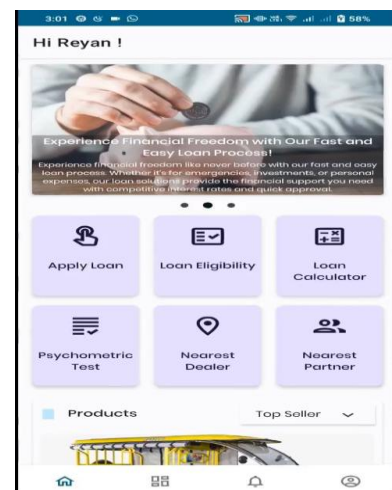
**User Management:** APIs for registration, login, and role-based access control.

**Transaction Engine:** Handles secure, high-throughput financial transactions.

**Report Generation:** REST APIs to generate and export data-driven insights.

**Audit Trail Logging:** Full traceability of all backend activities and changes.

**Dashboard Integration:** Seamless interaction with web or mobile dashboards through API endpoints.



### 4. Return on Investment (ROI):

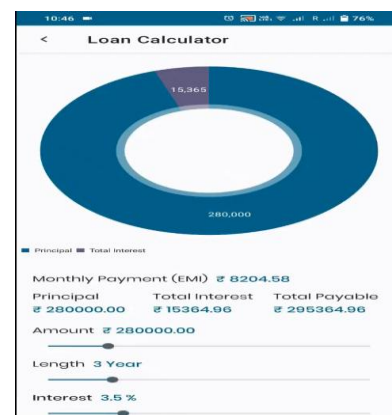
**Operational Efficiency:** Automates manual processes, reducing employee workload by up to 60%.

**Faster Time-to-Market:** Modular backend makes feature deployment quick and non-intrusive.

**Scalability & Reliability:** Handles thousands of requests concurrently without performance degradation.

**Cost Savings:** Reduces dependency on third-party solutions by offering an in-house engine.

**Security Compliance:** Meets modern standards for secure financial data handling.



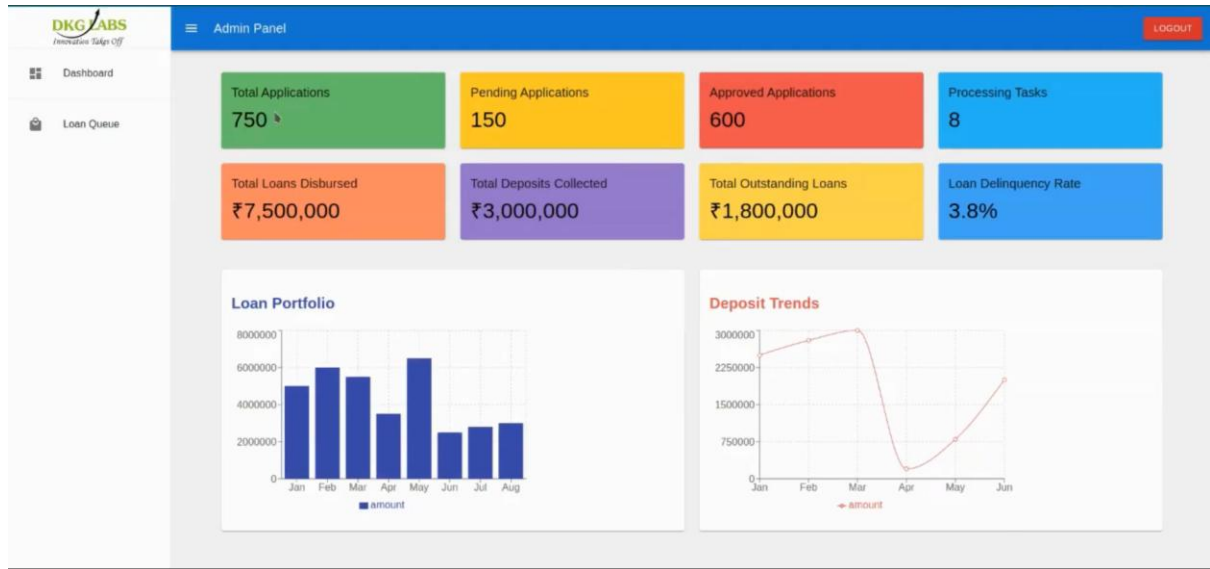
## 5. Key Functionalities:

**Authentication & JWT :** Secure user login and session management using tokens.

**Account Management:** Create, update, and retrieve user account data.

**Transaction APIs:** Endpoints for initiating, tracking, and auditing financial transactions.

**Role-Based Authorization:** Admin, user, and reviewer-level permissions.



The screenshot displays the 'Pending Requests' section of the Admin Panel. It includes a sidebar with 'Dashboard' and 'Loan Queue' links. The main content area has a top navigation bar with 'Admin Panel' and a 'LOGOUT' button. Below the navigation bar, there are three tabs: 'PENDING REQUESTS', 'APPROVED REQUESTS', and 'REJECTED REQUESTS'. The 'PENDING REQUESTS' tab is active, showing a table of pending requests.

