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Customer Support Voice Bot Assistant for a Car Service Agency

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Abstract*— Customer support in car service agencies often faces delays due to manual handling of booking requests, service reminders, and query resolution. This project proposes a Customer Support Voice Bot Assistant that enables customers to interact in real time through natural voice communication. The system integrates Chatterbox/ElevenLabs for AI-based speech-to- text and text-to-speech, N8n workflow automation for service scheduling and notifications, and Supabase with PostgreSQL for secure storage of customer data and conversation history. Additionally, Google OAuth authentication ensures secure access, while Tailwind CSS provides a responsive interface for administrators. The proposed system improves efficiency by reducing response time, minimising manual intervention, and providing 24/7 customer support.

Keywords*— Voice Bot, Workflow Automation, Supabase, PostgreSQL, Google OAuth, Tailwind CSS, Customer Support.

I. INTRODUCTION

Customer Satisfaction in the Automobile Service Industry relies heavily on timely communication and efficient support. Traditional customer support structures commonly employ human agents, which causes long wait times, limited availability, and inconsistent service quality. With advancements in Artificial Intelligence (AI) and workflow with automation, it is possible to design a voice-enabled system that can assist in automating repetitive queries and ensuring the information provided is accurate. continuous service availability. This paper presents the design and implementation of a customer support voice bot assistant tailored for car service agencies. The system aims to facilitate necessary customer interactions like booking appointments, providing service updates, and sending reminders, while maintaining secure data management and scalability. In recent years, the rapid development of Artificial Intelligence, Natural Language Processing, and speech synthesis technologies has enabled the development of speech synthesis systems that can be integrated into products like the Maestro of voice-enabled conversational agents. In contrast to traditional text-based communicating chatbots, voice bots. This can, in turn, further facilitate the workflow by making it easier and more accessible to users. This is especially useful in the motor service industry. where it may be preferable for customers to interact hands-free and with a rapid voice. Interacting instead of having to type out long queries, this research. This section focuses on the design and implementation of a Customer Support Voice Bot Assistant Catered to Car Services. agency. The proposed system integrates several technologies like N8n workflow automation, Chatterbox/ElevenLabs for AI-driven voice handling, Tailwind CSS for designing the frontend, and Supabase with PostgreSQL for secure backend data management. The Google OAuth authentication has been used in addition to ensure that there is the availability of secure access for users.

II. RELATED WORK

A. *Voice-Based Customer Support Systems*

Voice-based customer support systems have gained significant attention in recent years due to their ability to improve communication between customers and service providers. These systems allow users to interact using natural speech instead of typing, which makes the process faster and more convenient. Several researchers have developed voice assistants to automate customer queries and provide instant responses. These systems help reduce waiting time and improve overall service efficiency. In customer service

environments, voice assistants are commonly used to handle tasks such as answering frequently asked questions, providing service information, and assisting with booking requests. Voice interaction improves accessibility, especially for users who prefer speaking rather than typing. This approach also enables hands-free interaction, which is useful in real-world environments such as automotive service centres.

B. Conversational AI and Workflow Automation

Conversational systems are built to understand user input and provide suitable responses automatically. These systems utilise speech recognition technology to turn speech into text and then process the request. Workflow automation tools enable these systems to perform tasks such as retrieving information, scheduling services, and handling customer requests without human help. Automation platforms boost efficiency by linking various system parts, including the user interface, database, and backend services. This minimises manual work and leads to quicker response times. Workflow automation also enhances system reliability by making sure tasks are completed accurately and consistently.

C. Limitations of Existing Systems and Research Gaps

Several customer support systems have been created using chatbots and voice assistants to automate customer interactions. These systems help organisations deliver quicker responses and decrease manual effort. Voice assistants enhance customer experience by allowing users to communicate naturally through speech instead of typing [1].

Many conversational AI systems utilise speech recognition technology to convert voice input into text and automatically process customer requests. These systems manage common tasks such as answering customer queries, providing service information, and assisting with appointment scheduling [3], [4]. This enhances efficiency and reduces response time compared to traditional manual support systems.

Workflow automation platforms are also used in customer support applications to automate backend operations. These systems connect different services such as databases, APIs, and user interfaces to ensure smooth operation. Automation tools improve system performance and reduce human intervention in repetitive tasks [5].

Secure authentication mechanisms such as OAuth are commonly used to protect user information and prevent unauthorised access. These authentication systems ensure that only authorised users can access the service, improving overall system security [7].

Cloud-based backend platforms such as Supabase and PostgreSQL are widely used for storing customer data and interaction history. These platforms provide secure data storage, fast access, and reliable system performance [6].

