Architecture Document for

V BOT

Your Virtual Nurse

Team Name: Dominatrix

College: Knowledge Institute of Technology, Salem

Team Members:

- Prasanna Sekaran E
- Siva Sankar C
- Parvathi P
- Sowndarya T
- Sree Varshini S

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virtusa

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1 Introduction – PART-A

1.1 Purpose

To ensure people's health and lifespan, the healthcare sector is essential. However, it takes time and can be overwhelming for patients to seek medical care for every one of a disease's symptoms. V Bot was created as a solution to this problem and to offer prompt and effective medical consulting services.

With the help of the conversational AI system V Bot, distant users and clients may easily get medical consultation and services while relaxing in their homes. V Bot can accurately identify and diagnose health issues, provide online consultation, and provide advice on nutrition and cancer prevention methods by utilizing cutting-edge technologies like ML (Machine Learning), NLP (Natural Language Processing), AI (Artificial Intelligence), and DL (Deep Learning).

V Bot is developed on a two-part architecture made up of front-end and back-end technologies to enable its functionality. The framework's Front-End makes use of HTML, CSS, and JavaScript to deliver an informative and responsive website. It contains a variety of specialized medical disciplines and knowledge to answer questions about healthcare. The V Bot is embedded into the website to offer end customers 24 hours a day, seven days a week, medical information, and solutions.

V Bot has a broad range of applications, including those in dentistry, orthopedics, dermatology, pediatrics, ENT, pharmacology, podiatry, and many more specialized areas of medicine. Patients can consult with V Bot to have access to expert medical guidance and assistance. The software also provides voice recognition, speech recognition, and maps with surrounding amenities. The conversational AI in V Bot Health care has a wide range of applications since it offers end-users remote access to medical consultation and questions, 24-7 availability of medical information, and solutions. Its scope covers a range of specialized medical specialties, including dermatology, pediatrics, ENT, dentistry, orthopedics, pharmacology, and podiatry, among others.Scope

1.2 Scope

V Bot can recognize user inquiries and reply by giving relevant medical advice, booking appointments, and providing information about local facilities with the aid of ML, NLP, AI, and DL approaches. In addition, V Bot provides cancer preventive methods, healthy meals, and voice and speech recognition. Its reach extends beyond only handling medical inquiries and offers a practical and approachable platform for getting access to healthcare.

V Bot Health care conversational AI can be deployed in hospitals, clinics, and healthcare facilities to improve healthcare delivery, shorten wait times, and improve the patient experience. It may also be linked into healthcare apps, giving remote access to medical consultations and boosting healthcare service accessibility. V Bot Health care conversational AI has endless potential, and its use is expanding as technology progresses

1.3 Definitions, Acronyms and Abbreviations

AI (Artificial intelligence) is the replication of human intellect in computers that are programmed to do activities that require human cognitive abilities, such as learning, problem solving and decision making.

ML (Machine Learning) is a subset of AI that use statistical approaches to allow computer systems to improve their performance on a certain job over time without explicitly programming them.

An Algorithm (ALGO) is a set of rules or instructions that guide the completion of a task or the resolution of a problem. They are a crucial component of computer programming and have multiple uses, including data analysis and machine learning.

Natural Language Processing (NLP) is a domain of research that concentrates on enabling communication between computers and human language. It encompasses the creation of models and algorithms that can analyze and interpret human language to accomplish various tasks, such as sentiment analysis or language translation.

Natural Language Understanding (NLU) is a specialized branch of NLP that emphasizes on understanding the meaning of human language. NLU models and algorithms strive to assist computers in comprehending the intention behind human language and responding accordingly.

Front-end development refers to designing the user interface (UI) and user experience (UX) of a website or application utilizing HTML, CSS, and JavaScript.

HTML5 is the latest version of the Hypertext Markup Language used for creating web pages and other types of content that can be displayed in a web browser. It includes new features such as support for multimedia and graphics, as well as APIs for storage, drag and drop, and web sockets.

CSS3 is the latest version of the Cascading Style Sheets language, used for describing the presentation of web pages written in HTML5. It includes new features such as border radius, box shadow, and gradients, as well as improved support for animations and transitions.

