

**Project Report  
On**

**VocalMart: A Talking  
Inventory Management AI Assistant**



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# Introduction

Inventory management forms the backbone of any business involving goods, whether in retail, wholesale, or manufacturing sectors. Traditional inventory tracking methods involve manual counting, spreadsheets, and point-of-sale integrations, which are often tedious, error-prone, and inefficient. With advancements in Artificial Intelligence (AI) and Natural Language Processing (NLP), integrating a voice-controlled assistant for inventory management significantly optimizes these processes, reducing manual effort and minimizing human errors.

This project explores the development of a voice-driven inventory management system utilizing Kivy for frontend design, SQLite for database management, OpenAI APIs for natural language understanding, and ElevenLabs API for text-to-speech services. The solution is designed to assist small to medium enterprises in managing stock efficiently using simple voice commands.

By allowing users to interact naturally through speech, the system removes the need for technical knowledge or training, making it highly accessible for local shopkeepers and non-technical users. This not only enhances ease of use but also promotes digital adoption among businesses that may otherwise find traditional systems intimidating or complex.

Furthermore, the system supports bilingual interaction, enabling commands in both English and Hindi, ensuring inclusivity and practicality in an Indian business context. The ability to generate real-time reports, automate daily stock tasks, and provide audio responses creates a seamless experience that brings the benefits of AI to the grassroots level of commerce.

## Problem Statement

Inventory management is an essential part of any business that deals with goods, but for many small and medium enterprises, the current tools available are either too complex or too outdated. The most common methods like manual stock counting, Excel spreadsheets, or basic POS software are not only time-consuming but also highly prone to errors. These limitations can result in incorrect stock levels, missed sales opportunities, and even financial losses, especially in fast-moving retail environments.

On top of that, there is a noticeable gap in accessibility. Most inventory systems are built for users who are familiar with digital tools or can afford technical training. However, many local shopkeepers and small business owners, especially in developing regions, lack the digital literacy or resources to use such systems efficiently. This creates a barrier between them and the operational benefits that modern technology could otherwise provide.

### Key Problems Identified:

- **Manual Processes Are Inefficient:**  
Traditional inventory management methods involve repetitive tasks that slow down daily operations and increase the risk of human error.
- **High Dependence on Technical Skills:**  
Many software solutions assume users are familiar with computers, spreadsheets, or accounting tools — which alienates a large portion of small business owners.
- **Language and Literacy Barriers:**  
Most tools are English-centric and text-based, making them inaccessible to shopkeepers who are more comfortable with local languages or who have limited literacy.
- **No Real-Time Reporting:**  
Without automated systems, generating daily or weekly reports is either skipped or done manually, which can delay decision-making and cause stock imbalances.
- **Paper-Based Tracking is Outdated:**  
Maintaining paper records is not only environmentally unfriendly but also harder to back up, share, or analyze compared to digital formats.
- **Lack of Personalization or Flexibility:**  
Existing systems often don't adapt to the working style of small shop owners — they force them to fit into rigid templates

## Project objectives:

The primary goal of this project is to design and implement a voice-driven inventory management system that simplifies operations for small business owners, particularly those with limited digital skills. By leveraging modern AI tools and user-centric design principles, this solution aims to make inventory handling faster, smarter, and more accessible for everyone especially local shopkeepers who are often left behind in the digital shift.

### The specific objectives of the project are:

- **Develop a voice-activated inventory management system:**  
Build a system where users can interact with the assistant using voice commands instead of typing or clicking, making the experience hands-free and intuitive.
- **Enable natural language interaction for key functions:**  
Integrate NLP to allow users to perform tasks like checking stock levels, adding or updating stock, generating sales reports, and querying the database using natural everyday language.
- **Provide real-time feedback using speech synthesis:**  
Incorporate text-to-speech responses so that the assistant can confirm actions, notify errors, and guide the user audibly, creating a truly conversational experience.
- **Ensure system scalability and adaptability for future enhancements:**  
Design the system in a modular way so that new features like barcode scanning, multilingual support, or cloud integration can be added easily in the future.
- **Maintain a user-friendly, lightweight, and efficient frontend interface:**  
Use tools like Kivy to create a simple yet functional GUI that works smoothly even on low-end systems, ensuring accessibility across a wide range of hardware.

