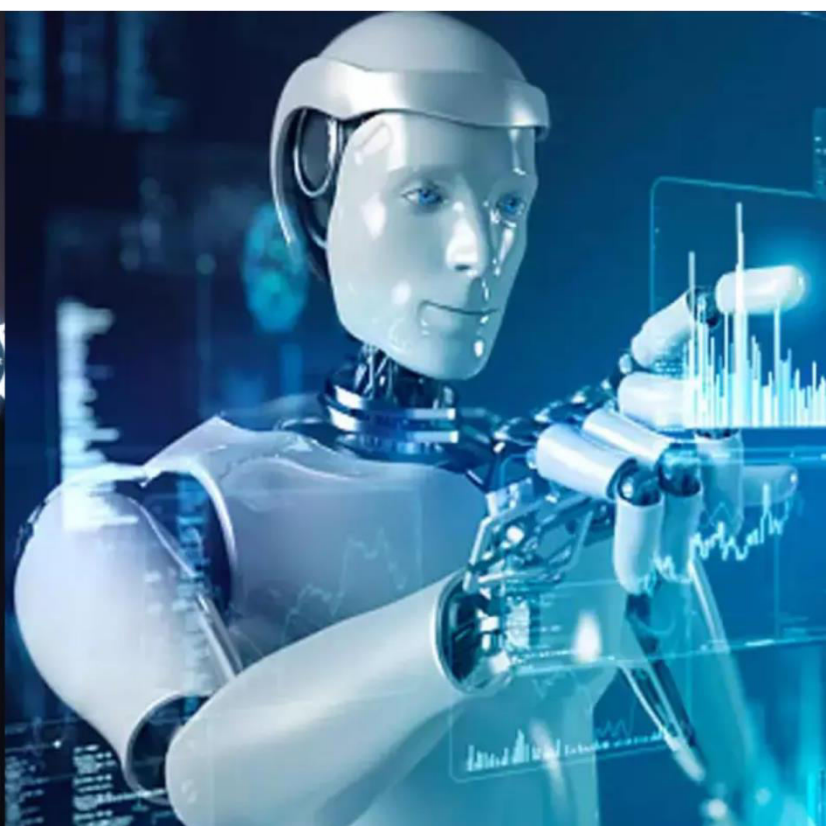




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AI-Based Car Diagnosis System using Convolutional Neural Networks

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ABSTRACT: The fast growth of the automobile industry and the rising complexity of today's cars have made it hard to diagnose vehicle problems quickly and accurately. Traditional car service methods depend a lot on manual checks, talking face-to-face, and the experience of technicians, which can lead to wrong diagnoses, slower fixes, higher repair costs, and less clear information for car owners. This paper introduces an AI-based system for car diagnosis and service management that uses Convolutional Neural Networks (CNN) to offer smart fault detection and full-service management through a single digital platform.

The system allows users to upload pictures of car parts like the engine compartment, tires, body panels, lights, and dashboard displays. A CNN model analyzes these images to spot visible issues and give initial diagnostic suggestions. Besides diagnosis, the system lets users book mechanics online, find workshops near them, buy spare parts, make secure payments using Razorpay, and manage feedback. The platform is built with a role-based structure that includes Admin, User, and Mechanic sections to ensure security and smooth operation. Testing shows that this system improves the accuracy of diagnosis, speeds up service coordination, and gives car owners more clear information compared to traditional car service systems.

KEYWORDS: Car Diagnosis, Convolutional Neural Network, Artificial Intelligence, Vehicle Fault Detection, Service Management System

I. INTRODUCTION

More and more people are relying on personal cars, which makes it important to keep up with regular maintenance and spot problems early to stay safe and ensure the car runs well. Today's cars have lots of complicated parts that work together mechanically, electrically, and electronically, so it's hard for regular users to figure out what's wrong on their own. Car owners often find it difficult to understand issues like engine problems, worn brakes, damaged suspension, overheating, or body damage. This can lead to putting off servicing, which in turn causes more expensive repairs down the line. Traditional car servicing usually involves a technician checking the car manually and then explaining what's wrong, which can sometimes lead to misunderstandings or not being clear enough. Artificial Intelligence, especially Convolutional Neural Networks (CNNs), can help by automatically analyzing photos of cars to find faults. When combined with digital tools for managing services, this can make car maintenance more precise, faster, and easier for users. This paper introduces an AI-Based Car Diagnosis and Service Management System that uses CNN. It brings together smart image analysis for diagnosing car problems with features like booking a mechanic, making payments online, and getting services based on your location.