JavaScript (JS) is a programming language used for creating interactive and dynamic web pages that respond to user input. With HTML5 and CSS3, JS can be used to create advanced animations and effects, as well as communicate with web servers to retrieve and update data in real-time.

SQL Alchemy is a Python library that provides a set of high-level APIs for working with relational databases using Python code. It supports multiple database management systems, including PostgreSQL, MySQL, SQLite, and Oracle, among others. SQL Alchemy also provides an Object Relational Mapper (ORM) that allows developers to work with database tables and records as if they were regular Python objects, simplifying the process of interacting with the database.

Flask is a Python-based lightweight web application framework used for developing web applications and APIs. It provides tools, libraries, and patterns for building web applications in a simple and straightforward way. Flask is known for its simplicity, flexibility, and ease of use, making it a popular choice among developers for building web applications quickly and efficiently.

AJAX (Asynchronous JavaScript and XML) is a set of web development techniques that allow web pages to update content asynchronously without requiring a full page reload. It uses a combination of JavaScript and XML (or JSON) to communicate with the server in the background.

PHP: PHP is a server-side scripting language commonly used for web development. It enables the creation of dynamic and interactive web pages, allowing developers to generate content, handle forms, interact with databases, and more.

MySQL: MySQL is an open-source relational database management system (RDBMS). It provides a robust and scalable platform for storing and managing structured data, making it an ideal choice for web applications that require efficient data storage and retrieval.

XAMPP: XAMPP is a free and cross-platform web server solution that bundles several key components, including PHP, MySQL, Apache, and Perl. It simplifies the setup of a local development environment, allowing developers to test and run web applications on their own machines before deploying them to a live server.

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2 Architectural Goals and Constraints - PART-B

2.1 Reusability

The V Bot is a Conversational AI voice bot equipped with various functionalities, including location access to hospitals, pharmacies, clinics, blood banks, and ambulances, as well as appointment scheduling. The system utilizes a dataset in JSON format and leverages technologies such as NLTK for natural language processing, speech recognition for audio input, and an artificial neural network (ANN) for enhanced performance. The location access feature enables users to find nearby healthcare facilities, while the appointment scheduling functionality streamlines the process of booking appointments with doctors. The V Bot is seamlessly integrated into a website, providing a user-friendly interface for efficient interaction. This report provides an overview of V Bot's features, their implementation, and highlights the potential impact and benefits of this advanced AI-powered healthcare assistant.

2.2 Scalability

The V Bot, a Conversational AI voice bot equipped with location access to healthcare facilities, appointment scheduling, and powered by NLTK, speech recognition, and ANN in the backend, demonstrates scalability in various aspects. The system is designed to handle a growing user base, efficiently managing location-based queries for hospitals, pharmacies, clinics, blood banks, and ambulances. It scales its appointment scheduling feature to accommodate an increasing number of appointment requests and bookings, minimizing scheduling conflicts. The system effectively manages the expanding dataset of JSON files, ensuring fast data retrieval and storage scalability through techniques like data partitioning and query optimization. Additionally, the backend technologies employed by V Bot are scalable, leveraging cloud-based services and optimized algorithms to handle higher computational demands as the system expands. Overall, these scalability measures ensure that V Bot can seamlessly grow to meet the demands of a larger user base while maintaining optimal performance and user satisfaction.

2.3 Customizability

The Conversational AI voice bot, V Bot, offers significant customizability to cater to specific requirements and enhance user experience. Its modular architecture allows for easy customization and seamless integration of new features. With configurable settings and parameters, V Bot can be tailored to adapt its behavior, responses, or functionalities to meet specific user preferences and deployment scenarios. The front-end interface, developed using HTML, CSS, and related technologies, can be customized to match the branding, style, and specific needs of the website or platform where V Bot is integrated. The utilization of MySQL as the database backend enables flexible data management and customization, allowing the database schema and queries to be adapted as required. This customizability empowers users to configure and personalize V Bot according to their unique needs, ensuring an optimized and tailored conversational experience.

