IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 15, Issue 1, January 2026

DOI: 10.17148/IJARCCE.2026.15125

HEMO-HUB: AI-Enabled Blood Donation Management System with Voice-Based Text-to-Speech Interaction

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Abstract: Blood donation management systems are critical healthcare applications that ensure the timely availability of safe blood for patients. Most existing systems rely on text-based interfaces, which may limit accessibility during emergencies or for users with visual impairments and low technical literacy. This paper presents an AI-enabled blood donation management system implemented on a localhost platform, integrated with an intelligent voiceover text-to-speech (TTS) module. The proposed system converts system-generated notifications, instructions, and alerts into natural-sounding speech, thereby enhancing accessibility and usability. Unlike cloud-based solutions, the system operates entirely on a local server, making it suitable for small hospitals and blood banks with limited internet dependency. Experimental observations show improved user interaction, faster response to emergency alerts, and reduced operational errors.

Keywords: Blood Donation System, Artificial Intelligence, Text-to-Speech, Multi-Language Voice Assistance, Localhost Platform, Healthcare Applications

I. INTRODUCTION

Blood transfusion services are a vital component of healthcare, requiring efficient coordination between donors, blood banks, and hospitals. Although digital blood donation systems have improved data management and accessibility, most existing platforms rely on text-based and single-language interfaces, which may limit usability during emergencies or for diverse user groups.

To address these limitations, this paper proposes a localhost-based blood donation management system integrated with an AI-powered multi-language voiceover text-to-speech (TTS) module. The system delivers spoken alerts and instructions in the user's preferred language, enhancing accessibility, inclusivity, and emergency responsiveness without cloud dependency.

II. LITERATURESURVEY

Related Work

Several studies have examined the use of automated systems to improve blood donation and transfusion management. Early approaches focused on digitizing donor records and blood inventory using standalone or desktop-based applications. Although these systems reduced manual paperwork, they lacked real-time coordination and scalability.

With the advancement of web technologies, researchers introduced online blood bank management platforms to support donor registration and blood availability search. These systems improved accessibility but continued to depend primarily on visual interfaces and manual user interaction. As a result, their effectiveness during emergency situations remained limited.

Recent developments in healthcare information systems emphasize the role of artificial intelligence in enhancing system usability and user interaction. Text-to-speech technology has been applied in assistive healthcare applications to support visually impaired users and to provide audio-based guidance. However, the application of AI-driven voice assistance in blood donation management systems is still limited, particularly in systems operating on local server environments.

The reviewed literature indicates a lack of integrated solutions that combine blood donation management with multi-language voice-based interaction. This research gap motivates the development of the proposed AI-enabled blood donation management system with voiceover text-to-speech support.

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III. EXISTING SYSTEM

Conventional blood donation management platforms are generally implemented as web or desktop applications that maintain donor details and blood stock information through centralized databases. These systems mainly rely on text-based communication to present notifications and system updates to users.

In most cases, the interaction is limited to a single language and requires continuous visual attention from users. During urgent scenarios, such as emergency blood requests, this dependency on textual alerts may reduce response efficiency and user awareness. Additionally, users with visual impairments or limited familiarity with digital systems may face difficulties while using such platforms.

Furthermore, existing systems typically provide minimal automated assistance and lack intelligent notification mechanisms. Alerts are delivered as static messages without contextual prioritization or adaptive communication. These limitations highlight the need for an enhanced system that supports voice-based, multi-language interaction to improve accessibility and real-time responsiveness.

IV. PROPOSED SYSYTEM

The proposed system is a localhost-based blood donation management platform integrated with an AI-powered multi-language voiceover text-to-speech (TTS) module. It is designed to improve accessibility, user engagement, and emergency responsiveness in blood donation services. The system enables efficient management of donor information, blood inventory, and hospital requests through a centralized local database.

The core feature of the proposed system is the AI voiceover module, which converts system-generated notifications and instructions into spoken output in the user's preferred language. Voice alerts are triggered for critical events such as donor registration confirmation, blood availability updates, and emergency requests, reducing dependence on visual interaction.

The system operates entirely on a local server environment and does not rely on cloud infrastructure, making it suitable for small hospitals and blood banks with limited internet connectivity. By combining multi-language voice assistance with a structured local architecture, the proposed system enhances inclusivity, usability, and real-time awareness in blood donation management.

