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Revolutionizing Vehicle Inspections with AI

Offering fast, accurate, and cost-effective inspection solutions.

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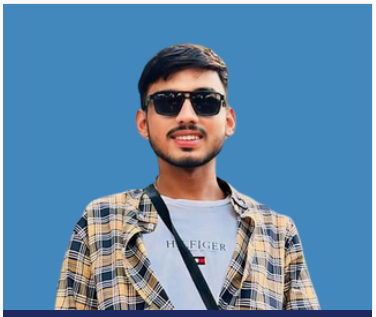

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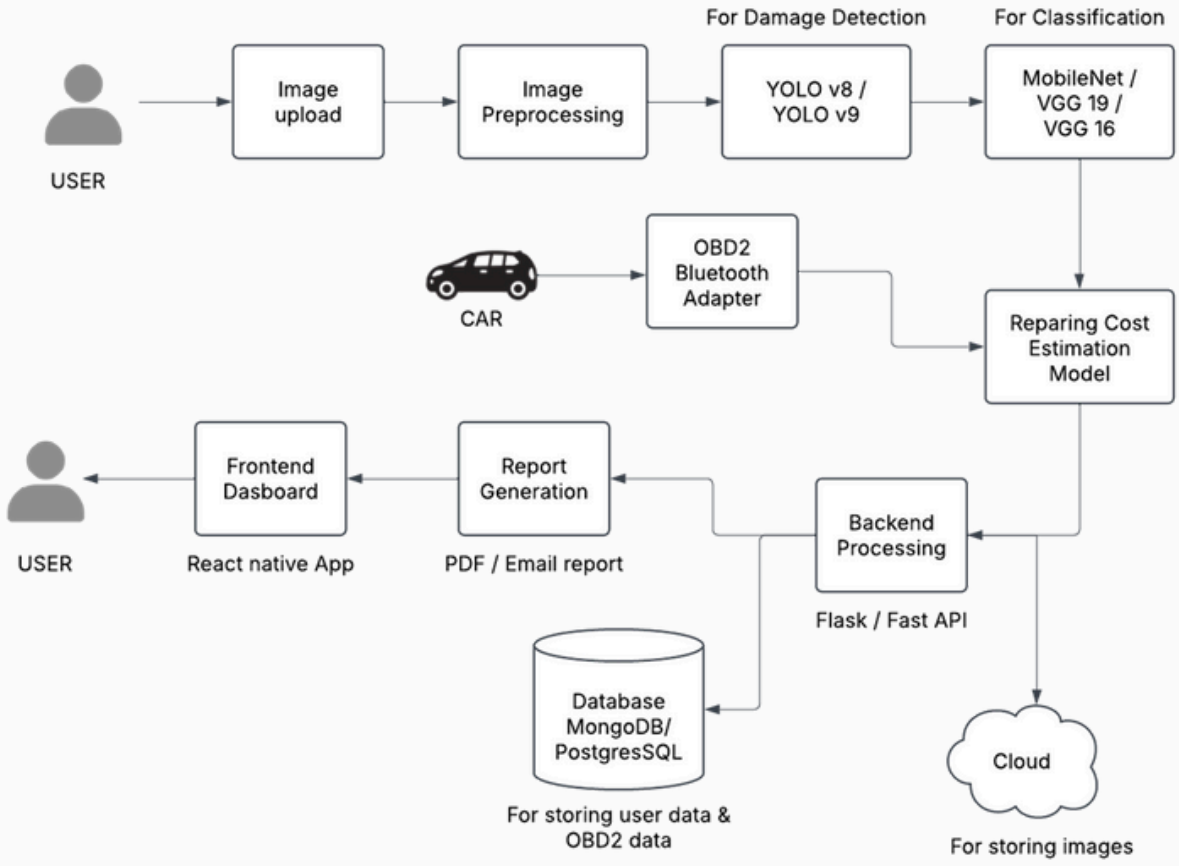
Problem Statement

Create an AI-powered visual inspection tool that uses computer vision to evaluate the condition of returned vehicles. The tool should detect damages, assess wear and tear, and estimate repair costs, streamlining the vehicle return and reconditioning process.

Current inspection solutions like PakWheels and OLX rely on **manual processes**, leading to inefficiencies, inconsistencies, and delays. This affects **customer satisfaction** and slows vehicle transactions.