## Technologies Used:

Technology	Purpose & explanation
Python	Serves as the core programming language, offering flexibility, simplicity, and strong library support for building the entire system logic.
Kivy	Used for frontend development to create a lightweight, touch-friendly graphical user interface (GUI) that runs seamlessly across platforms.
SQLite	A lightweight, embedded database used to store inventory, sales, and user data locally without the need for an external server.
OpenAI API	Powers the natural language understanding (NLU) by interpreting user voice input and converting it into appropriate database queries or responses.
ElevenLabs API	Converts text responses into human-like speech, allowing the system to communicate results and confirmations back to the user in a natural way.
Pandas	Handles data processing and enables easy export of inventory and sales data to Excel spreadsheets for further analysis.
FPDF	Used to generate downloadable PDF reports of inventory summaries, sales records, or query results, providing users with printable documentation.

## Methodology

### 1. Problem Understanding & Planning:

We began by identifying the common struggles of local shopkeepers , managing inventory, billing, and lack of digital tools and planned a voice-enabled AI solution.

### 2. Technology Stack Selection:

We chose Python for backend development, Kivy for GUI, SQLite for local database storage, ElevenLabs API for text-to-speech, and OpenAI's API for NLP.

### 3. Modular Architecture Design:

The project was divided into modules like Voice Input, NLP-based Chatbot, Sales Reporting, and PDF Export. Each module was built and tested independently.

### 4. Database & Inventory Integration:

We used SQLite to store product details, stock levels, and sales records, with automatic updates triggered by chatbot commands or user inputs.

### 5. Voice & Chat Functionality:

User speech was converted to text, interpreted by AI for intent, and responded back using ElevenLabs voice synthesis ,creating a natural assistant experience.