Loan ID	NBFC ID	Download as CSV	Status	Remarks	Created By	Created Date	Updated Date	Action
L90000002	50000002	Print	Pending	null	Admin	2023-08-02T08:2...	2023-08-02T08:2...	APPROVE REJECT
L90000040	50000002		Pending	null	Admin	2023-09-08T12:1...	2023-09-08T12:1...	APPROVE REJECT
L90000042	50000002		Pending	null	Admin	2023-09-05T11:2...	2023-09-05T11:2...	APPROVE REJECT
L90000043	50000002		Pending	null	Admin	2023-08-02T08:0...	2023-08-02T08:0...	APPROVE REJECT
L90000046	50000002		Pending	null	Admin	2023-09-18T10:3...	2023-09-18T10:3...	APPROVE REJECT
L90000048	50000002		Pending	null	Admin	2023-11-15T08:3...	2023-11-15T08:3...	APPROVE REJECT
L90000053	50000002		Pending	null	Admin	2023-11-28T07:4...	2023-11-28T07:4...	APPROVE REJECT
L90000058	50000002		Pending	null	Admin	2023-09-09T10:2...	2023-09-09T10:2...	APPROVE REJECT
L90000081	50000002		Pending	null	Admin	2023-11-25T14:3...	2023-11-25T14:3...	APPROVE REJECT
L90000063	50000002		Pending	null	Admin	2023-11-25T15:0...	2023-11-25T15:0...	APPROVE REJECT

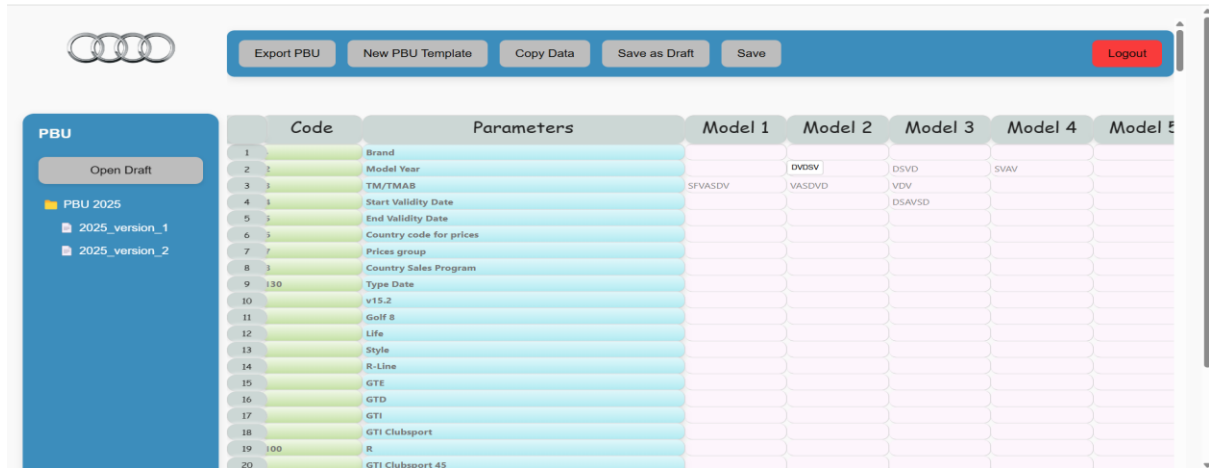
Rows per page: 10 1-10 of 13

[illegible]

## 5. Key Functionalities:

**React.js Core:** Framework for building interactive UIs using reusable components.

**React Router:** Handles dynamic routing without full page reloads.



Code	Parameters	Model 1	Model 2	Model 3	Model 4	Model 5
1	Brand					
2	Model Year		DVDSV	DSVD	SVAV	
3	TM/TMAB	SFVASDV	VASDSD	VDV	DSAVSD	
4	Start Validity Date					
5	End Validity Date					
6	Country code for prices					
7	Prices group					
8	Country Sales Program					
9	Type Date					
10	v15.2					
11	Golf 8					
12	Life					
13	Style					
14	R-Line					
15	GTE					
16	GTD					
17	GTI					
18	GTI Clubsport					
19	R					
20	GTI Clubsport 45					

**Vercel Deployment:** Continuous deployment and hosting with global CDN.

**Environment Configuration:** Support for `.env` variables and development setup.

**Responsive Design:** Consistent look and feel across devices using responsive units.



## Project VII: Optimize Performance – AI-Driven Asset Management Powered by Generative AI Insights for Tyres Major and Govt Sport Organization

### 1. Description:

Optimize Asset Performance is an AI-powered asset management platform that tracks and analyzes physical and digital assets in real time. Using predictive analytics and Generative AI insights, it helps organizations reduce downtime, extend asset life, and boost operational efficiency across various industries.