II. PROPOSED SYSTEM

The proposed system is designed as a **centralized web-based platform** that integrates AI-driven car diagnosis with service management functionalities. The system consists of three primary modules:

2.1 User Module

- User registration and secure authentication
- AI-based car diagnosis by uploading car images
- Viewing diagnostic results and repair recommendations
- Location-based discovery of nearby workshops and mechanics
- Booking mechanics and services

- Purchasing spare parts
- Secure online payments using Razorpay
- Viewing service history and payment records

2.2 AI Diagnosis Module (CNN-Based)

- Image preprocessing and normalization
- CNN-based feature extraction
- Fault classification and prediction
- Generation of diagnostic insights for users and mechanics

2.3 Admin Module

- Registration and verification of mechanics
- Management of service categories, spare parts, and workshops
- Monitoring service bookings and diagnostic activity
- Payment and transaction monitoring
- Reviewing user feedback and system performance

2.4 Mechanic Module

- Mechanic registration and admin approval
- Viewing AI-based diagnostic reports
- Accepting or rejecting service requests
- Updating service status
- Communicating with users
- Improving repair accuracy using AI-supported diagnosis

III.METHODOLOGY

3.1 Model Design

The Convolutional Neural Network(CNN) model is built to examine images of cars showing various types of faults. It is trained using labeled image data that includes pictures of engine parts, tires, lights, dashboard signals, and body damage.

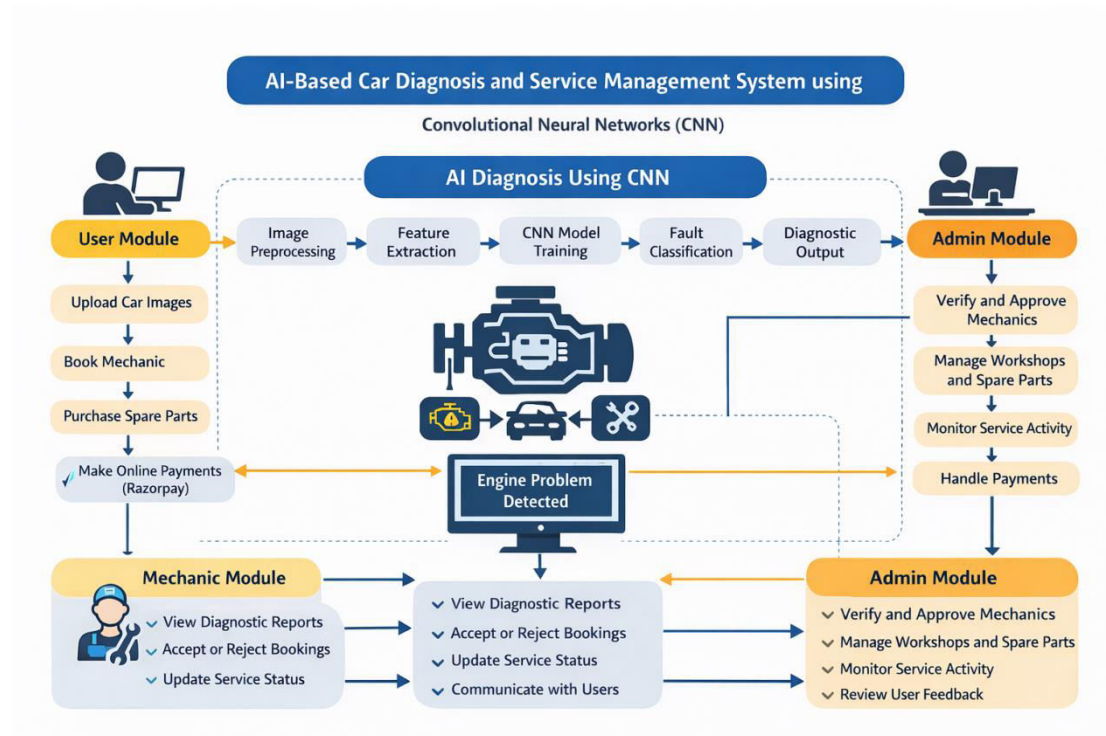
3.2 Working Methodology

Users can upload images of cars or their parts via the web interface. The images go through preprocessing steps like resizing, adjusting brightness, and removing noise. The CNN then identifies visual patterns in layers, helping to detect different issues. The system categorizes the faults into specific groups. It then shows the diagnostic findings to the user. These results are sent to mechanics to help them repair the vehicle more quickly and accurately.