However, many existing systems focus only on text-based interaction or basic automation. They do not provide a fully integrated voice-based system with workflow automation, secure authentication, and real-time database management. This limitation highlights the need for an integrated voice-based customer support assistant, such as the system proposed in this paper.

III. PROPOSED SYSTEM

A short explanation of the methodology followed for building the proposed voice. The basis of this smart assistant is a modular and scalable architecture that integrates several open-source technologies and APIs.

The proposed system is designed as a modular and scalable voice-based customer support assistant for car service agencies. It integrates speech recognition, workflow automation, secure backend services, and user authentication to provide an efficient and user-friendly solution. The system allows customers to interact using voice commands, which reduces manual effort and improves service accessibility.

The interaction begins with the frontend interface developed using Tailwind CSS. This interface provides a responsive and user-friendly environment that allows customers to access the system through a web browser. The design ensures compatibility across different devices, enabling users to interact with the assistant conveniently.

The system uses Speech-to-Text technology provided by ElevenLabs or Chatterbox to convert the user's voice input into text format. This conversion enables the system to understand spoken commands without requiring manual typing. The converted text is then sent to the n8n workflow automation engine, which processes the request and determines the appropriate action. Based on the user's intent, the system can perform tasks such as booking service appointments, retrieving service details, or registering customer complaints.

The backend infrastructure is implemented using Supabase, which provides secure backend services built on PostgreSQL. The database stores essential information such as customer records, service history, and conversation logs. This ensures reliable data management and allows the system to retrieve information efficiently whenever required.

For secure access, the system uses Google OAuth authentication. This allows users to log in using their Google accounts, ensuring secure authentication and protecting customer data. It also simplifies the login process while maintaining proper access control.

The integration of ElevenLabs or Chatterbox for speech recognition, n8n for workflow automation, Supabase for backend management, and Google OAuth for authentication ensures smooth communication between system components. This architecture provides a reliable, scalable, and efficient solution for voice-based customer support in car service agencies.

A. System Architecture

The proposed system architecture consists of five main components: frontend interface, speech processing module, workflow automation engine, backend database, and authentication service. These components work together to provide a reliable and efficient voice-based customer support solution.

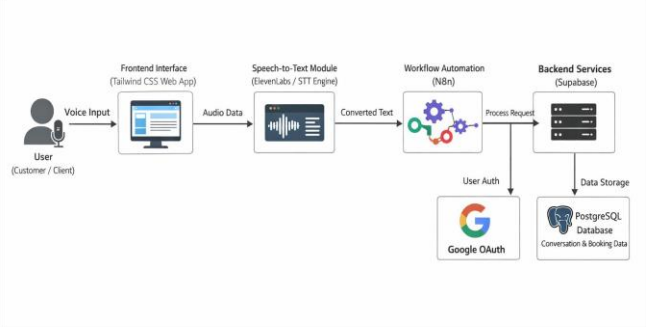

Fig. 1. System Architecture Of the Customer Support Voice Bot Assistent

The frontend interface is developed using Tailwind CSS, a utility-first framework that enables the creation of responsive and user-friendly web interfaces. This interface allows users to easily interact with the system and provide voice input through the browser. The design ensures

compatibility across different devices, improving accessibility and usability. The speech processing module is responsible for converting user voice input into text using Speech-to-Text technology provided by services such as Chatterbox or ElevenLabs. This module plays a critical role in enabling voice interaction by transforming spoken commands into a format that can be processed by the system. The workflow automation is handled using N8n, an open-source automation platform. N8n processes the converted text, identifies the user's request, and executes the appropriate workflow. These workflows include service appointment booking, customer query handling, reminder generation, and complaint management. N8n also communicates with backend services through secure APIs to retrieve or store relevant data. The backend infrastructure is powered by Supabase, which provides Backend-as-a-Service functionality. Supabase uses PostgreSQL as the database to securely store user information, conversation history, and service booking records. The backend ensures efficient data retrieval, real-time updates, and reliable system performance. User authentication is implemented using Google OAuth, which allows users to securely log in using their Google accounts. This authentication mechanism enhances security, protects user data, and ensures proper access control within the system. Overall, this architecture provides a scalable, secure, and efficient framework for delivering voice-based customer support services in a car service environment.

B. System Workflow

The system workflow describes the sequence of operations involved in providing voice-based customer support. Initially, the user accesses the system through the web interface and logs in using Google OAuth authentication.

