

Voice AI For Optimized Dental Scheduling

¹Vedanth B L, MCA,

PES Institute of Technical and Management, Shivamogga, Karnataka, India.

² Dr. Sanjay K S, Assistant Professor and Head, MCA,

PES Institute of Technical and Management, Shivamogga, Karnataka, India.

ABSTRACT

This document explains the design and operation of an audio interaction device created for automated appointment scheduling and notification services. A code-free, flexible integration framework manages complex processes, including information collection, artificial intelligence handling, flexible timing control, and various communication channels for confirmations and alerts. The device aims to increase efficiency, reduce missed appointments, and enable clear, continuous voice communication.

KEYWORDS: *Google Gemini AI, Webhooks, Vapi, Twilio*

I. OVERVIEW

In the contemporary digital world, efficient appointment management and reminders have become a critical success factor for many businesses in the services industry, healthcare, schools, and even personal time management. The conventional method of manually recording appointments, making phone calls, and sending reminders via SMS/email has several limitations, including being time-consuming, prone to human errors, and hard to scale. However, the emergence of Artificial Intelligence and robust integration platforms offers a prime opportunity to tackle these issues.

This work details the Smart Speech Interface system, presenting its design and implementation approach, which fully automates appointment management from booking to reminders. The system intelligently uses voice to interact with users, processes requests, integrates with calendars, and sends notifications via diverse channels, ultimately aiming for a seamless, automated system for managing appointments and reminders.

II. FUNDATIONAL RESEARCH

This part aims to illustrate how audio interaction functions, drawing from existing research.

Voice assistants have significantly evolved from phones and laptops to smart speakers and home automation systems, making technology interaction easier through voice commands. Despite being a major advancement in AI, especially in natural language processing, they still face key challenges and limitations. (Pankaj Kunekar et al. [1]) AI aims to simplify interaction with technology, and voice assistants for daily tasks are now very common. Many big tech companies have their virtual assistants, but our approach improves accuracy by better understanding both what you say and how you say it, reducing errors. (Aabhas Kumar et al. [2]) Rapid advances in artificial intelligence, particularly in Natural Language Processing (NLP), are making voice assistants standard in millions of homes and increasingly in schools. Originally launched on smartphones and laptops, these cloud-based assistants now support home automation and smart speakers, easing human interaction with technology. This paper will discuss the current challenges and limitations faced by these voice assistants. (Ajinkya Deshmukh et al. [3]) The

paper "On the Track of Artificial Intelligence: Learning with Intelligent Personal Assistants" by Nil Goksel and colleagues examines the potential of intelligent personal assistants (IPAs) that use advanced computing and NLP for learning. They review how IPAs operate within the AI framework. (Nil Goksel et al. [4]) Voice Assistants are intelligent programs that interpret voice commands and respond accordingly. Found on smartphones and smart speakers, they enable users to ask questions and perform daily tasks, such as managing emails and calendars, all through voice commands.