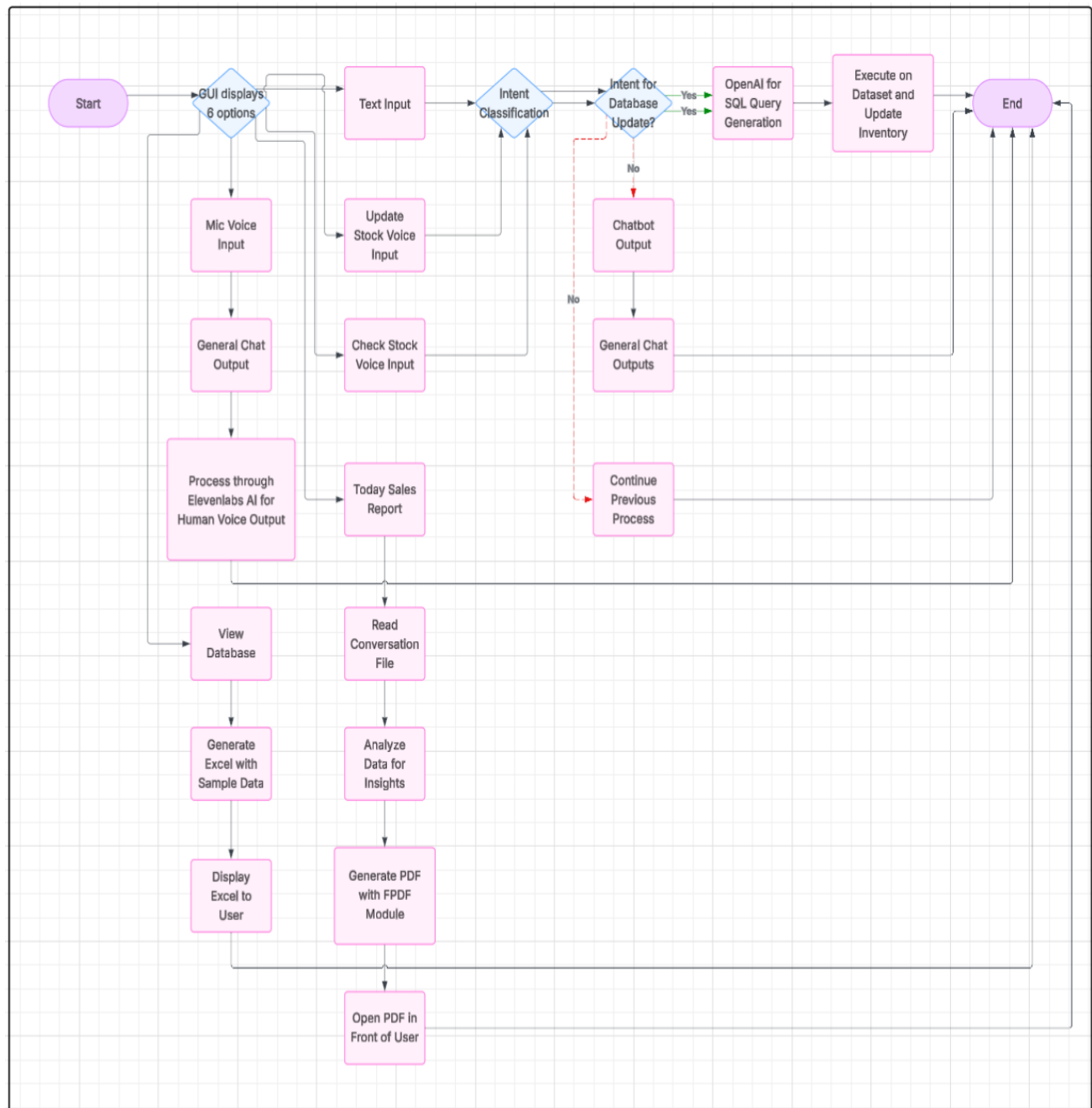
### 6. UI/UX Design:

A simple, one-screen interface was designed with Kivy to minimize user confusion and provide quick access to essential functions like viewing inventory or exporting reports.

### 7. Testing & Iteration:

The system was iteratively tested with various inputs and scenarios, including invalid commands, and multi-step queries, to improve reliability and user-friendliness.

## System Design and Architecture (Workflow):



## Process Steps:

### 1) GUI-Based Option Selection:

Upon launching the assistant, the user is presented with a GUI displaying 8 core options such as stock update, sales report, and chat with the assistant — offering a user-friendly entry point.

### 2) Dual Input Modes – Text and Voice:

Users can interact via voice (mic input processed by ElevenLabs AI) or text. Both input modes are directed toward intent detection to identify the user's requirement.

### 3) Intent Classification & Action Routing:

The system uses Open AI-powered NLP to classify the intent of input — whether it's a database update, general query, or analytics request — and routes it to the appropriate module.

### 4) SQL Query Generation via Open AI + Action Execution:

If the intent involves database updates (like stock changes or sales logging), the assistant generates corresponding SQL commands using OpenAI and executes them on the SQLite database.

### 5) Data Output & Reporting Modules:

Users can view real-time stock status, export Excel sheets with sample data, and generate dynamic PDF reports using the FPDF module based on conversation history and insights.

### 6) Multimodal Feedback System:

All outputs, whether general queries or data insights, are presented visually on screen and vocally using ElevenLabs' lifelike voice, ensuring accessibility even for non-tech users.

### 7) Looping and Continuation Flow:

If the chatbot output doesn't match a defined function, it loops back to the chat flow and allows the user to continue with previous processes — making the system adaptive and seamless.