V. SYSTEM ARCHTECTURE

The proposed system follows a modular localhost-based architecture, as illustrated below.

3.1 Architecture Description

Architecture Components:

1. User Interface Module
Web-based interface for donors, blood bank staff, and administrators
Supports registration, login, blood search, and request submission

2. Local Application Server
Developed using server-side scripting and runs on a localhost environment (XAMPP/WAMP)
Handles business logic and request processing

3. Database Module
Stores donor details, blood inventory, hospital requests, and transaction logs

4. AI Voiceover Text-to-Speech Module
Converts system-generated text into speech
Operates locally without cloud dependency

5. Notification Handler
Triggers voice and text alerts for key events such as successful registration, blood availability, and emergency requests

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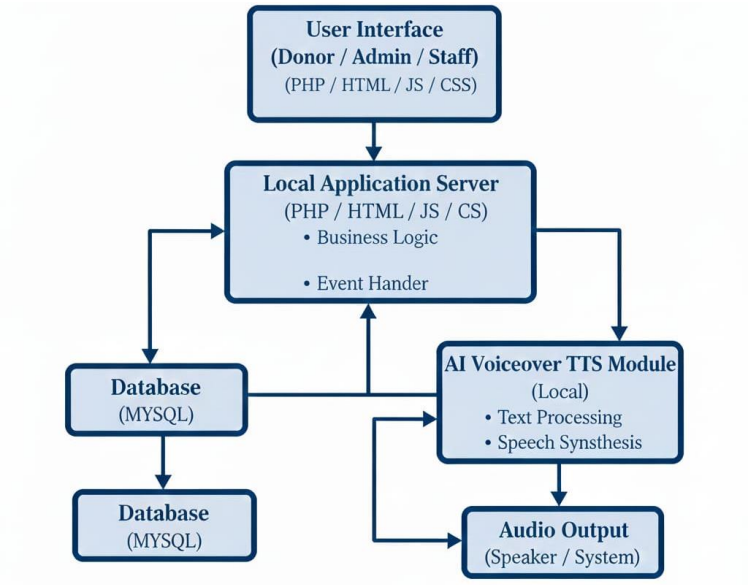

Figure: Flow Diagram

VI. AI VOICE WORKFLOW EXPLANATION

The AI voiceover text-to-speech workflow operates as follows:

1. **Event Trigger**: A system event occurs (e.g., donor registration success, blood stock update, emergency request).
2. **Language Selection**: The system identifies the user's preferred language from profile settings or system defaults.
3. **Text Generation:** The application server generates a contextual message in the selected language.
4. **Text Preprocessing**: The message is formatted for pronunciation, clarity, and linguistic accuracy.
5. **Speech Synthesis:** The AI TTS engine converts the processed text into a natural-sounding audio signal.
6. **Voice Output:** The generated speech is played through the system interface in real time.

This workflow ensures that critical information is communicated instantly in a language familiar to the user, reducing dependency on visual interaction and minimizing misinterpretation.

Algorithm 2: Multi-Language Selection for AI Voice Module

Input: User ID U, System Event E
Output: Spoken Voice Alert in Selected Language

Step 1: Retrieve language preference L for user U
If L is not set
L ← Default language (English)

Step 2: Detect system event E
Examples:
- Registration Success
- Blood Availability Update
- Emergency Request

Step 3: Generate event-specific text T in language L
T ← Language_Message_Map(E, L)
Step 4: Preprocess text T
- Normalize text
- Adjust pronunciation rules for language L

Step 5: Invoke AI Text-to-Speech Engine
Audio A ← TTS_Engine(T, L)
Step 6: Play audio output A
- Deliver through system speaker

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Step 7: Log language and event details
End Algorithm

VII. TECHNICAL METHODOLOGY

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Fig. 1 —Login Page

This Fig. 1 shows the **functional modules of a Blood Bank Management System**. Each button represents a different part of the system.