III. DESIGN AND IMPLEMENTATION

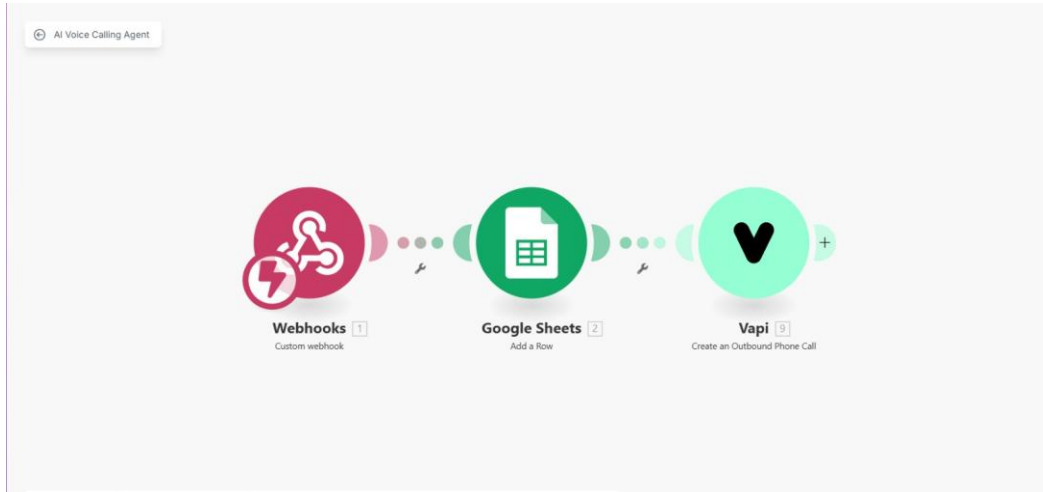


Figure 3.1 AI Voice Calling Agent Design

The process kicks off when a webhook receives real-time data from external systems, triggered by specific events. When this happens, the relevant call details are sent to the webhook. This information is then automatically logged into Google Sheets, where it is organized and stored for easy access and tracking. This ensures every call request is logged accurately, creating a clear record for future analysis. Once the data is ready, Vapid uses it to place an AI-powered outbound call, engaging recipients with advanced conversational AI in real time. All in all, this system simplifies communication, keeps data organized and secure, and enables efficient, scalable interactions that enhance the entire voice outreach process.



Figure 3.2 Log the AI Voice Calling System

The system then uses the collected data to trigger an AI-driven outbound call, allowing the conversational AI to interact with the recipient seamlessly in real-time. There is a 7-step intelligent automation system for AI voice calls. It springs into action upon a Webhook trigger, instantly capturing and logging all relevant details into a Google Sheet, ensuring a comprehensive record. These details are then sent to Google Gemini AI, its core intelligence, to generate informed responses or process requests. A JSON step meticulously organizes Gemini's output for seamless integration, potentially even feeding back the AI's decisions to the Google Sheet. A powerful feature allows the system to directly interact with Google Calendar, autonomously creating appointments. Custom "tools" and a Google Sheet lookup enhance its operational capabilities. Finally, a smart router evaluates the AI's findings, dispatching appropriate follow-up communications, whether a detailed email or a swift Twilio text message. This highly robust and adaptable system completely automates the entire lifecycle of AI voice call management and logging.

IV. MODEL DIAGRAM

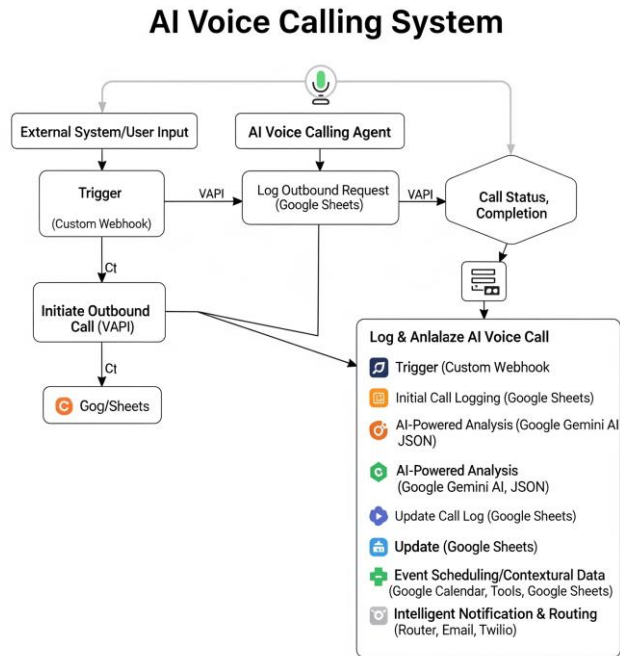


Figure 4.1 AI Voice Calling System

This process starts with a user's response, which triggers a specific custom webhook, which in turn initiates an outbound call from the system to the caller through Vapi. At the same time, the calling process is recorded in Google Sheets immediately for data capture straight away.