2.4 Extendibility

The Conversational AI voice bot, V Bot, exhibits a high level of extendibility in various aspects of its design and implementation. Its architecture is built to support easy extension and integration of new functionalities. With location access to healthcare facilities and appointment scheduling capabilities, V Bot can easily accommodate the addition of new services or features related to the healthcare domain. The utilization of technologies such as NLTK, speech recognition, ANN, Python, and MySQL further enhances the extendibility of V Bot. For instance, new natural language processing algorithms can be integrated into the NLTK module, additional speech recognition models can be incorporated, and the ANN can be enhanced with new training data or architectures. The use of a JSON dataset and MySQL database allows for seamless expansion of data entries, facilitating the inclusion of more hospitals, clinics, doctors, or related information. Additionally, the front-end interface, implemented with HTML, CSS, and other technologies, can be easily extended to support new user interactions or visual elements. Overall, the extendibility of V Bot enables the incorporation of new features, technologies, data, and user experiences, ensuring its adaptability to evolving user needs and advancements in the healthcare industry.

2.5 Use of Existing Business Logic

The Conversational AI voice bot, V Bot, leverages existing business logic to enhance its functionality and provide a seamless user experience. By incorporating location access to hospitals, pharmacies, clinics, blood banks, and ambulances, V Bot utilizes existing business logic to retrieve and present relevant information to users based on their geographical proximity. This feature streamlines the process of finding nearby healthcare facilities and ensures that users have access to essential services in their vicinity.

Additionally, V Bot's appointment scheduling feature utilizes existing business logic to facilitate the booking of appointments with doctors. The system incorporates predefined business rules and logic to manage available time slots, handle scheduling conflicts, and ensure a smooth appointment booking process for customers. By utilizing existing business logic, V Bot efficiently manages the appointment scheduling process, providing a convenient and efficient solution for users.

Moreover, the use of NLTK, speech recognition, ANN, Python, and MySQL in the backend of V Bot enables the application of existing business logic in natural language processing, speech recognition, and data management. These technologies offer pre-existing algorithms, models, and frameworks that have been developed and refined to handle various tasks, allowing V Bot to leverage the power of existing business logic to process user queries, understand speech inputs, and manage data effectively.

By leveraging existing business logic in these key areas, V Bot benefits from proven methodologies, algorithms, and systems, ensuring reliable and accurate results for users. This approach reduces development time and effort while maximizing the effectiveness and efficiency of the conversational AI voice bot in delivering valuable healthcare services to customers.

2.6 Time to Market

The time to market for a conversational voice AI solution involves various key points that should be included in a report. Firstly, it is crucial to conduct market research to understand the demand and competition for such solutions in the healthcare industry. This helps identify target audiences and their specific needs. The report should clearly define the solution's scope and objectives, outlining the healthcare use cases it aims to

address, such as appointment scheduling or symptom assessment. Evaluating available technologies, frameworks, and libraries is essential to make informed decisions on the development approach. Data acquisition and preparation should be detailed, including the process of obtaining relevant healthcare datasets and ensuring data quality. Model development and training should cover the selection of appropriate machine learning algorithms and optimization techniques.

2.7 Portability

The Conversational AI voice bot, V Bot, exhibits a good level of portability in its design and implementation. The use of technologies like NLTK, speech recognition, ANN in Python, and MySQL for databases allows for easy migration and deployment across different platforms and environments. The separation of the backend logic using Python and the frontend interface developed with HTML, CSS, and related technologies enables flexibility in deploying the bot on various web servers or hosting platforms. Additionally, the utilization of a JSON dataset for storing information further enhances portability, as JSON is a widely supported data interchange format that can be easily read and processed by different systems. This portability enables V Bot to be deployed and run on different servers or platforms, making it accessible to a wider audience and adaptable to evolving technological landscapes. XAMPP is a free and cross-platform web server solution that bundles several key components, including PHP, MySQL, Apache. It simplifies the setup of a local development environment, allowing developers to test and run web applications on their own machines before deploying them to a live server.

2.8 Availability

The availability of a conversational healthcare voice bot can greatly benefit users by providing continuous support and assistance. With round-the-clock availability, users can access the voice bot at any time, even outside regular healthcare provider hours. This ensures that users have reliable assistance and information readily available, regardless of the time or day. The 24/7 availability of the voice bot allows for convenient and immediate access to healthcare-related queries, guidance, and even basic triaging. This availability empowers users to seek assistance and find answers to their healthcare concerns promptly, promoting a more efficient and accessible healthcare experience.

