**AI-Powered Medical Kiosk for Preliminary Health Assessment**

**Abstract**

This document outlines an AI-powered medical kiosk designed to streamline preliminary health assessments in hospitals. The system addresses the need for efficient patient intake by automating data collection through an integrated suite of technologies. It combines secure facial recognition for patient identification, a voice-driven conversational AI for empathetic symptom gathering, and hardware integration for measuring key vital signs. Upon concluding the interaction, the system generates a professional summary of the assessment and saves it to a persistent patient record. This kiosk serves as an intelligent front-line tool to reduce administrative workload and provide medical staff with clear, structured patient information.

**1. Introduction and System Workflow**

Hospitals and clinics consistently face the challenge of managing patient flow and the time-consuming process of initial data collection. The administrative tasks of identifying patients, documenting their chief complaints, and recording basic vitals can create bottlenecks, impacting both staff workload and patient wait times. This project introduces a standalone AI kiosk to automate and optimize this crucial preliminary assessment phase. By providing an intuitive, conversational interface, the kiosk improves the efficiency and consistency of data gathering while offering patients a more engaging and empathetic experience.

The patient's journey through the kiosk is designed to be seamless and intuitive, flowing through several key stages:

1. Authentication: The process begins when the patient approaches the kiosk. The system uses a camera to perform facial recognition to identify a returning patient or initiate a one-time registration for a new user. A unique "peace sign" gesture can be used to trigger the face-locking mechanism for initial setup.
2. Conversational Assessment: Once authenticated, the patient engages in a natural language conversation with the AI assistant, facilitated by Speech-to-Text (STT) and Text-to-Speech (TTS) technologies. The AI, guided by a sophisticated prompt, asks empathetic and targeted questions to understand the patient's symptoms.
3. Vital Signs Measurement: If the AI determines that clinical data is required, it will prompt the patient to use integrated sensors. The kiosk then communicates with external hardware to measure vital signs such as blood pressure and temperature, appending the results to the current session's record.
4. Conclusion and Data Logging: After the conversation concludes, the system processes the entire dialogue to generate a structured, professional summary of the key points and major details discussed. This summary, along with the full conversation history and vitals, is saved to the patient's secure and persistent JSON file.

**2. Core Technology Modules**

The kiosk's functionality is built upon several integrated technology modules that work in concert to deliver a comprehensive assessment experience.

Patient Identity Management

The system’s foundation is a robust facial authentication module that securely manages patient identity.

* For new users, a registration process captures multiple facial images, analysing them for quality and sharpness before creating a new patient profile with a unique ID. This process includes advanced features like facial alignment based on eye landmarks to ensure high-quality encodings.
* For returning patients, the system compares a live image against its database of saved facial encodings to find a match with a high confidence score, ensuring the correct medical record is retrieved.

Conversational AI Engine

The heart of the kiosk is its conversational AI, which handles all patient interaction.

* LLM and Prompt Engineering: The engine uses a local Large Language Model (LLM) from the langchain\_ollama library, guided by a detailed system prompt. This prompt defines the AI's persona as an empathetic medical assistant, ensuring it asks questions one at a time and maintains a human-like, conversational tone. The AI can also factor in the patient's detected emotion to provide more tailored responses.
* Dialogue and State Management: Voice interaction is enabled by STT and TTS modules. A ConversationManager class oversees the dialogue flow, using rule-based logic to recognize when a user wishes to end the conversation and guiding them through a graceful exit confirmation process.

Clinical Data Acquisition and Persistence

The kiosk is capable of collecting both conversational and physiological data.

* Hardware Integration: The system can interface with external diagnostic hardware. When the AI requests vitals, a function communicates via a serial port with an ESP32 microcontroller to capture blood pressure and temperature readings.
* Data Persistence Layer: All patient data is managed through a set of dedicated functions. Each patient has a unique JSON file that stores their profile, a complete history of their conversations, measured vitals, and professionally formatted summaries of past visits. This ensures a comprehensive and persistent medical record is maintained for every user.

**3. Technical Implementation and Conclusion**

The successful integration of these modules is made possible by a carefully selected technical stack. Key technologies and libraries used in this project include:

* AI and Machine Learning: langchain\_ollama, face\_recognition, transformers.
* Speech Processing: pyttsx3, speech\_recognition.
* Hardware Communication: pyserial.
* Core Functionality: OpenCV, asyncio, NumPy, pickle.

**Conclusion**

In summary, the AI-powered medical kiosk offers a powerful and effective solution to modernize the preliminary stages of patient care. By automating patient identification, symptom gathering, and data logging, the system significantly reduces the administrative burden on hospital staff and minimizes wait times. Its empathetic, AI-driven conversational interface ensures a positive patient experience, while the structured data output provides medical professionals with clear, reliable, and actionable information. This project serves as a robust blueprint for the future of patient intake, demonstrating how intelligent automation can lead to more efficient and patient-centric healthcare.