While the call is in progress, the status of the call and its completion are monitored. A deep logging and analysis process is also triggered at the same time as the call process. This process is triggered by a specific webhook.

The in-depth logging and analysis process is as follows: -1. Record initial call in Google Sheets. 2. Deep analysis of the call using Google Gemini to learn about the call interaction. 3. The JSON step is used to interpret the results of the analysis and then update the Google Sheets call log with the outcome of the AI learning from the call.

The system is also able to manage events and Google Calendar, as well as custom tools and Google Sheets lookup or checking information.

The final step is the intelligent notification and routing process. The router checks the AI learning and then sends the appropriate follow-up step. It could send an email (10), which would be a formal message. The process is stable and reliable for a variety of situations. It provides end-to-end automation for AI Voice call operation, including management and logging.

V. BLOCK DIAGRAM OF AUTOMATION PROCESS

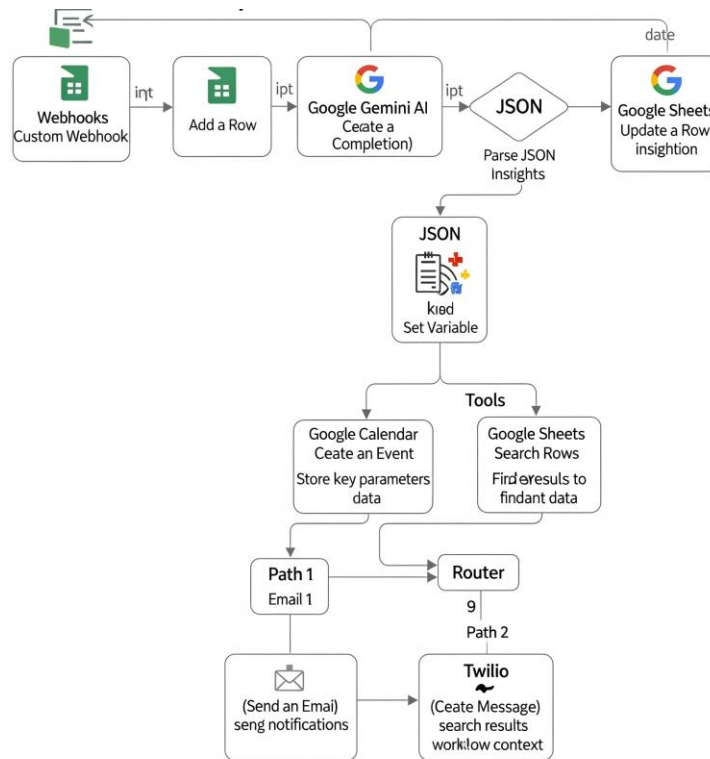


Figure 5.1 Automation Process

This process is all about automating a series of actions that kick off when a specific event happens. Here's how it flows more understandably:

Triggering Event (Custom Webhook): The whole thing starts when an external system or app sends a signal through a custom webhook, which essentially "alerts" the system to begin the process.

Recording the Data (Add a Row): Once the signal comes in, a new data entry (like a row) gets created—most likely in a database or a spreadsheet. This is where the initial information gets captured.

AI-Powered Insight (Google Gemini AI): The core of the process is when Google Gemini AI takes that data and does its magic. It "creates a completion," meaning it processes the data and generates useful insights—probably some analysis or text that adds value to the original data.

Parsing the Insights (Parse JSON Insights): Since the insights from Google Gemini come as structured data in JSON format, the system extracts the relevant details (the "insights") from that data for easier use in the next steps.

Logging in Google Sheets: These insights are then automatically logged into Google Sheets. This way, all the generated information is organized and tracked in a spreadsheet for later use or reference.

Storing as a Variable: The data (either original or processed) is then set as a variable. This allows the system to keep the data handy for the next parts of the workflow.