In the context of a conversational voice AI solution, it is crucial to consider uptime constraints and the need for fault tolerance. The uptime constraints refer to the requirement of maintaining a high level of availability for the system, ensuring that it always remains operational and accessible to users. Downtime can lead to user frustration, loss of trust, and potential business repercussions. Therefore, it is essential to design the system with robust fault tolerance mechanisms. Fault tolerance measures aim to minimize the impact of system failures or errors by implementing redundancy, backup systems, and failover mechanisms. These measures ensure that the system can continue to function even in the event of component failures or other issues. By addressing uptime constraints and incorporating fault tolerance measures, the conversational voice AI solution can provide reliable and uninterrupted service, enhancing user satisfaction and overall system performance.

3 Productization Assessment – PART-B

3.1 Re-Usable Components

The Conversational AI voice bot, V Bot, exhibits reusability through its modular design and utilization of various components. The following aspects contribute to its reusability:

Modular Architecture: V Bot is designed with a modular architecture, allowing different components to be developed and maintained independently. This modular approach enables easy integration of new features or enhancements without impacting the overall system.

Reusable Codebase: The use of popular libraries and frameworks such as NLTK, speech recognition, ANN in Python, and MySQL for databases promotes code reusability. These well-established tools provide pre-built functions and modules that can be leveraged for similar projects or future iterations of V Bot.

Dataset Reusability: The JSON dataset used for creating entries in the website can be reused for other purposes or integrated with different applications. This dataset can serve as a valuable resource for analyzing user behavior, conducting research, or developing new AI models.

Frontend and Backend Separation: The separation of frontend technologies like HTML, CSS, and related technologies from the backend logic implemented in Python and MySQL further enhances reusability. This separation allows for flexibility in modifying or replacing either component without affecting the other, making it easier to adapt V Bot to different environments or interface requirements.

By adopting a modular architecture, leveraging reusable code, utilizing datasets effectively, and separating frontend and backend components, V Bot can achieve a high degree of reusability. This facilitates future enhancements, iterations, or even the adaptation of its components to other projects, promoting efficiency and reducing development time and effort.

3.2 Analyze Architectural Frameworks in Repository

In the context of the Conversational AI voice bot, V Bot, and its associated components, an analysis of architectural frameworks in the repository can be performed to assess their suitability and effectiveness. The following frameworks are relevant for consideration:

Natural Language Toolkit (NLTK): NLTK is a popular Python library used for natural language processing (NLP). It provides a wide range of tools and algorithms for tasks such as tokenization, stemming, tagging, and parsing. By utilizing NLTK, V Bot benefits from a robust and well-established framework for processing and understanding user input, enabling accurate and context-aware responses.

Speech Recognition: The integration of speech recognition technology into V Bot allows users to interact with the system using their voice. Speech recognition frameworks, such as Google Speech-to-Text or CMU Sphinx, offer powerful speech recognition capabilities. These frameworks convert spoken language into text, enabling V Bot to understand user commands and queries accurately.

Artificial Neural Networks (ANN): ANN is an architectural framework used in machine learning for pattern recognition and prediction tasks. ANN models, implemented using Python libraries like TensorFlow or PyTorch, can be leveraged in V Bot for tasks such as sentiment analysis, intent recognition, or user behavior prediction. ANN provides a flexible and scalable framework for training and deploying machine learning models within the voice bot.

MySQL Database: V Bot utilizes a MySQL database for storing and retrieving data related to doctor listings, appointments, and other relevant information. The use of a structured database management system allows for efficient data organization, retrieval, and manipulation. MySQL provides a reliable and widely adopted framework for handling data persistence and management.

HTML/CSS: The front-end component of V Bot relies on HTML and CSS for rendering user interfaces and displaying information. These web technologies provide a standardized and widely supported framework for designing and presenting the user interface, ensuring compatibility across different browsers and devices.

By analyzing and incorporating these architectural frameworks, V Bot benefits from established and efficient tools and technologies. These frameworks provide robust solutions for natural language processing, speech recognition, machine learning, database management, and user interface design, enhancing the functionality and performance of the voice bot.