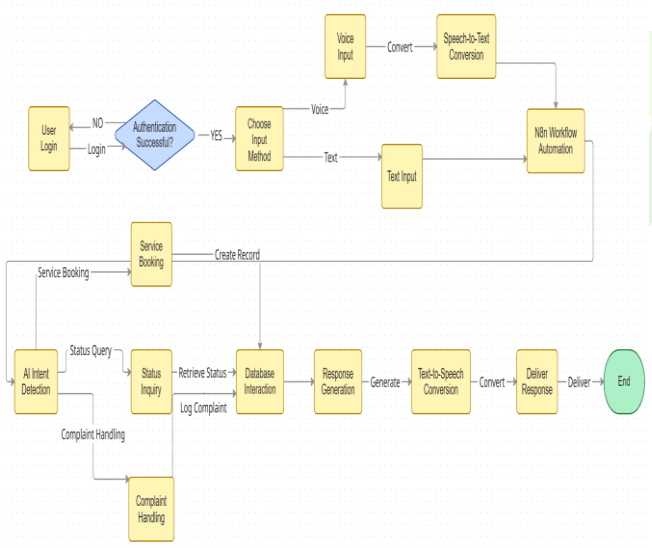

Fig. 2. System Workflow of the Customer Support Voice Bot Assistent

This ensures secure access and protects user information. Once authenticated, the user provides voice input through the frontend interface developed using Tailwind CSS. The voice input is then captured and forwarded to the Speech-to-Text module, where the spoken command is converted into text format. The converted text is transmitted to the N8n workflow automation engine, which analyses the user's request and determines the appropriate action. Based on the identified intent, N8n communicates with the backend services provided by Supabase. The backend interacts with the PostgreSQL database to retrieve or store relevant information, such as service booking details, customer records, or conversation history. After processing the request, the backend sends the response back through the workflow engine to the frontend interface. The result is then displayed to the user in real time. This workflow ensures efficient handling of customer requests, secure data management, and smooth interaction between system components.

C. Development Methodology

"The development of the voice assistant system followed an inductive approach, in which researchers sought an agile, iterative methodology. This methodology enabled rapid prototyping, modular development, and constant feedback integration at every stage of the project. In Phase 1, a "A prototype of the frontend interface was developed with basic text input/output functionality to test initial interaction. In phase 2, the speech synthesis and recognition modules were integrated to enable voice interaction. This phase included evaluation of the quality of various TTS services, e.g. Chatterbox vs Eleven Labs, to ensure optimal clarity and naturalness of responses. Phase 3 centred on building intelligent workflows in N8n for key functions, such as handling service bookings, answering FAQs, etc.
user complaints. These workflows were tested using mock data to ensure correctness and reliability.

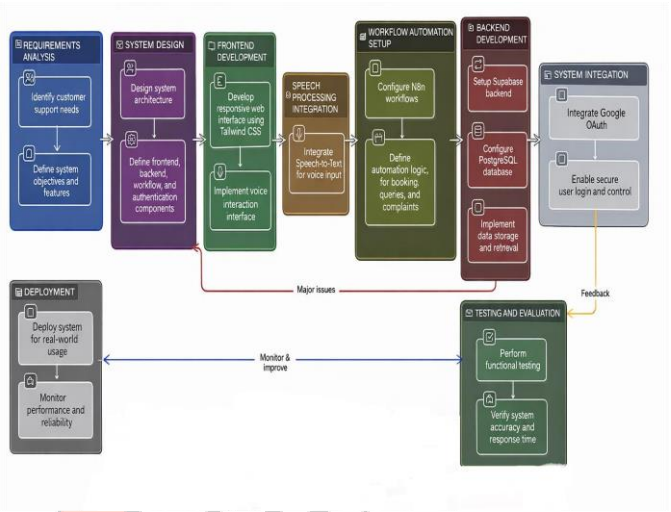

Fig. 3. Development Methodology of the Proposed Voice Bot System

In Phase 4, the Supabase backend was also connected to enable real-time data retrieval and persistence. The PostgreSQL schema was designed to support dynamic conversation data, user records, service categories, and appointment scheduling. Finally, in Phase 5, Google OAuth was implemented to provide secure and convenient authentication mechanisms for end-users. "Each component was individually tested for performance and security before being integrated into the final system. This modular and agile approach ensured that problems were identified and resolved early, thereby building a robust and user- friendly voice assistant.

TABLE I. AVERAGE RESPONSE TIMES OF THE BOT FOR EACH TYPE OF ACTION

Types Of Action	Avg Response Time (in seconds)
Intent identification	0.08
Input & Confirmation	2.4
API Call & Output	4.6

IV. System Component

The Customer Support Voice Bot Assistant is built using multiple interconnected components that function together to provide reliable and efficient voice-based customer support. Each component is responsible for handling a specific task, such as user interaction, voice processing, workflow execution, data storage, and authentication. The proper coordination of these components ensures smooth system operation, fast response time, and secure handling of user information.