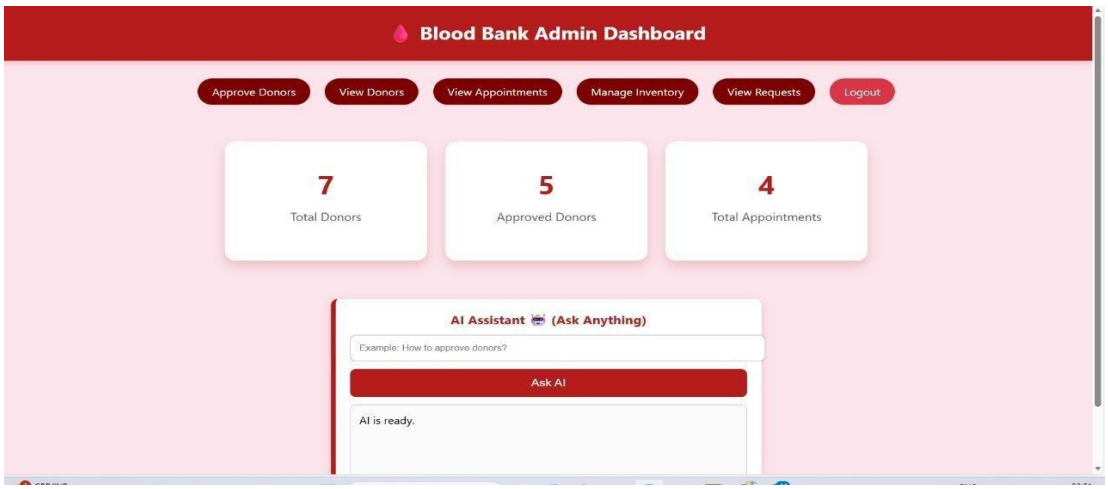

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Fig.2 Blood Bank Admin Dashboard

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The Fig.2 displays the This diagram shows the Blood Bank Admin Dashboard (Home Page) of a Blood Bank Management System. It is the functional overview of the Admin module, where the blood bank administrator monitors and controls all activities.

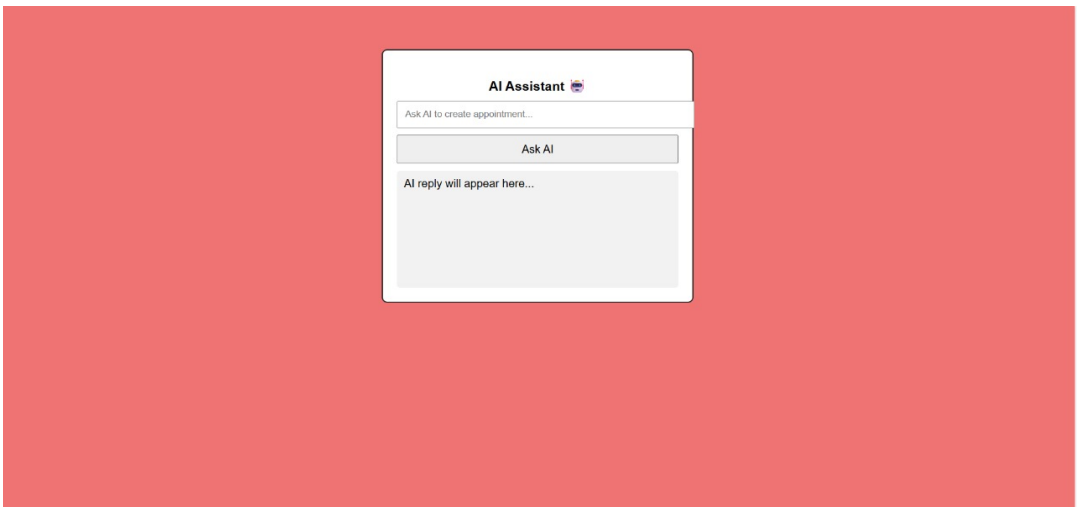

Fig.3 — AI-Assistant – prompt

This Fig.3 shows the This diagram shows the AI Assistant – Prompt Input Page of the system.
It illustrates how the user interacts with the AI Assistant by entering a prompt to get instant responses.