3.3 Identify and Analyze Open Source and COTS Products

This section aims to provide an overview of the open-source and Commercial Off-The-Shelf (COTS) products that have been identified for potential use in the project. It includes an analysis of their suitability, licensing, and legal requirements to ensure compliance and address any copyright considerations.

Open-source products, which are freely available software accompanied by licenses granting users the right to modify and distribute the software, were considered for their cost-effectiveness, flexibility, and wide range of features. However, careful evaluation of the specific licensing terms is necessary to ensure compliance with copyright and legal requirements.

Similarly, COTS products, which are commercially available software solutions, were examined to determine their compatibility with the project and meet specific functionality requirements. Key factors evaluated include compatibility with existing systems, vendor reputation, support services, and licensing agreements.

4 System Architecture – PART-A/B

4.1 Overview - PART-A

The VBOT application follows a modular architectural design, consisting of independent functions that communicate through well-defined interfaces. It is comprised of two essential components: the frontend and the backend.

The frontend of VBOT is responsible for the user-facing aspects of the application. It includes features such as the user interface, visual elements, and user interaction components. The frontend is designed to provide a seamless and intuitive experience for customers and users. It communicates with the backend through defined interfaces, allowing for smooth data exchange and functionality integration.

On the other hand, the backend of VBOT handles the core functionality and data processing. It encompasses various independent functions and modules responsible for tasks such as symptom identification, query resolution, appointment scheduling, and data management. The backend components operate behind the scenes and communicate with the frontend to fulfill user requests and provide accurate responses. The interfaces between the frontend and backend ensure effective coordination and information exchange.

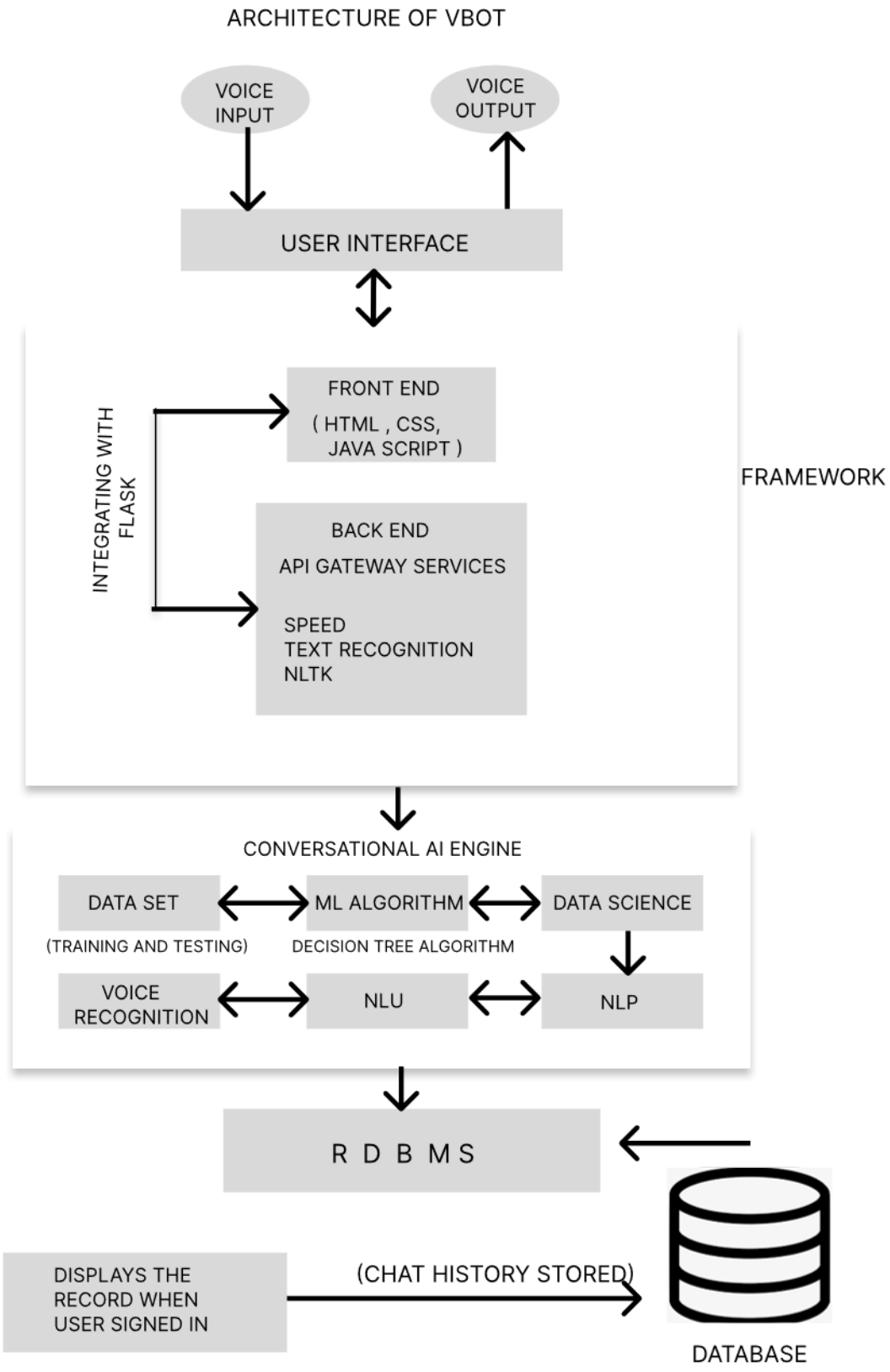
This modular architecture allows for scalability, maintainability, and flexibility in the development and deployment of VBOT. Each component can be developed independently, enabling efficient testing, updates, and enhancements. The interfaces serve as the integration points, ensuring smooth communication between the frontend and backend components.