## Working Model

The voice assistant processes user commands through the following workflow:

- 1. Voice Input:** The user presses the mic button and issues a voice command.
- 2. Speech Recognition:** Captured audio is converted to text.
- 3. Command Interpretation:**
  - Check stock commands (e.g., "How much sugar is left?").
  - Update stock commands (e.g., "Sold 5 packets of flour.").
  - View today's report.
  - View full database.
- 4. Database Interaction:** Based on classified intent, appropriate SQL queries are executed.
- 5. Feedback:**
  - Text response shown on the interface.
  - Audio feedback using ElevenLabs TTS.
- 6. Export:** Sales reports generated as PDFs; Inventory exported to Excel.

## Sample Voice Commands & Assistant Responses

- User Command: "How much wheat do we have?"  
Assistant Response: "You currently have 12 kilograms of wheat."
- User Command: "Sold 3 packets of biscuits."  
Assistant Response: "Inventory updated successfully!"
- User Command: "Show today's sales report."  
Assistant Response: "Today's report generated and opened."
- User Command: "Add 10 liters of milk to stock."  
Assistant Response: "Inventory updated successfully!"
- User Command: "Check how many rice bags are left."  
Assistant Response: "You have 5 bags of rice remaining."

These voice command examples demonstrate the real-world usability of the assistant in a retail or inventory-focused environment. The system is designed to interpret natural language inputs and respond with clear, accurate, and context-aware outputs — whether it's checking stock, updating inventory, or generating reports. This interaction model not only saves time but also allows even non-technical users to manage complex tasks with ease, promoting digital efficiency and reducing operational workload. The ability to interact through simple speech makes the system highly accessible and practical for daily business operations.

## Benefits

- i) **Hands-Free Operation:**  
Users can manage stock using just their voice, eliminating the need for typing or navigating complex menus — ideal for busy shopkeepers managing multiple tasks simultaneously.
- ii) **Fast and Efficient Inventory Updates:**  
Inventory can be updated instantly through simple voice commands, reducing time spent on manual entries and ensuring records remain accurate and up to date.
- iii) **Easy Access to Reports and Stock Status:**  
Users can request sales summaries, stock availability, or restocking alerts using natural language and receive immediate verbal or visual feedback.
- iv) **Reduced Stock-Outs and Overstocking:**  
Real-time data helps prevent situations where products either run out unexpectedly or are overstocked, improving customer satisfaction and storage efficiency.
- v) **Smarter Decision-Making with Real-Time Insights:**  
The assistant provides instant data retrieval and analytics, empowering business owners to make timely and informed decisions about purchasing, pricing, and promotions.
- vi) **Time and Cost Savings:**  
Automation of daily inventory tasks drastically reduces manual labor and paperwork, allowing small businesses to cut down operational costs and focus more on growth.
- vii) **Increased Accessibility for Non-Technical Users:**  
Designed with simplicity in mind, this system makes inventory management approachable for users with little to no technical or language expertise — encouraging broader digital adoption.
- viii) **Scalable for Future Enhancements:**  
Built with modular architecture, the system can be easily extended to include features like barcode scanning, cloud sync, multilingual support, or mobile integration.

## Challenges Faced

Developing a voice-enabled inventory management system posed several real-world technical and user experience challenges. While the concept aims to simplify interactions, ensuring smooth and reliable communication between the user, AI services, and the database required careful attention to detail across both backend logic and frontend design. Here are some of the key hurdles encountered during development:

- **Ensuring Accurate Speech Recognition Across Different Accents**

Accents, pronunciation variations, and background noise made it difficult for the system to always capture voice commands correctly, requiring tuning and fallback mechanisms.

- **Handling Network Failures During API Calls**

Since the system relies on external APIs like OpenAI and ElevenLabs, unstable internet connections occasionally disrupted functionality, demanding retry logic and offline modes.

- **Designing an Intuitive Yet Powerful GUI with Kivy**

Balancing simplicity for non-technical users with the need for multiple features and status updates required careful design iterations within Kivy's constraints.