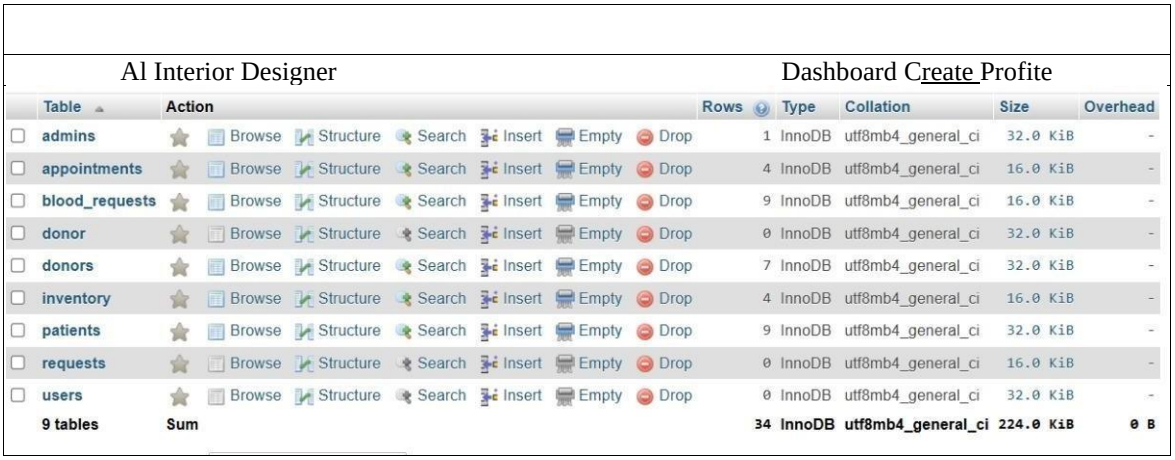

Fig.4 —User Dashboard

The Fig.4 shows the dashboard of User Dashboard / Database Management View of the system.It illustrates a tabular dashboard where different system modules and database tables are managed, along with the actions that can be performed on each.

VIII. CONCLUSION AND FUTURE ENHANCEMENT

This paper presented a localhost-based blood donation management system integrated with an AI-powered multi-language voiceover text-to-speech module. By eliminating cloud dependency and incorporating voice-based interaction in multiple languages, the system significantly enhances accessibility, inclusivity, and emergency responsiveness for diverse user groups.

Future enhancements include integrating speech-to-text functionality for complete voice-based interaction, expanding support for additional regional languages, and improving speech naturalness using advanced neural TTS models.

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REFERENCES

[1]. World Health Organization, "Blood Safety and Availability." Available: https://www.who.int/health-topics/blood-safety

[2]. S. K. Saha and A. K. Das, "Design and Implementation of a Web-Based Blood Bank Management System," International Journal of Computer Applications, vol. 97, no. 6, 2014. Available: https://www.ijcaonline.org/archives/volume97/number6/17033-7205

[3]. P. Kumar and R. Singh, "Online Blood Bank Management System," International Journal of Engineering Research and Technology (IJERT), vol. 4, no. 5, 2015. Available: https://www.ijert.org/online-blood-bank-management-system

[4]. M. R. Alam and M. M. Rahman, "Web-Based Healthcare Information System Using PHP and MySQL," International Journal of Advanced Research in Computer Science, vol. 8, no. 5, 2017. Available: https://www.ijarcs.info/index.php/Ijarcs/article/view/3389

[5]. R. Miotto et al., "Deep Learning for Healthcare: Opportunities and Challenges," Briefings in Bioinformatics, vol. 19, no. 6, 2018. Available: https://academic.oup.com/bib/article/19/6/1236/3764555

[6]. S. King, "An Introduction to Text-to-Speech Synthesis," Foundations and Trends in Signal Processing, vol. 3, no. 1, 2009. Available: https://www.cambridge.org/core/journals/foundations-and-trends-in-signal-processing/article/introduction-to-texttospeech-synthesis/

[7]. P. Taylor, Text-to-Speech Synthesis, Cambridge University Press, 2009. Available: https://www.cambridge.org/core/books/texttospeech-synthesis/

[8]. A. Pradhan and K. Mehta, "Assistive Voice-Based Systems for Healthcare Applications," IEEE Access, vol. 7, 2019. Available: https://ieeexplore.ieee.org/document/8664691

[9]. World Wide Web Consortium (W3C), "Speech Synthesis Markup Language (SSML) Version 1.1." Available: https://www.w3.org/TR/speech-synthesis11/