Our AI-powered visual inspection tool **automates the process**, ensuring quick, accurate, and cost-effective assessments for businesses and individuals.



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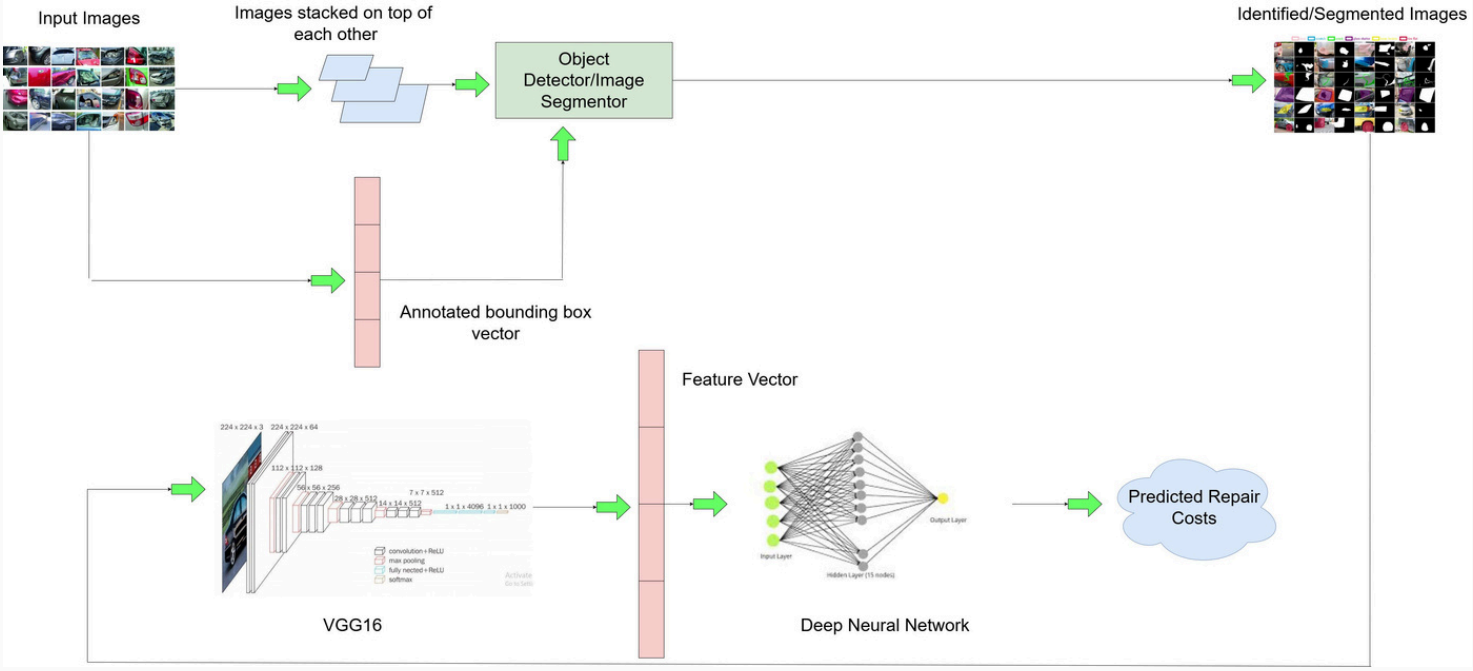
Proposed Solution

Our AI-driven visual inspection tool uses computer vision technology to automate the inspection process. By utilizing **YOLOv8** for object detection and **MobileNet** or **VGG19** for regression (cost estimation), the tool will provide a reliable method for assessing vehicle damage and wear. The tool will offer a tiered pricing model to cater to different customer categories, including businesses and individual users.

Architecture Model Diagram



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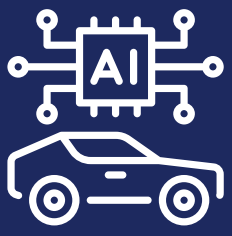

Technical Approaches for Vehicle Inspection and Repair Cost Estimation

Our technical approaches are categorized into two main types:

- **Supervised Approaches:**
    - **Object Detection:** YOLO for object detection + VGG19/MobileNet for cost prediction.
    - **Image Segmentation:** UNET for segmentation + VGG19 for cost prediction.
    - **Classification-Regression:** CNN for damage classification + deep neural network for cost prediction.
- **Unsupervised Approaches**:
    - To simplify the tedious task of data annotation, unsupervised techniques can be utilized. This approach allows us to handle unlabeled data, which is more abundant and easily accessible.
    - **Auto-encoders:** Anomaly detection based on reconstruction error.
    - **GANs:** Anomaly detection through high reconstruction errors, with a generator trained on non-damaged images and a discriminator distinguishing real from fake. Pretrained CNNs estimate repair costs.

