

# 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**

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

#### **SYSTEM TERMINATION OUTPUT**

<b>Stage</b>	<b>System Voice Output (Hindi)</b>	<b>Purpose</b>
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.