IV. SYSTEM IMPLEMENTATION

4.1 CNN Architecture

The Convolutional Neural Network (CNN) used in the car diagnosis system is built to efficiently detect layered features from images related to vehicles. The model includes several convolutional layers paired with pooling layers to shrink the image size and make the processing faster. ReLU functions are added to help the model learn better by introducing some complexity. After extracting the features, they are converted into a single vector and sent through fully connected layers, ending with a Softmax layer that helps classify different types of vehicle faults. This setup allows for precise fault detection while keeping the model from learning too much from the training data and reducing the time needed to train the system.



4.2 Algorithm Steps

Input: Vehicle fault images / diagnostic indicators

Output: Predicted fault category

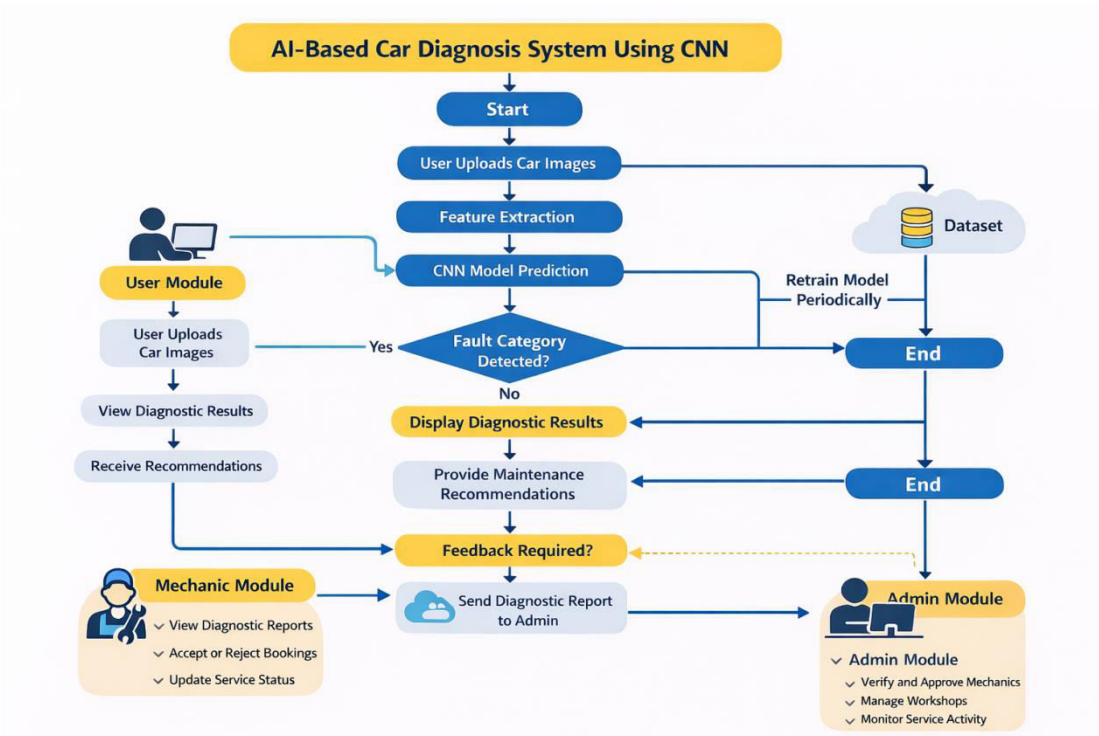
- Collect vehicle-related image data and fault indicators
- Perform data preprocessing such as resizing, normalization, and noise reduction
- Split the dataset into training and testing sets
- Initialize the Convolutional Neural Network model
- Apply convolution and pooling operations to extract features
- Flatten the extracted feature maps
- Pass features through fully connected layers
- Apply Softmax activation for fault classification
- Train the CNN model using labeled data
- Evaluate model performance using test data
- Display diagnostic results to the user interface

4.3 Web Application Implementation (Python Django)

The system is implemented as a web-based application using Python Django, providing a secure, scalable, and user-friendly interface. Django manages authentication, role-based access (User, Admin, Mechanic), AI diagnosis integration, service bookings, payment handling, and result visualization, ensuring seamless interaction across all modules.