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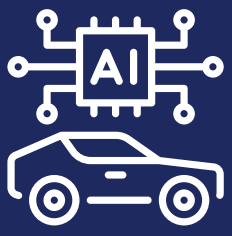

OBD2:

OBD2 usually provides engine specific stats, TPMS, Collison Detection. It is a standardized way to access and interpret fault codes generated by the vehicle's various control units (ECUs).

Live Sensor Data:

- Engine RPM
- Coolant Temperature
- Oxygen Sensors
- Battery Voltage
- Transmission Fluid Temperature

Optional: Integrate **thermal cameras** for detecting hidden issues (like overheating).

Usecase

- TPMS for tire pressure monitoring.
- Accelerometer/Impact Sensors to detect collision impacts.
- Vehicle Speed Sensor for understanding the vehicle's usage.
- Suspension and ABS Sensors to monitor the condition of critical safety systems.

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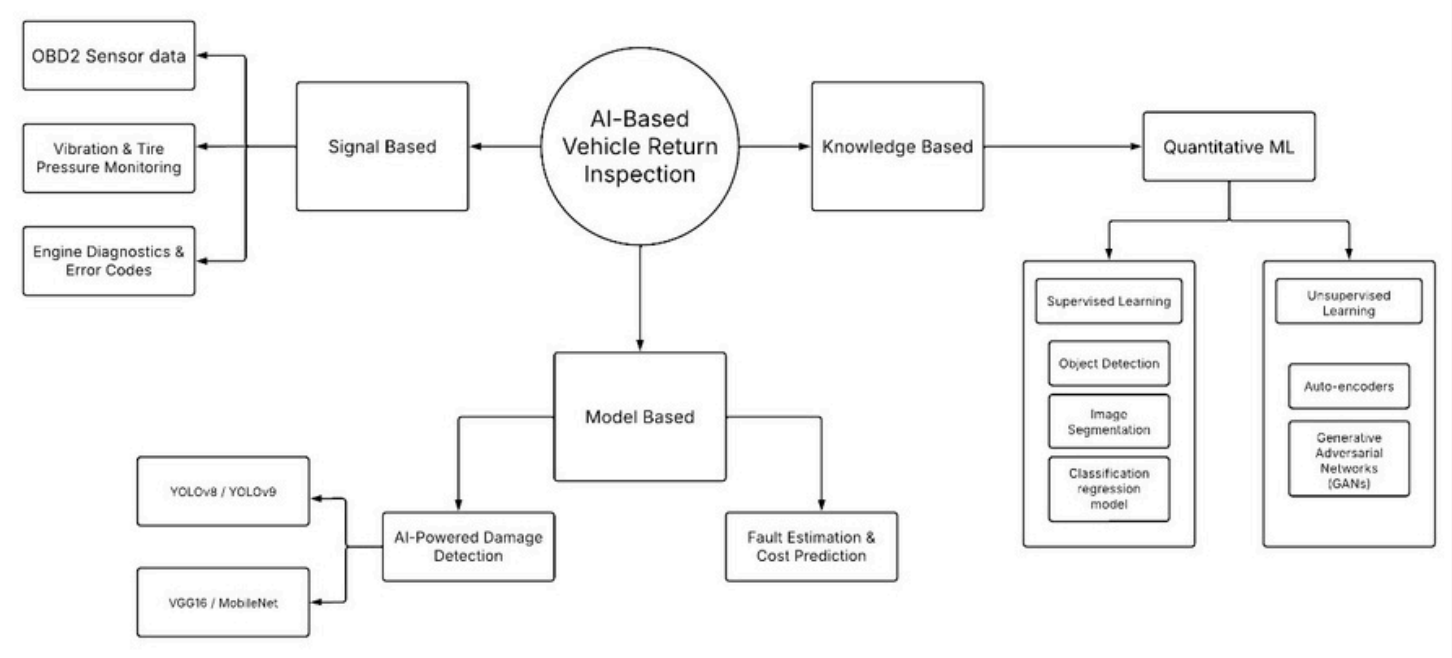
AI-Powered Vehicle Inspection & Fault Diagnosis System