Creating Events (Google Calendar): Based on the data gathered, the system creates an event in Google Calendar, perhaps scheduling a task or reminder. The important details from the data are stored with this event.

Searching Data (Google Sheets Search): The system also looks up existing data in Google Sheets, searching for relevant information that could provide context or additional details for the next steps.

Routing (Path 1 & Path 2): Now, here's where things get a bit more complex. The process uses a "router" to decide which path to take next based on specific conditions.

- Path 1 (Send an Email): If Path 1 conditions are met, an email is sent to notify someone or trigger some further action.
- Path 2 (Send SMS via Twilio): If Path 2 conditions are met, a message is created and sent via Twilio, which handles SMS notifications. This message might be based on the previous data search.

VI. Results and Conclusion

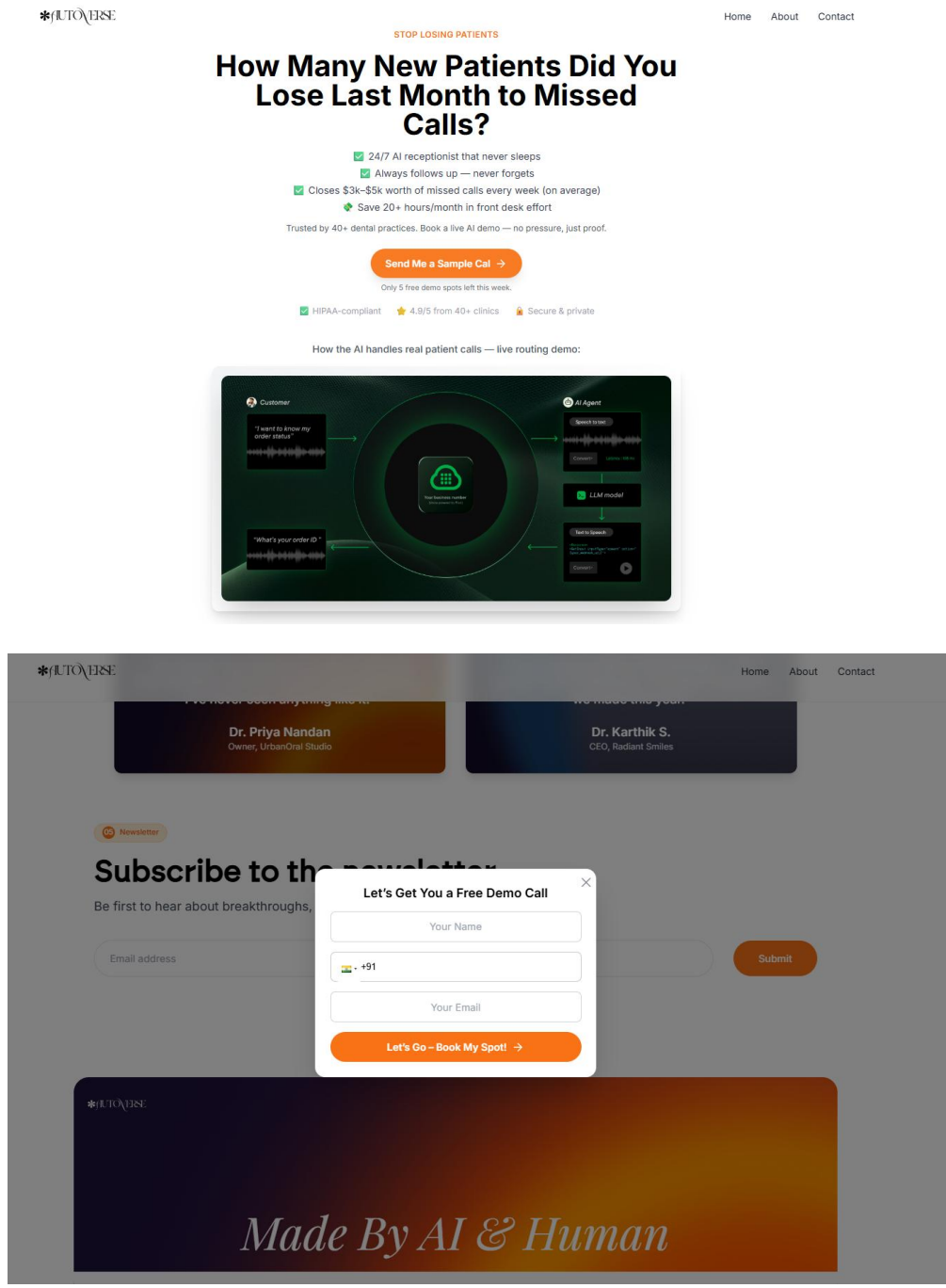


Figure 6.1 Screenshots of the website

	A	B	C	D	E	F
1	Typescript	Summary	Name	Interested	Appointment Time	Appointment timings for Google Calendar
2	<p>AI: Thank you for calling Autoverse. This is Neha, your scheduling assistant. May I know your name?</p> <p>User: My name is Adesh.</p> <p>AI: Hi, Adish. Are you the owner of the dental clinic?</p> <p>User: Yes. I'm the owner.</p> <p>AI: Great. Mind if I ask a couple of quick questions?</p> <p>User: Yeah. Sure. That's correct.</p> <p>AI: Thanks, Adesh. Are you currently using any software or CRM to manage your appointments?</p> <p>User: Yes. I'm currently using 1 of the CRMs.</p> <p>AI: Perfect. That's good to know. Have you ever thought about using a voice assistant like me to handle bookings and follow-ups?</p> <p>User: No. I have, uh, not thought about it. I'm thinking of developing 1.</p> <p>AI: Got it. Many clinics are starting to explore voice AI automation now, so you're definitely on the right track. Would you be open to a short 10-minute Google Meet demo to see how our voice assistant works? It's quick and completely free.