Garage Management AI Assistant

1. Introduction

The Garage Management AI Assistant is an AI-powered web application designed to assist mechanics, garage staff, and customers with a variety of automotive-related tasks.
The system leverages the **IBM Granite-3.3-2B Instruct** model to provide intelligent, real-time responses about repairs, parts availability, maintenance schedules, and troubleshooting common vehicle issues.

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2. Project Overview

This project streamlines garage operations by integrating an AI assistant capable of understanding natural language queries related to vehicle maintenance.
Users can ask about repair steps, required tools, part specifications, or recommended service intervals.
The system is built using **Python** and **Gradio**, with Hugging Face's **Transformers** library to integrate IBM Granite.

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3. Team Roles & Contributions

- **Team Leader (AI Integration & Development)**
  Responsible for integrating IBM Granite model, designing prompt templates, and ensuring AI output quality.
- **Frontend Developer**
  Designs and implements the Gradio-based user interface.
- **Backend Developer**
  Manages routing, handles AI queries, and manages authentication.
- **Testing & Optimization Engineer**
  Ensures smooth functionality and optimizes AI responses.

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4. Scenarios / Use Cases

1. **Repair Advice**
   Mechanic inputs a car issue like "engine overheating" and receives troubleshooting steps.
2. **Parts Lookup**
   The assistant provides compatible part numbers for a specific make and model.
3. **Service Schedule**
   Users can ask when their next oil change or brake service is due.
4. **Noise Diagnosis**
   The AI suggests possible causes for unusual vehicle sounds.
5. **Customer Query Handling**
   Front desk staff can use the assistant to answer customer questions instantly.

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5. Technical Architecture

- **Model**: IBM Granite-3.3-2B Instruct via Hugging Face Transformers
- **Frontend**: Gradio web interface
- **Backend**: Python functions connecting user input to AI model
- **Hosting**: Local server or cloud deployment
- **Security**: Environment variables for API key storage

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6. Model Selection

The IBM Granite-3.3-2B Instruct model was chosen for:

- Strong performance in **instruction-based** responses
- Ability to provide **clear, step-by-step** guidance in the automotive domain
- Support for conversational and context-aware outputs

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7. Prompt Strategies

Example prompts include:

- "The customer reports [SYMPTOM]. What could be the cause?"
- "List the tools needed for [REPAIR_TASK]."
- "What is the recommended service interval for [VEHICLE_MODEL]?"

Prompt engineering ensures the AI provides:

- Context-aware responses
- Clear step-by-step instructions
- Relevant automotive terminology

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8. Core Functionalities

1. **Repair Guide Generator**
   Suggests possible repairs for reported symptoms.
2. **Parts Finder**
   Retrieves compatible part numbers for a make and model.
3. **Maintenance Advisor**
   Provides recommended service intervals.
4. **Noise Diagnosis Tool**
   Suggests possible issues based on unusual sounds.
5. **Customer Service Assistant**
   Answers FAQs with professional and friendly language.

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9. UI/UX Design

- **Input**: Gradio Textbox for queries
- **Output**: AI-generated text with step-by-step guides
- **Layout**:
    - Title & description section
    - Main input area
    - Output box
    - Mobile-friendly responsiveness

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10. Deployment Plan

- **Local Deployment**: Python + Gradio
- **Cloud Deployment**: Streamlit Cloud / Hugging Face Spaces
- **Security**: API keys stored in .env file
- **Testing**: End-to-end checks for each scenario

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11. Testing & Optimization

- Test for relevance and accuracy of AI responses
- Validate prompt structure
- Optimize max_new_tokens and temperature for balanced creativity and accuracy
- Handle invalid or unclear queries gracefully

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12. Future Enhancements

- Add **voice input and output**
- Integrate with **garage inventory system**
- Support **image-based part identification**
- Maintain a **customer repair history log**

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13. Conclusion

The Garage Management AI Assistant demonstrates how AI can improve operational efficiency in garages by providing instant, reliable, and structured responses to mechanics and customers alike.
Its modular design ensures scalability for more advanced automotive diagnostics and broader garage management applications.