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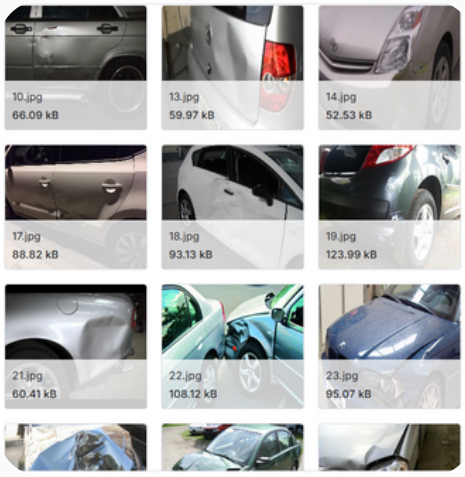
Chosen Dataset:

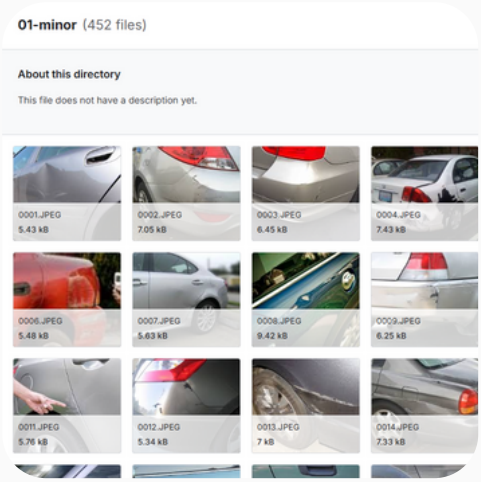
1. COCO Car Damage Detection Dataset



- Pros: Realistic damaged car images, annotated for detection.
- Cons: Small dataset (80 images), lacks non-damaged cars.
- 80 images (Train: 59, Val: 11, Test: 8)

Dataset Link

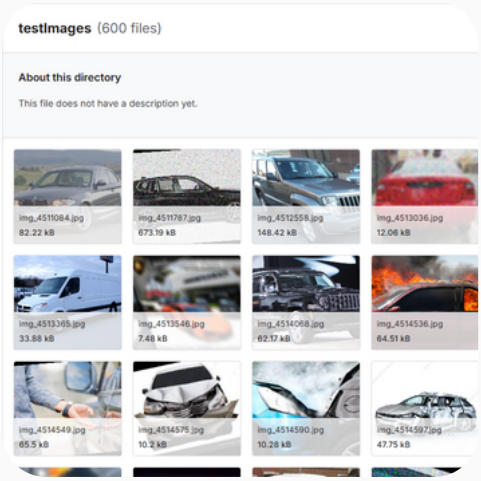
2. Car Damage Severity Dataset



- Pros: Helps in repair cost estimation, enhances user experience and Classifying damage severity (minor, moderate, severe).
- Cons: Not comprehensive for training, lacks non-damaged cars.
- 1,631 images (Train: 1,383, Val: 248

Dataset Link

3. Fast, Furious, and Insured Dataset



- Pros: Multimodal (images + tabular data), includes non-damaged cars.
- Cons: Unrealistic representation, limited detailed damage images.
- 1,999 images (Train: 1,399, Test: 600) + Tabular Data

Dataset Link

*We will be merging three datasets to enable a seamless AI pipeline

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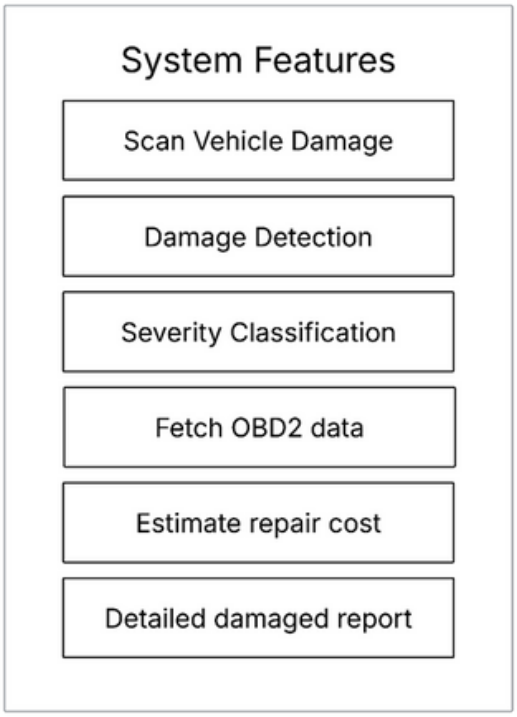
Innovation & Impact

What Makes Our Solution Innovative?