Overall, the architectural design of VBOT frontend and backend components facilitates the efficient delivery of healthcare services, seamless user interactions, and effective data processing, all while maintaining modularity and independence among the key functions of the application.

4.2 Logical/Functional View - PART-A

The V Bot is a healthcare service that provides remote access to customers and patients for consulting services, appointment scheduling, and access to medical information such as symptoms, nutritional diets, and cancer prevention techniques. The V Bot employs Machine Learning (ML), Natural Language Processing (NLP), Artificial Intelligence (AI), and Deep Learning (DL) methods to process user input and provide instantaneous results through voice calls or chats.

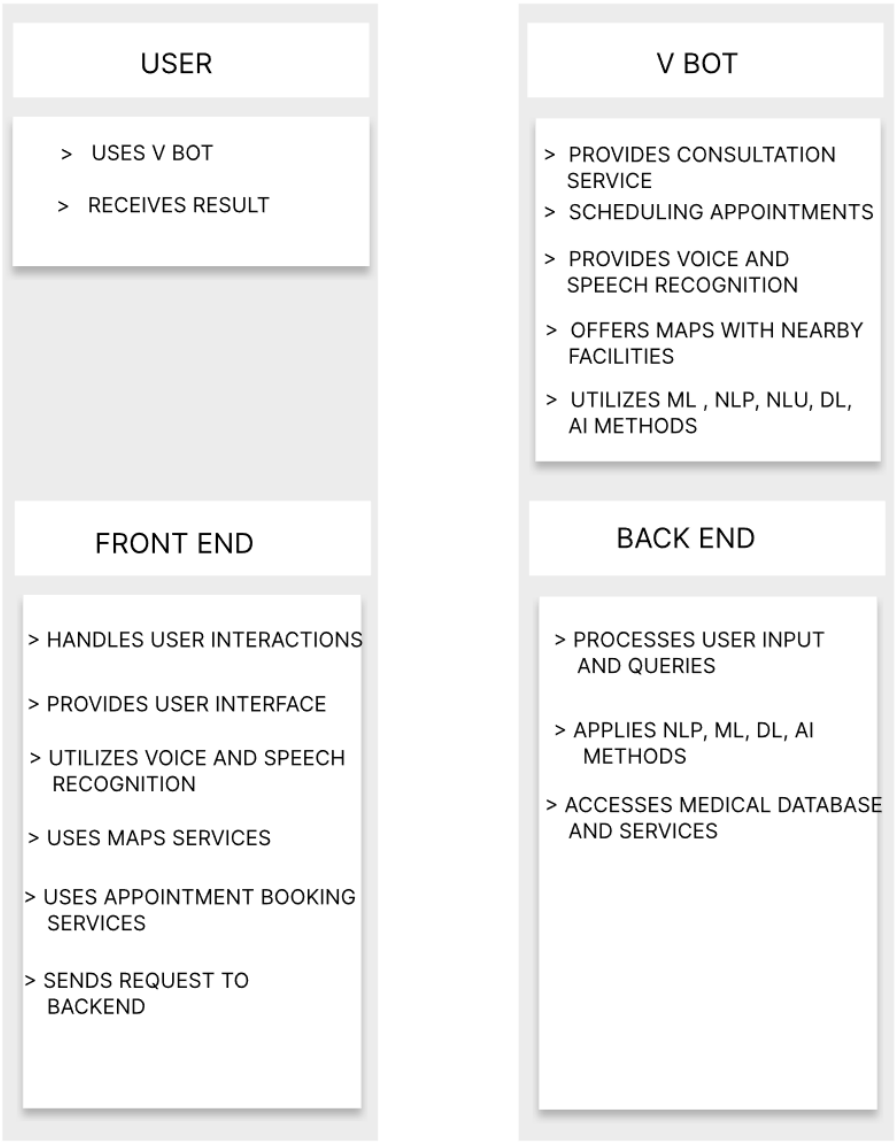
The V Bot architecture consists of two frameworks:
Front-End and Back-End. The Front-End handles user interaction and provides the user interface for the V Bot. It utilizes voice and speech recognition, maps services, and sends requests to the Back-End. The Back-End processes user input and queries, applies ML, NLP, AI, and DL methods to access medical databases and services, and provides consulting and scheduling services. The Back-End also provides the necessary functionalities to communicate with the Front-End and send the results back to the user. Overall, the V Bot architecture provides an efficient and accessible healthcare service for customers and patients.