</p> <p>User: Yes. I would be</p>	<p>An AI assistant from Autoverse called Sahas, the owner of a dental clinic, to discuss their voice AI assistant for automating bookings. Sahas agreed to a demo and they scheduled it for 4 PM British Standard Time the day after tomorrow. Sahas provided his email address to receive the Google Meet invite for the demo.</p>	Adesh	Yes	5 PM tomorrow	2025-06-07T16:00:00+05:30

<p>interested in joining a Google Meet. AI: Great. Would 11 AM or 4 PM tomorrow work better for you? User: Uh, can we connect by 5 PM tomorrow? AI: I understand 5 PM would be more convenient. Unfortunately, I have openings at 11 AM or 4 PM tomorrow. Would 4 PM work for you? User: Yeah. Okay. 4 PM is fine. AI: Perfect. I'll book you for 4 PM tomorrow. Before wrapping up, can I have your email to send over the Google Meet invite? User: It's Abhiram Bharadwaj, b h I r a I m b h a r a d w a j 10 at g mail dot com. AI: Thank you, Abhiram. I've noted your email as bhiram harad baj at g mail dot com. We'll send the Google Meet invite shortly. Looking forward to speaking with you at 4 PM tomorrow. User: Yeah. That's great. Thank you. AI: You're very welcome, Adesh. If you have any questions before the meeting, feel free to reach out.</p>					
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With the help of **VOICE AI FOR OPTIMIZED DENTAL SCHEDULING**, dental practices can enhance their operations while providing a better experience for their patients. By automating the process of scheduling appointments, confirming them, and sending reminders through natural language processing, dental staff can be freed from tedious administrative tasks, no-shows can be reduced, and the overall experience of the patient can be improved.

In conclusion, the **VOICE AI FOR OPTIMIZED DENTAL SCHEDULING** is not simply a matter of catching up with the times but a step towards a future where practices that leverage this technology will be better positioned to operate more efficiently, communicate more effectively with their patients, and, in turn, enjoy more success.