V. FLOWCHART

The flowchart shows how the AI car diagnosis system works using Convolutional Neural Networks. It starts when a user uploads pictures of their vehicle via the web app. The images are then cleaned and important features are extracted from them. These processed data are sent to a trained CNN model for analysis. The system then finds out what's wrong with the car and categorizes the issue. After that, it provides the user with the diagnosis and suggestions for maintenance. The system can also send this information to an admin section where it can be watched and used to retrain the model, helping the system get better over time.



VI. EXPERIMENTAL RESULTS

The performance of the proposed AI-based car diagnosis and service management system was measured based on how accurate it was in diagnosing issues, how reliable it was in working consistently, and how efficiently it handled service requests. The CNN-based diagnosis module showed good results in spotting visible car problems from uploaded images, and it was able to learn and recognize complex patterns of faults linked to different parts of the vehicle. The automated diagnosis process greatly cut down the time needed to find initial issues compared to traditional manual checks. By offering AI-generated diagnostic information before a mechanic even gets involved, the system improved how well users and mechanics understood each other, which helped reduce unnecessary service visits and repeated checks. Combining mechanic dashboards with AI-assisted diagnosis made repairs more accurate and improved the overall workflow.

The feature that helps users find nearby workshops based on their location and allows online bookings helped reduce how long it took to get service, especially in urgent situations like breakdowns. Using secure Razorpay-based digital payments made transactions more transparent and removed the need for cash. Overall, the test results show that the proposed system improves the reliability of diagnoses, coordination between service providers, and user confidence compared to traditional car service methods.

VII. FUTURE ENHANCEMENTS

- Integration of real-time sensor data from vehicles with IOT
- Audio-based engine fault detection using deep learning
- Predictive maintenance using hybrid CNN-LSTM models
- Mobile application support for end users
- Cloud-based diagnostic analytics to make it user friendly