ARCHITECTURE OF VBOT
VOICE INPUT
VOICE OUTPUT
USER INTERFACE
FRONT END
(HTML , CSS, JAVA SCRIPT)
INTEGRATING WITH FLASK
BACK END
API GATEWAY SERVICES
SPEED
TEXT RECOGNITION
NLTK
FRAMEWORK
CONVERSATIONAL AI ENGINE
DATA SET
ML ALGORITHM
DATA SCIENCE
(TRAINING AND TESTING)
DECISION TREE ALGORITHM
VOICE RECOGNITION
NLU
NLP
R D B M S
DISPLAYS THE RECORD WHEN USER SIGNED IN
(CHAT HISTORY STORED)
DATABASE

Layering Diagram:

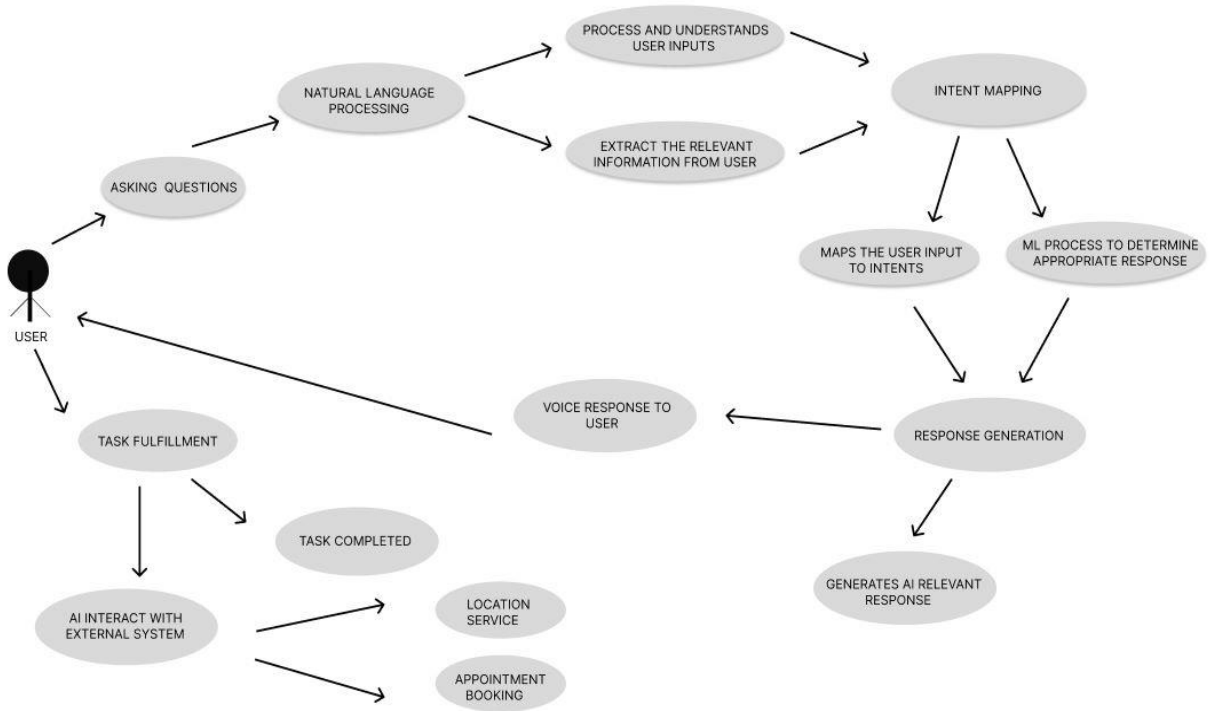
The V Bot offers a range of services to users, including consultations, appointment scheduling, voice and speech recognition, and map-based location searches. It employs advanced machine learning, natural language processing, artificial intelligence, and deep learning techniques