### 2. Unique Selling Proposition (USP):

Optimize Asset Performance stands out with its use of Generative AI and machine learning. It goes beyond tracking by understanding asset behaviour and predicting failures. The system recommends proactive maintenance and simulates optimal usage. These shifts operations from reactive to predictive, reducing costs and boosting reliability.

### 3. Core Features:

**Predictive Analytics:** Machine learning models forecast potential asset failures based on historical usage, sensor data, and external factors.

**Asset Lifecycle Tracking:** Real-time monitoring of asset status from procurement to decommissioning.

**Dynamic Reporting Dashboards:** Interactive dashboards provide customizable insights on asset health, performance, and risk

**Multi-Asset Management:** Supports both physical assets (equipment, machinery, vehicles) and digital assets (software licenses, servers, data pipelines).



### 4. Return on Investment (ROI):

**30–50% reduction in unplanned downtime** through proactive maintenance strategies.

**20–40% increase in asset utilization** by aligning operations with real-time performance data.

**Significant decrease in maintenance costs** by preventing unnecessary service actions.

**Extended asset lifespan** resulting from optimized usage and predictive servicing.





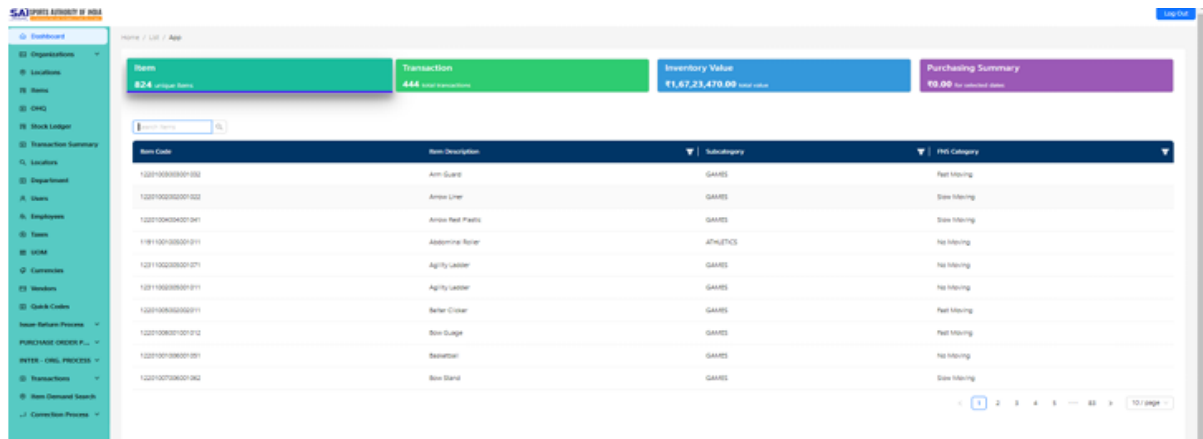
## 5. Key Functionalities:

**Predictive Maintenance:** Forecasts issues and schedules repairs before failures occur

**AI-Generated Reports:** Generates insights and performance summaries with minimal human input

**Real-Time Asset Monitoring:** Offers continuous tracking of asset health, usage, and environmental conditions

**Integration with IoT & ERP:** Connects seamlessly with sensors and enterprise systems



The screenshot displays the 'Inventory Management System' interface. At the top, there are four summary cards: 'Items' (824 unique items), 'Transaction' (444 total transactions), 'Inventory Value' (₹1,67,21,410.00 total value), and 'Purchasing Summary' (₹0.00 for selected items). Below these is a search bar and a table with columns: Item Code, Item Description, Subcategory, and Item Category. The table lists various items like 'Arm Guard', 'Armo Liner', 'Armo Pad Pallet', 'Assessing Racer', 'Agility Ladder', 'Batter Charger', 'Box Gudge', 'Basketball', and 'Box Stand'. A sidebar on the left contains navigation links for Dashboard, Locations, Items, CMQ, Stock Ledger, Transaction Summary, Suppliers, Employees, Users, CRM, Connections, Warehouses, Quick Credits, and various reports and processes.