VIII.SCREENSHOTS

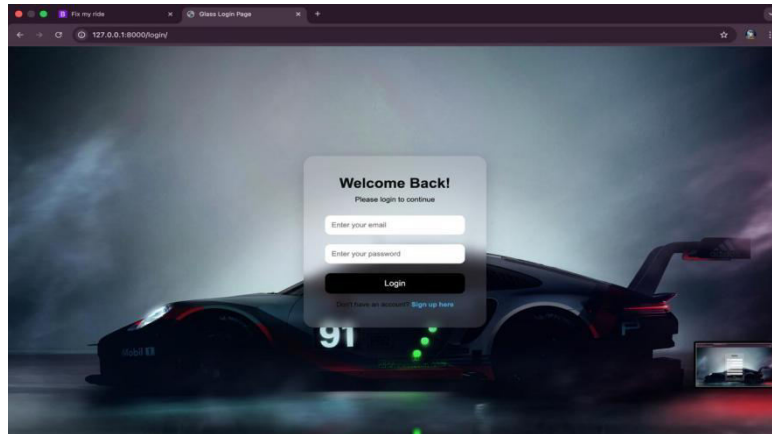


Fig: user login

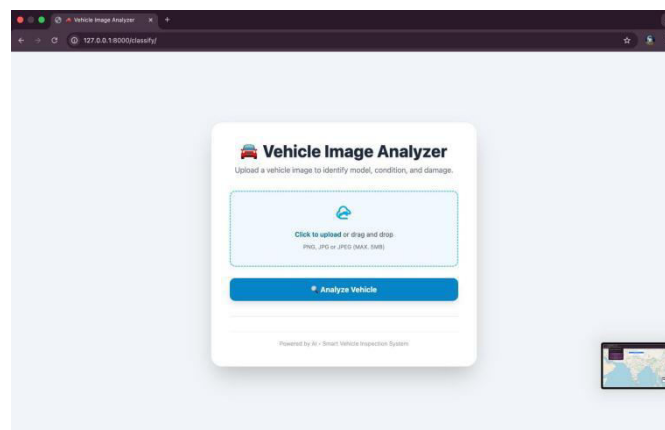


Fig: AI Analysis

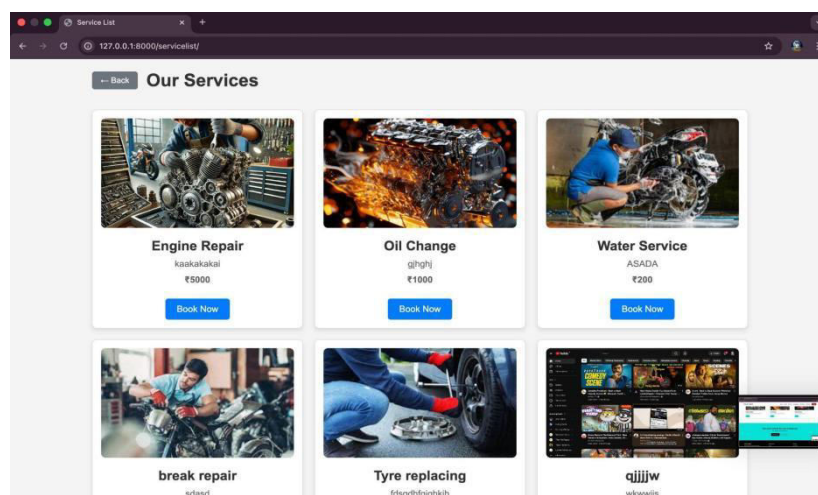


Fig: List Services

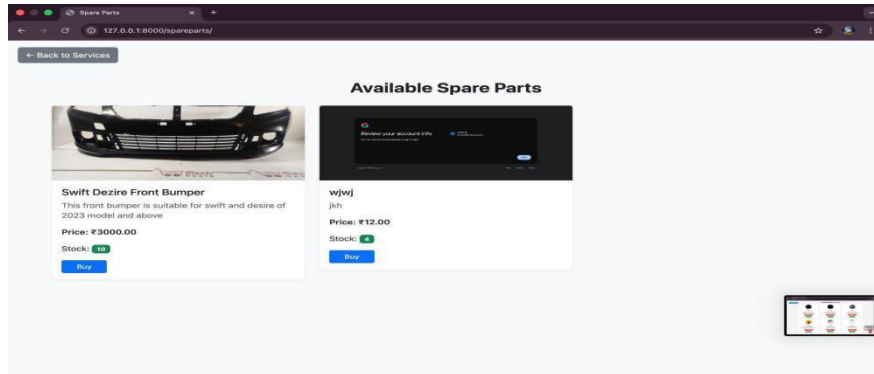


Fig: spare parts

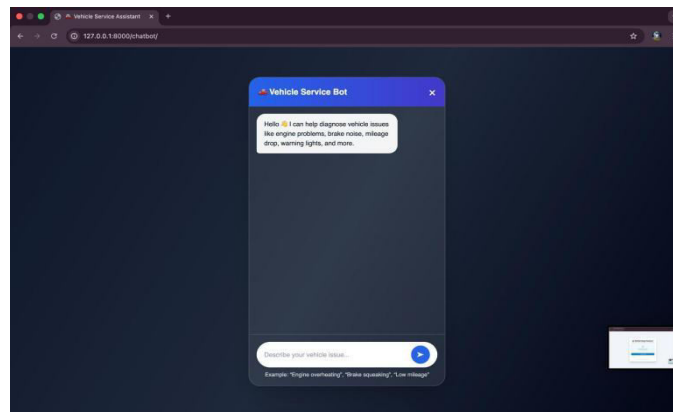


Fig: Service Chatbot

IX. CONCLUSION

This paper introduces an AI based car diagnosis and service management system that uses Convolutional Neural Networks to solve key problems in traditional car maintenance. The system combines CNN based image analysis for diagnosing car issues, allows users to book mechanics, offers location-based services, manages spare parts, supports secure online payments, and includes a feedback system. This creates a full digital solution for both car owners and service providers. The platform improves the accuracy of diagnoses, makes service processes more transparent, increases efficiency, and builds trust among users. It shows how AI technologies can effectively support modern automotive service environments.

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