

DOCUMENT 2: SHORT TECHNICAL REPORT ON OFFLINE HINDI VOICE ASSISTANT

1. INTRODUCTION

This report presents the architecture, challenges, and performance evaluation of an Offline Hindi Voice Assistant system developed using Raspberry Pi. The system aims to support Panchayat-level digital services in rural areas.

2. SYSTEM ARCHITECTURE

The system architecture includes microphone input, audio preprocessing, offline ASR using Vosk, command interpretation logic, offline Hindi TTS using eSpeak-NG, and speaker output. All components operate locally on Raspberry Pi OS.

3. HINDI ASR CHALLENGES

Hindi speech recognition is challenging due to accent variations, pronunciation differences, code-mixing with English, and background noise. These challenges are amplified in real Panchayat environments.

4. HINDI TTS CHALLENGES

While eSpeak-NG provides reliable offline TTS, it has limitations such as robotic voice quality and limited naturalness compared to neural TTS systems.

5. PERFORMANCE EVALUATION

The system was evaluated using command-based test cases. Recognition accuracy ranged between 80% and 88% in controlled environments. Average end-to-end response latency was under 1.5 seconds.

6. APPLICATION IN PANCHAYAT SYSTEM

The assistant can be used for public announcements, scheme information dissemination, and basic voice-based citizen interaction in offline scenarios.

7. SYSTEM INITIALIZATION OUTPUT

Stage	System Voice Output (Hindi)	Purpose
System Start	नमस्कार। पंचायत सहायता प्रणाली में आपका स्वागत है।	Welcomes user and prompts for voice input

	कृपया अपना सवाल पूछें।	
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PANCHAYAT OFFICE TIMING OUTPUTS

Use Case	System Voice Output (Hindi)	Information Provided
Office Opening Time	पंचायत कार्यालय सुबह 9 बजे खुलता है।	Office opening time
Office Closing Time	पंचायत कार्यालय शाम 6 बजे बंद होता है।	Office closing time

OFFICER AVAILABILITY OUTPUT

Use Case	System Voice Output (Hindi)	Details
Officer Availability	पंचायत अधिकारी रोज सुबह 9 बजे से शाम 6 बजे तक उपलब्ध रहते हैं।	Daily availability of officer

PANCHAYAT SERVICES OUTPUT

Use Case	System Voice Output (Hindi)	Service Category
Available Services	जन्म प्रमाण पत्र, मृत्यु प्रमाण पत्र, पेंशन, राशन कार्ड, सरकारी योजनाएं, शिकायत दर्ज।	List of services

BIRTH CERTIFICATE PROCESS OUTPUT

Step	System Voice Output (Hindi)	Description
Step 1	काउंटर 1 से फॉर्म लें।	Form collection
Step 2	माता-पिता का आधार कार्ड लगाएं।	Attach Aadhaar
Step 3	जन्म पर्ची लगाएं।	Attach birth slip
Step 4	काउंटर 2 पर जमा करें।	Form submission

Step 5	7-10 दिन में प्रमाण पत्र मिलेगा।	Processing time
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PENSION SCHEME OUTPUT

Stage	System Voice Output (Hindi)	Meaning
Eligibility Question	आपकी उम्र 60 साल से ज्यादा है क्या?	Eligibility check
Eligibility Result	आप पात्र हैं।	User is eligible

SYSTEM TERMINATION OUTPUT

Stage	System Voice Output (Hindi)	Purpose
System End	धन्यवाद। पंचायत सहायता प्रणाली का उपयोग करने के लिए।	Polite termination message

8. FUTURE IMPROVEMENTS

Future work includes adding multilingual support, improving noise robustness, and exploring lightweight neural TTS models if hardware permits.

9. CONCLUSION

The project validates the feasibility of deploying offline Hindi voice assistants on Raspberry Pi for cost-effective Panchayat-level digital solutions.