

# Smart Weather Voice Assistant – A Voice-Integrated Weather Forecasting Application

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**Abstract**—Weather is a critical factor in daily decision-making, especially for vulnerable communities including the differently-abled. Existing weather apps predominantly rely on graphical user interfaces, often creating accessibility barriers. This paper presents a Smart Weather Voice Assistant—an inclusive and real-time voice-integrated system that empowers users through spoken weather and air quality updates. Built using Python and Streamlit, and powered by APIs such as OpenWeatherMap, OpenCage Geocoder, and AirVisual, the system integrates Google Text-to-Speech (gTTS) for converting weather data into natural speech. By enabling IP-based geolocation, screen-reader-friendly UI, and low-resource deployment, this assistant bridges the accessibility gap and supports proactive environmental awareness.

**Index Terms** – Voice Assistant, Weather Forecasting, Accessibility, Streamlit, gTTS, Real-time APIs, Differently-abled Users, Air Quality, IP Geolocation.

## I. INTRODUCTION

Modern life is increasingly influenced by real-time data, and weather forecasting is no exception. Despite the availability of various weather applications, a large segment of the population—especially those who are visually impaired or differently-abled—face difficulty accessing vital information due to visually dominant interfaces. The digital divide in accessibility is particularly critical during weather emergencies, where spoken alerts can be life-saving.

To address this gap, we propose the Smart Weather Voice Assistant, which provides real-time weather and air quality information using voice output. The system is designed to detect the user's location automatically via IP, retrieve weather and pollution data using APIs, and communicate the information through speech. The voice-first interface is deployed using Streamlit, ensuring ease of use, minimal setup, and compatibility with assistive technologies.

## II. LITERATURE REVIEW / PREVIOUS STUDY

Recent studies have highlighted the growing need for inclusive weather solutions.

- Kaur and Sharma (2020) designed an AI-based voice forecasting tool but lacked air quality insights and relied on static input.
- Suresh and Chandrasekaran (2022) proposed a Python-based system integrating weather APIs but was restricted to desktop use and manual input.
- Patel and Gupta (2019) emphasized the effectiveness of speech-enabled interfaces in assisting visually impaired users.
- Swetha et al. (2021) introduced a basic voice weather assistant but lacked dynamic location detection and alert systems.
- Kumar and Jayanthi (2022) advocated for accessible environmental systems, underscoring the urgency for voice-activated, inclusive designs.

This paper extends existing work by incorporating geolocation, real-time pollution metrics, and voice alerts via a lightweight deployment model.

## III. PROBLEM STATEMENT

While weather apps are abundant, they often exclude users who require auditory interaction. The challenges include:

- Lack of automated spoken alerts.
- No IP-based location detection, requiring manual inputs.
- Complex visual dashboards unsuitable for screen readers.
- High resource requirements for installation and use.

These limitations restrict accessibility during emergencies and everyday use for the differently-abled. Thus, there is a need for a lightweight, voice-enabled, geolocation-based weather assistant with support for real-time alerts and compatibility with assistive technologies.

#### IV. PROPOSED SYSTEM

The Smart Weather Voice Assistant is designed as an accessible, voice-first application that delivers weather and air quality data in real-time. Key features include:

- **Location Auto-Detection:** Using OpenCage Geocoder API, it identifies user location via IP.
- **Real-Time Data Retrieval:** Weather and pollution data fetched from OpenWeatherMap and AirVisual APIs.
- **Text-to-Speech:** gTTS converts textual content into spoken language.
- **Accessible UI:** Built using Streamlit, the interface is screen reader-friendly and lightweight.
- **Spoken Alerts:** In critical conditions (e.g., poor air quality), voice alerts are automatically played.

This modular architecture ensures that users, regardless of disability or technical literacy, can access essential environmental updates hands-free.

#### V. TECHNOLOGIES USED

The system combines multiple technologies:

- **Python:** The core programming language for backend logic.
- **Streamlit:** A fast, open-source Python framework for web apps, suitable for accessibility.
- **gTTS (Google Text-to-Speech):** For converting textual information into spoken output.
- **OpenWeatherMap API:** Provides weather parameters like temperature, wind, humidity, and conditions.
- **OpenCage Geocoder API:** Converts IP address to latitude and longitude.
- **AirVisual API:** Supplies real-time air quality index and health recommendations.

These tools work together to create a low-resource, accessible, and responsive application.

#### VI. SYSTEM ARCHITECTURE

The architecture comprises four primary modules:

**Location Detection:** Uses IP address with OpenCage to obtain geolocation.

**Data Aggregation:** Calls OpenWeatherMap and AirVisual APIs using location coordinates.

**Audio Generation:** Combines retrieved data and converts it into speech using gTTS.

**Frontend Display & Interaction:** The Streamlit app shows readable text for screen readers and plays audio alerts.

#### System Architecture of Smart Weather Voice Assistant

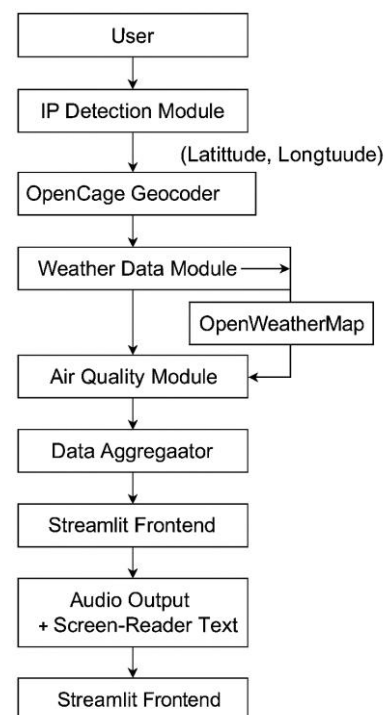


Fig.1.1 System Architecture

The pipeline ensures continuous feedback, even in low-bandwidth environments, and minimizes the need for user input.

#### VII. RESULTS AND DISCUSSION

Testing was conducted across various network conditions and devices. Key observations include:

- **Accuracy:** The weather and pollution data matched standard forecasts.
- **Clarity:** The voice output was clear and effective, even in moderately noisy areas.
- **Performance:** The application consumed minimal resources and ran smoothly on low-spec laptops.
- **User Feedback:** Visually impaired testers appreciated the voice-first interaction, especially during mock emergency alerts.

These results validate the system's usability and practical benefits, especially for accessibility-focused deployment.

## VIII. FUTURE ENHANCEMENTS

To make the system more robust and far-reaching, future upgrades will include:

Multilingual Voice Output: Support for Indian regional languages. Mobile App Version:

Using React Native for Android/iOS platforms.

Alert Expansion: Integration with email/SMS notifications.

Data Visualization: Charts for historical trends, weather maps, and radar overlays.

User Feedback Module: To continuously gather and implement suggestions from end-users.

These enhancements will further solidify the application's usability and social impact.

## IX. CONCLUSION

The Smart Weather Voice Assistant bridges a critical gap in digital weather solutions by offering a voice-centric, inclusive, and accessible tool. Its design accommodates the needs of differently-abled users and performs reliably even under hardware and bandwidth constraints. Through geolocation, real-time APIs, and natural voice responses, the assistant empowers all users—especially the underserved—to stay informed and safe. As climate unpredictability rises, inclusive systems like this become vital public resources.

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