A. Module 1: User Interface Component

The user interface serves as the communication layer between the user and the system. It is developed using Tailwind CSS, which helps in creating a responsive and visually clean web interface. Through this interface, users can provide voice input and receive responses from the system in an organised manner. The design focuses on simplicity and ease of use, allowing users to interact with the system without technical difficulty. Additionally, the interface supports multiple devices, ensuring accessibility through desktops, laptops, and mobile browsers.

B. Module 2: Speech Recognition Component

The speech recognition component converts spoken input from the user into text format so that the system can understand and process the request. This is achieved using Speech-to-Text technology integrated through platforms such as ElevenLabs or Chatterbox. This component allows users to communicate naturally using their voice instead of typing commands. After conversion, the generated text is forwarded to the automation component, where it is analysed and processed further.

C. Module 3: Workflow Automation Component

The workflow automation component plays a key role in controlling the internal operations of the system. It is implemented using n8n, which enables automated handling of user requests. Once the speech input is converted into text, this component evaluates the request and triggers the appropriate workflow. These workflows may include tasks such as booking service appointments, retrieving service information, recording customer complaints, or providing automated support. This automation reduces manual intervention and improves overall system efficiency.

D. Module 4: Backend and Database Component

The backend component is responsible for managing system data and ensuring proper storage and retrieval. Supabase is used as the backend service, and PostgreSQL is used as the database management system. This component securely stores customer details, service records, and conversation logs. It also ensures that data can be accessed quickly when required. The backend structure supports reliable performance and allows the system to handle multiple users efficiently.

E. Module 5: Authentication Component

The authentication component ensures that only authorised users can access the system. Google OAuth is used to provide secure login functionality. This allows users to sign in using their existing Google accounts, eliminating the need to create separate login credentials. This approach improves system security and helps protect sensitive user information from unauthorised access.

F. Module 6: System Integration Component

The system integration component ensures proper coordination between all other components. It connects the user interface, speech recognition service, automation workflows, backend database, and authentication system into a unified structure. This integration allows the system to receive voice input, process it correctly, execute the required actions, and deliver responses without delay. The modular structure also makes it easier to maintain and expand the system in the future.

All modules together are responsible for a smooth interaction between customers and the organisation, making the process easier and minimising manual work. The Voice Input Module (Speech-To-Text), also mentioned as a speech recognition mechanism, enables customers to interact with the system and conceptualise their voice into a language understood by the system. The voice input is converted into text using speech-to-text technology and is processed through the AI model, which analyses this text and decides on a response according to the query sent by the customer. Here, we are using a speech recognition mechanism without any text-to-speech activity, making it simple and efficient. It is handled totally by the Workflow Automation Module (n8n). Depending upon the intent detected, workflows are initiated in the n8n module to perform operations such as booking appointments for services, sending reminders, registering complaints, and updating services, without the need for human intervention. The Database Module, wherein the entity Supabase and PostgreSQL integrate, is intended to securely save user information, service history, and past conversations. This way, the system can retrieve necessary information when the need arises, and the agency can keep proper records of customer interactions. This is achieved through the Authentication Module, "Google OAuth," which provides secure access to the system. Customers can access the system using their Google account, thus preventing unauthorised access and ensuring no abuse of their personal data. The User Interface Module (Tailwind CSS) assists in creating a simple and interactive dashboard for employees in the service company. Using this interface, employees are able to view various customer requests in real time. Overall, these modules are integrated to create a reliable, secure, and efficient speech-based customer support system specifically designed for a car service agency.

V. Experimentation And Results

The performance of the proposed voice-based customer support assistant was evaluated via a series of controlled experiments using actual and artificial voice commands from customers. The proposed system was evaluated in a live environment to assess its responsiveness, accuracy, and reliability for handling customer requests for a car service agency. The total number of sample voice commands received for evaluation was 300. The voice commands included different use cases such as appointment booking, service checking, complaint registration, payment checking, and customer-related queries. The system was evaluated on the basis of two prominent performance indicators, namely average response time and intent recognition accuracy. In this case, the system was able to identify the user's intent from the words spoken to it within an average of 0.08 seconds, thus making it a very fast processor. In other cases, when the backend activities, such as retrieving the data from the database or executing the workflows through n8n, were involved, such activities were processed in an average of 4.6 seconds, which is considered acceptable. Each of these functional modules was tested separately to examine its performance. The average time taken for different modules varied between 2.12 and 2.62 seconds, thus indicating stable system performance. The system successfully achieved an appreciable accuracy of 93.67% during the trials for the

recognition of intent, as the system classified 281 of the 300 voice commands provided to the users. The results of the intent classification were mostly due to the unclear or ambiguous inputs provided by the users. Overall, the experimental results show that the proposed system is efficient, robust, and capable of performing real-time customer interactions. The voice assistant system successfully reduces the workload, improves response time, and enhances the customer experience in a car service agency.