Item Code	Item Description	Subcategory	Item Category
12201000000001000	Arm Guard	GAHRES	Real Training
12201000000001002	Armo Liner	GAHRES	Real Training
12201000000001041	Armo Pad Pallet	GAHRES	Real Training
11811001000001011	Assessing Racer	ATHLETICS	Real Training
12211002000001071	Agility Ladder	GAHRES	Real Training
12211002000001011	Agility Ladder	GAHRES	Real Training
12201000000000011	Batter Charger	GAHRES	Real Training
12201000000001012	Box Gudge	GAHRES	Real Training
12201001000001001	Basketball	GAHRES	Real Training
12201007000001002	Box Stand	GAHRES	Real Training

**Historical Data Analysis:** Identifies trends over time for smarter long-term planning

**Role-Based Access Control:** Ensures secure and segmented access across teams and departments

# Project VIII : Precision in Every Pixel – Unleashing the Power of Object Detection Using Computer Vision

## 1. Description

**Object Detection using Computer Vision** is a cutting-edge solution that enables machines to visually identify, classify, and locate objects within digital images or video streams. It serves as the foundational layer for a variety of automation and AI-driven decision-making tasks across industries such as manufacturing, surveillance, healthcare, agriculture, logistics, and more.

By leveraging deep learning models, this solution provides real-time analysis of visual data, turning raw image feeds into actionable insights. Whether it's detecting defects on a production line, tracking vehicles in traffic systems, or monitoring safety compliance in workplaces—object detection ensures **faster response times, higher accuracy, and reduced human dependency**.

## 2. Unique Selling Proposition (USP)

- **Real-Time Accuracy:** Processes video feeds in real-time with high confidence levels, enabling instant detection and response.
- **Industry-Specific Customization:** Capable of learning and detecting domain-specific objects for tailored applications.
- **Automation-Ready:** Integrates directly into automated workflows to trigger alarms, generate logs, or initiate further actions.
- **Reduces Human Error:** Consistently performs visual tasks without fatigue, distraction, or bias.

## 3. Core Features

**High-Precision Object Identification:** Uses AI algorithms to identify and label objects across varied environments.

**Multi-Object Detection:** Simultaneously detects and distinguishes between multiple object types in one frame.

**Visualization with Bounding Boxes:** Marks detected objects with labeled boxes and confidence scores for better interpretability.

**Self-Improving Models:** Supports retraining and model improvement based on feedback loops.

**Seamless Integration:** Can be integrated with APIs, ERP systems, dashboards, or edge devices.

**Smart Filtering:** Filters results based on confidence thresholds, object types, or user-defined zones.



## 4. Return on Investment (ROI)

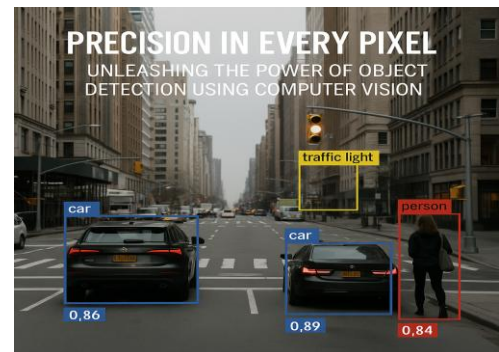
**Time Savings:** Automates manual monitoring and inspection tasks, freeing human resources for high-value work.

**Cost Reduction:** Minimizes the need for manual labor and significantly reduces error-related losses.

**Improved Uptime:** Enables predictive maintenance and early fault detection, decreasing downtime.

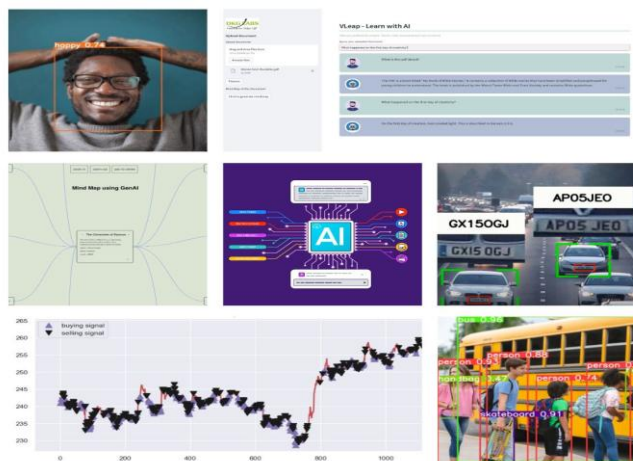
**Data-Driven Insights:** Offers visual data analytics that drive strategic improvements in operational processes.

**Scalability:** Once deployed, the solution can be scaled easily across multiple units or facilities.



## 5. Key Functionalities

- **Real-Time Detection & Alerts:** Monitors camera feeds live and triggers alerts when specified objects are detected.
- **Classification and Tracking:** Assigns labels and tracks movement of each object across frames.
- **Custom Object Library:** Train and maintain a repository of specific objects relevant to your industry.



- **Integration-Ready APIs:** Can be easily connected with business platforms, IoT systems, or cloud storage.
- **Event Logging & Reports:** Automatically logs detections for compliance, audits, or incident reviews.