✅ **Integration of Computer Vision & VFD Systems**
One platform utilizes CV for condition evaluation & VFD (specifically OBD) for automation.

✅ **Hassle-Free Process**
No venue or time slot issues, unlike traditional companies having manual processes like OLX & PakWheels.

✅ **Real-Time Inspection**
Instant results using AI-driven image analysis.



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Cost-Effective Subscription & Tier-Wise Plan

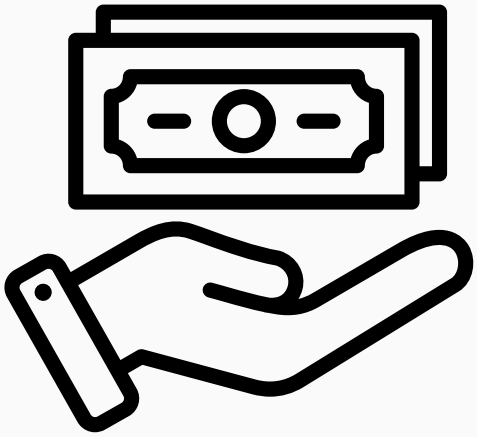
First Inspection Free
Attracts users with a free trial for early user adoption.

Tiers Division

- Tier 1: Business/Enterprise Solutions
  - Leasing companies, dealerships, insurance firms.
- Tier 2: Individual Consumers
  - Car buyers, sellers, owners.
  - Mobile app-based inspections with AI-generated reports

Collaborative Approach
Partner with already existing giant vehicle service-providing companies to integrate our system into their already existing process.

[MANUAL => AUTOMATED INSPECTION]



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Challenges & Solutions

- **Dataset Collection:** No annotated model available.
  - Solution: Capture images from *Itwaar Bazaar* **(Building Own Dataset)** or use web scraping (e.g., OLX/ PakWheels).

- **Hardware Limitations:** Running AI models on limited resources.
  - Solution: Utilize university-provided hardware labs.

- **Limited Team Experience:** Lack of prior expertise.
  - Solution: Guidance from experienced supervisors.

- **Data Imbalance**
  - Solution: Use data augmentation techniques to balance the dataset.

- **Lack of Dataset Annotations:** Most datasets are not annotated.
  - Solution: Annotate images using **Roboflow**

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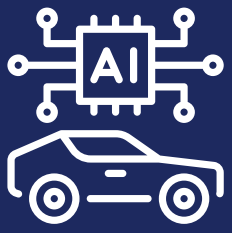

Why Choose Us?

- **Strong Technical Team:** Our diverse AI background and tech stack allow us to build and scale a solution that meets industry needs.

- **Clear Vision & Drive:** We're dedicated to bringing this project to life, with plans for market expansion and continuous improvement.

Conclusion

Our AI-powered visual inspection tool, **gaari.ai**, automates vehicle damage detection and repair cost estimation using advanced technologies like **YOLOv8** and **VGG19/MobileNet**.

By combining supervised and unsupervised learning (Auto-encoders, GANs) and integrating **OBD2** data, we deliver accurate, comprehensive assessments without extensive labeled data.

With a flexible subscription model, our solution is cost-effective and scalable, streamlining inspections for businesses and individuals. gaari.ai sets a new standard for efficiency, transparency, and reliability in vehicle inspections, transforming the industry for the better.

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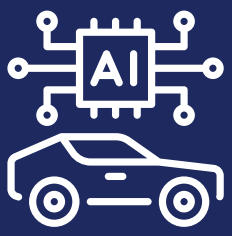

References

Vehicle Fault Diagnosis (VFD) Research

We adopted the VFD (OBD technique specifically) from this paper and are using it alongside Computer Vision technique we're using for automation.