- **Synchronizing Database Updates with Real-Time Voice Responses**

Ensuring that inventory changes were accurately reflected in the database before the assistant confirmed the action to the user involved managing concurrency and data integrity.

- **Managing Session States Between Commands**

Keeping track of context between multiple user commands in a session (e.g., "Add 5 kg" after "Add wheat") was complex and required memory handling and session design.

## Future Enhancements

**i) Integration with Barcode/RFID Scanning**

Adding barcode and RFID support will allow faster and more accurate product identification, simplifying tasks like adding or verifying inventory items.

**ii) Mobile Application Version (Android/iOS Compatibility)**

A mobile app version would bring flexibility and mobility, letting shopkeepers manage their stock directly from their smartphones, even when away from their shop.

**iii) Voice Biometrics for User Authentication**

Implementing voice-based user authentication can enhance security by ensuring that only authorized individuals can access or modify sensitive inventory data.

**iv) Predictive Analytics for Demand Forecasting**

Using AI-driven analytics, the system can predict future stock requirements based on past sales data, seasonal trends, and customer behavior, reducing stock-outs and overstocking.

**v) Multilingual Voice Support**

Supporting multiple regional and global languages would make the assistant more inclusive and usable by a wider audience, especially in diverse local markets.

**vi) Dashboard for Graphical Sales and Stock Insights**

A visual dashboard can provide real-time graphs, charts, and summaries, giving users quick insights into sales trends, inventory health, and overall performance.

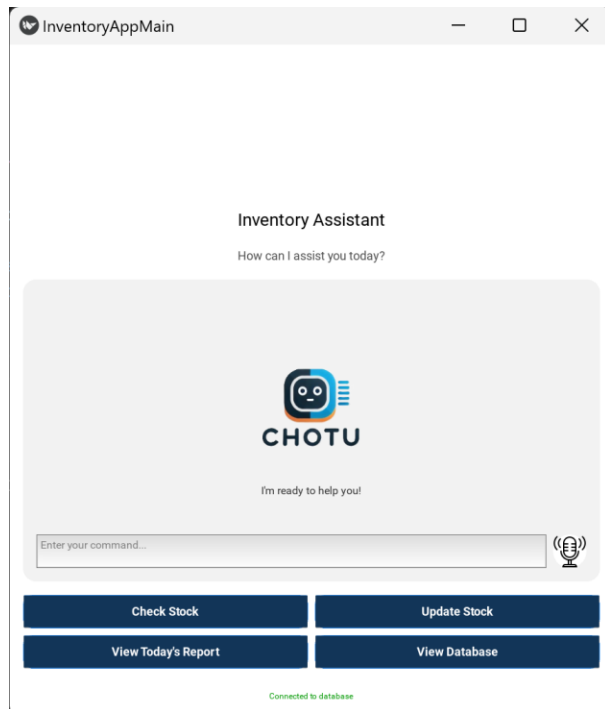
**vii) Cloud Database Migration for Multi-Device Access**

Moving to a cloud-based database would enable seamless access and synchronization across multiple devices, improving collaboration and business continuity.

These future enhancements aim to make the system even more powerful, scalable, and accessible to small business owners. As technology evolves, integrating these features will not only improve functionality but also extend the impact of AI into local markets where such innovation is just beginning to take root. The vision is to transform this assistant into a complete, intelligent business companion that grows with the user's needs.