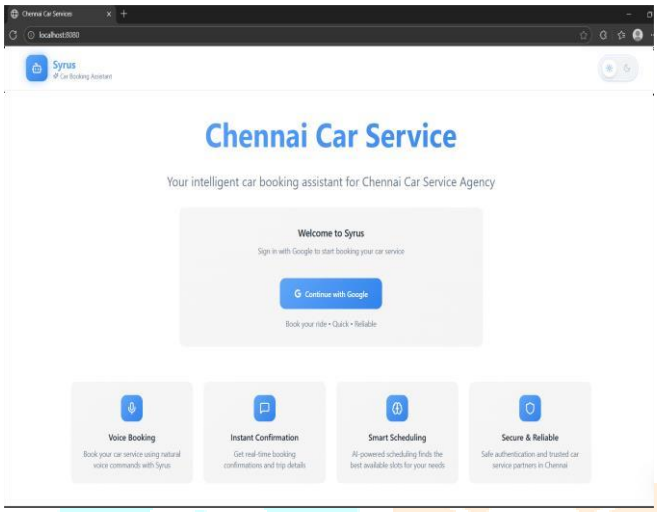

Fig. 4. User Interface Output

TABLE II. AVERAGE RESPONSE TIMES OF THE BOT FOR EACH TYPE OF ACTION

Module	Avg Response Time (in seconds)
Appointment Booking	2.1
Service Status Check	2.3
Complaint Registration	2.4
Appointment Cancellation	2.6
General Inquiry	2.0

VI. CONCLUSION AND FUTURE WORK

A. *Conclusion*

This paper has proposed the design and implementation of a Customer Support Voice Bot Assistant for a Car Service Agency, such that it incorporates Speech to Text technology, Artificial Intelligence for intent detection, workflow automation through n8n, backend data storage security through Supabase and PostgreSQL, and Google Authentication through OAuth. This proposed system will enable customers to interact with the service agency through voice commands, thereby increasing operational efficiency for the agency. The experimental results demonstrated that the system is able to accurately identify user intent with an overall accuracy of 93.67%. In addition, the system responded with quick response times. Further, the use of automated workflows ensured the timely scheduling of appointments, addressing customer complaints, and conveying service-related information to customers without relying on continuous human intervention. Finally, the proposal of a secure cloud-based database and authentication was beneficial for the overall database security of the system. The system is an effective solution for customer support in car service agencies due to its practicality, scalability, and usability. In the future, the system can be improved by adding a facility to provide voice-based responses to customers using Text to Speech (TTS) systems to achieve a fully interactive chat system. The system can also be improved to cater to customers speaking in multiple languages to serve customers across regions. Furthermore, the system can be improved to use sentiment analysis techniques based on machine learning to sense the customer's emotions as input to provide improved quality service. Integration with the payment gateways and vehicle diagnostic systems can improve the scope of the improved system to provide a comprehensive smart service assistant for the automotive sector.

B. *Future Work*

The proposed Customer Support Voice Bot Assistant provides an efficient solution for handling customer interactions using Speech-to-Text technology, workflow automation, and secure backend services. However, several improvements can be made in future versions to enhance the system's functionality and user experience. One important improvement is the addition of Text-to-Speech functionality. Currently, the system converts voice input into text and responds to the web interface. By adding Text-to-Speech capability, the system will be able to respond to users using voice, creating a more natural and interactive communication experience. Another possible enhancement is the implementation of multilingual support. This will allow the system to understand and process voice commands in different languages, making it more accessible to users from various regions. This feature will improve usability and make the system more flexible for real-world deployment. The system can also be extended by integrating online payment functionality. This will allow customers to pay for vehicle services directly through the system, reducing manual work and improving convenience. In addition, integration with vehicle service management systems can help provide real-time service updates, appointment tracking, and automated notifications. Furthermore, future improvements may focus on enhancing system performance, improving response accuracy, and supporting a larger number of users. These enhancements will make the system more scalable, reliable, and suitable for practical use in automotive customer service environments.

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