Marwadi University Marwadi Chandarana Group NAAC A+	**Marwadi University** **Faculty of Engineering & Technology** **Department of Information and Communication Technology**	
Subject: Capstone	**Aim: Ideation and stakeholder need analysis - Intermediate Review**	
Submission-2	**Date:**	**Enrollment No: 92200133044**

Ideation and Stakeholder Needs Analysis – Intermediate Review

1. Introduction

The growing use of voice as a biometric and digital resource has highlighted the need for reliable tools to manage, search, and compare audio recordings. Many institutions such as law enforcement, research laboratories, and service industries rely on voice data but face challenges in handling it effectively. This project, titled **Voice Data Management & Matching Application**, has been conceptualized to provide a simple yet practical system for voice storage, retrieval, and verification.

The application integrates feature extraction, similarity analysis, and a web-based interface, offering an accessible and affordable solution. This review focuses on the ideation process and the analysis of stakeholder needs, ensuring that the project aligns with real-world requirements.

2. Stakeholder Identification

The key stakeholders for this project include:

- **Law Enforcement and Forensic Teams** – Require accurate voice verification for suspect identification.
- **Banks and Call Centers** – Need low-cost, quick, and secure voice authentication to reduce fraud.
- **Academic Researchers** – Interested in speech data analysis and speaker verification experiments.
- **End Users (General Public)** – May benefit indirectly through improved security in services and transactions.

3. Needs Analysis

1. **Data Management** – A centralized system to store and manage multiple voice files securely.
2. **Search and Retrieval** – Fast searching and filtering of voice recordings.
3. **Verification and Matching** – Ability to compare two or more samples with reasonable accuracy.
4. **User-Friendly Interface** – Simple web interface accessible to non-technical users.
5. **Cost-Effectiveness** – Open-source, low-maintenance system without expensive licenses.
6. **Security and Privacy** – Protection of sensitive biometric data with user consent and deletion options.

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4. Problem Statement

Current ICT solutions for voice verification face three main challenges:

- Difficulty in managing medium-sized voice datasets.
- Lack of open-source, lightweight tools for voice matching.
- Security and operational risks in domains where reliable voice authentication is critical.

This project aims to address these gaps by offering a single application that integrates storage, search, and similarity detection in a cost-effective and user-friendly manner.

5. Solution Ideation

The proposed solution is a **Voice Data Management & Matching Application** with the following features:

- **Frontend**: Streamlit-based interface for uploading, searching, and comparing samples.
- **Backend**: Python and SQLite for local storage and metadata management.
- **Signal Processing**: MFCC-based feature extraction using Librosa.
- **Comparison Methods**: Cosine similarity and Dynamic Time Warping (DTW).
- **Utilities**: File handling, logging, and data export options.

This design was chosen because it is lightweight, cost-efficient, and meets the core needs of identified stakeholders.

6. Relevance to ICT Domain

The project is relevant to the ICT field in several dimensions:

- **Artificial Intelligence & Machine Learning** – Application of signal processing and similarity algorithms.
- **Software Development** – Integration of frontend, backend, and database technologies.
- **Data Analytics** – Feature extraction, quantitative evaluation, and performance measurement.
- **Information Security** – Ethical handling of biometric data.

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7. Feasibility Analysis

Technical Feasibility

- Tools: Python, Streamlit, Librosa, NumPy, SQLite.
- The required libraries are free and widely available.

Economic Feasibility

- The system is built entirely on open-source platforms with no licensing costs.

Ethical and Privacy Considerations

- As voice is sensitive biometric data, the project includes user consent, deletion options, and plans for database encryption.

8. Market and User Needs Analysis

The market analysis shows a growing interest in low-cost biometric verification tools:

- **Law Enforcement Agencies** require affordable forensic tools.
- **Call Centers and Banks** need fraud detection systems that reduce operational costs.
- **Research Institutions** require lightweight and customizable platforms.

This project fills the gap for institutions that cannot afford proprietary or large-scale voice recognition systems.

9. Literature Review

- Traditional biometrics such as fingerprint and facial recognition dominate in practice, while voice-based systems are less standardized.
- Academic studies highlight MFCC and DTW as strong methods for speaker verification.
- Industrial solutions exist but are costly and resource-intensive.
- The proposed project leverages proven techniques (MFCC, DTW, cosine similarity) in an open-source environment suitable for academic and small-scale use.

10. Conclusion

This intermediate review highlights the ideation and stakeholder needs analysis for the Voice Data Management & Matching Application. The project addresses practical gaps in existing solutions by combining storage, search, and verification features into a lightweight and affordable system. It is feasible, relevant to the ICT domain, and valuable for law enforcement, research, and service industries. Ethical safeguards and low-cost implementation make it a sustainable and academically meaningful contribution.