## Outputs :

- Frontend GUI with kivy



- Conversation between assistant and user

```

conversation_log.txt
1  User: 10 notebooks sold
2  Assistant: Inventory updated successfully! 2025-04-29, 20:04:54, Tuesday
3  User: 10 kilo Aalu Bik Gaye
4  Assistant: Inventory updated successfully!2025-04-29,20:05:18,Tuesday
5  User: 2 kg paneer sold
6  Assistant: Inventory updated successfully!2025-04-29,20:06:02,Tuesday
7  User: one bottle of soft drink soul
8  Assistant: Inventory updated successfully!2025-04-29,20:06:49,Tuesday
9  User: hello my name is
10 Assistant: Hello! How can I assist you today?
11 User: can you tell me my name
12 Assistant: I don't have your name at the moment. Could you please tell me your name?
13 User: hello my name is Kunal
14 Assistant: Nice to meet you, Kunal! How can I assist you today?
15 User: aaj ka din bahut bekar hai main bahut Pareshan hun
16 Assistant: Mujhe sun kar afsos hua, Kunal. Aapko pareshani kis baat ki hai? Shayad main madad kar sakoon.
17 User: Nahin Nahin Koi Nahin
18 Assistant: Samajh gaya. Agar aapko kabhi baat karni ho ya kisi bhi tarah ki madad chahiye ho, toh zaroor batayein. Kya aapko kisi aur cheez ke baare mein jaan na hai?
19 User: can you recall my name
20 Assistant: Yes, your name is Kunal. How can I assist you today?
21 User: ok thank you for today I am closing the program
22 Assistant: You're welcome, Kunal! If you need assistance in the future, feel free to reach out. Have a great day!

```

- Today's sales report pdf(according to the conversation)

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**\*\*Sales Report\*\***

Date: 2025-04-29

1. **\*\*Item:\*\*** Notebooks

**\*\*Quantity Sold:\*\*** 10

**\*\*Time of Sale:\*\*** 20:04:54

2. **\*\*Item:\*\*** Aalu

**\*\*Quantity Sold:\*\*** 10 kg

**\*\*Time of Sale:\*\*** 20:05:18

3. **\*\*Item:\*\*** Paneer

**\*\*Quantity Sold:\*\*** 2 kg

**\*\*Time of Sale:\*\*** 20:06:02

4. **\*\*Item:\*\*** Soft Drink

**\*\*Quantity Sold:\*\*** 1 bottle

**\*\*Time of Sale:\*\*** 20:06:49

**\*\*Summary:\*\***

Total Number of Sales: 4

Most Selling Item: Notebooks (10 sold)

Lowest Selling Item: Soft Drink (1 bottle sold)

- Viewing dataset button usage

The screenshot shows a Kivy IDE window with a Python file named `frontend.py` open. The code defines a `RoundedButton` widget with an `__init__` method. A small window titled `InventoryAppMain` is also visible. Below the IDE, a Microsoft Excel spreadsheet is open, displaying a dataset of inventory items. The spreadsheet has columns for `id`, `name`, `quantity`, and `unit`. The data includes items like apples, bananas, tomatoes, potatoes, onions, carrots, lemons, rice, wheat, sugar, salt, turmeric, lentils, chickpeas, milk, and curd.

	A	B	C	D	E	F	G	H	I	J	K
1	id	name	quantity	unit							
2	505	apples	10	kg							
3	506	bananas	30	dozen							
4	507	tomatoes	25	kg							
5	508	potatoes	100	kg							
6	509	onions	80	kg							
7	510	carrots	40	kg							
8	511	lemons	15	kg							
9	512	rice	199	kg							
10	513	wheat	150	kg							
11	514	sugar	90	kg							
12	515	salt	50	kg							
13	516	turmeric pc	20	kg							
14	517	lentils	60	kg							
15	518	chickpeas	40	kg							
16	519	milk	90	liters							
17	520	curd	40	kg							



## Conclusion

The voice-activated inventory management system presents a modern, efficient solution to traditional stock management challenges. By leveraging AI, NLP, and voice technology, it enhances accuracy, reduces manual workload, and provides a seamless, user-friendly experience. With planned future improvements, the system holds the potential to become a comprehensive smart inventory assistant for businesses of all sizes.

## References

- OpenAI Documentation - <https://platform.openai.com/docs>
- Kivy Documentation - <https://kivy.org/doc/stable/>
- ElevenLabs Text-to-Speech API - <https://elevenlabs.io/>
- SQLite Documentation - <https://sqlite.org/index.html>
- Pandas Documentation - <https://pandas.pydata.org/>