The assistant's ability to be accessible 24/7 and interact more meaningfully with patients by offering it in multiple languages for appointment scheduling and reminders would also be an asset in accommodating patients with different needs and sensitivities. The security that would come from using a biometric marker, such as the human voice, to identify the patient via voice recognition, would be used to ensure user security for critical requests, such as retrieving one's treatment plans. Creating a holding list and filling canceled appointments automatically with the next patients from the list would be another way to more efficiently schedule calls using waitlisting.

VII. Future Improvements

Imagine a healthcare voice assistant that genuinely gets you, making your healthcare journey smoother and more personal. It would speak your language, helping you schedule appointments and get reminders in the way that's most comfortable for you, no matter where you're from.

Dealing with bills would be a breeze. This assistant could let you make payments right away, taking the stress out of the financial side of things.

Your voice would become your secure ID. Using voice biometrics, the assistant would instantly recognize you, ensuring your health information is kept private and secure when you need to access it.

For busy clinics, this assistant would be a game-changer. It would intelligently manage waitlists, automatically filling canceled appointment slots, so practices run more efficiently and you get seen sooner.

And for healthcare providers, it offers powerful insights. Through advanced data analytics, they'd understand everything from popular call times to common patient questions and reasons for cancellations. This means they can constantly improve their services and give you the best care possible.

9. References

- [1] M. Bapat, H. Gune, and P. Bhattacharyya., “A paradigm-based finite state morphological analyzer for Marathi,” *in press of the 1st Workshop on South and Southeast Asian Natural Language Processing (WSSANLP)*, 26–34, 2020.
- [2] Nivedita Singh, Dr. Diwakar Yagyasen, Mr. Surya Vikram Singh, Gaurav Kumar, Harshit Agrawal, “Voice Assistant Using Python” *International Journal of Innovative Research in Technology*, Vol. 8, Issue July 2021.
- [3] Vishal Kumar Dhanraj, Lokeshkriplani, Semal Mahajan “Research Paper on Desktop Voice Assistant” *International Journal of Research in Engineering and Science (IJRES)* Volume 10 Issue 2022.
- [4] Nil Goksel, Canbek Mehmet, Emin Mutlu. On the track of Artificial Intelligence: Learning with Intelligent Personal Assistant, *proceedings of International Journal of Human Sciences*, 2016.
- [5] Voice assistants are software that understand spoken commands to help users with tasks like answering questions, controlling smart devices, and managing personal organizers. *IJERTV11IS05024*, 2022.
- [6] Kulibaba S, Popereshnyak S, Shcheblanin Y, Kurchenko O, Mazur N. Advanced Communication Model with Voice Control and Increased Security Level. *Cybersecurity Providing in Information and Telecommunication Systems* 2022.
- [7] Priya P, Gopinath B, Mohamed Ashif M, Yadeshwaran HS. AI-Powered Authentication for Smart Home Security A Survey. *In the International Conference on Information and Communication Technology for Intelligent Systems 2023*, Apr 27.
- [8] Schmidt R, Alt R, Zimmermann A. Assistant platforms. *Electronic Markets*, 2023.
- [9] Ahmed SF, Jaffari R, Ahmed SS, Jawaid M, Talbur S. An MFCC-based Secure Framework Voice Assistant Systems. *In 2022 International Conference on Cyber Warfare and Security (ICCWS)* 2022.
- [10] Venkatraman S, Overmars A, Thong M. Smart home automation—use cases of a secure and integrated voice-control system, 2021.
- [11] Huynh-The T, Pham QV, Pham XQ, Nguyen TT, Han Z, Kim DS. Artificial intelligence for the metaverse: A survey. *Engineering Applications of Artificial Intelligence*, 2023.
- [12] Valero C, Pérez J, Solera-Cotanilla S, Vega-Barbas M, Suarez Tangil G, Alvarez-Campana M, López G. Analysis of security and data control in smart personal assistants from the user’s perspective. *Future Generation Computer Systems*, 2023.