to provide accurate and immediate results. The V Bot is divided into two frameworks, namely the FRONT-END and BACK-END. The FRONT-END is responsible for managing user interactions and providing a user-friendly interface, and it utilizes voice and speech recognition and map-based services. The BACK-END processes user input and applies advanced techniques to access medical databases and provide consulting and scheduling services.

LAYERING VIEW OF V BOT



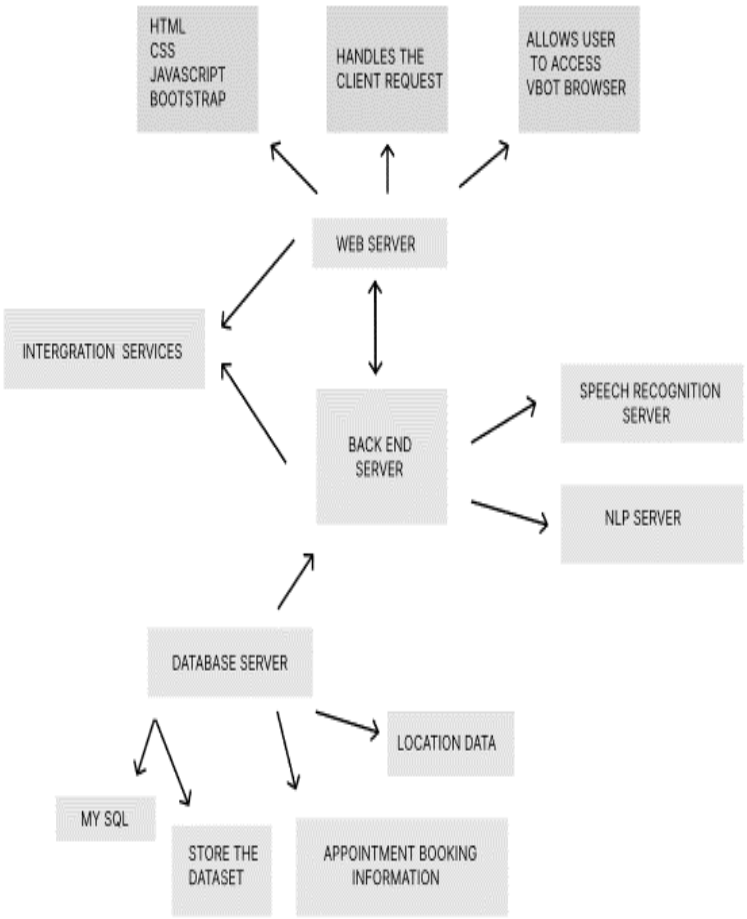
4.3 Use Case View:

The V Bot is a healthcare service that helps users identify symptoms and queries, schedule appointments, and access medical information. By utilizing ML, NLP, AI, and DL methods, it provides instant results through voice calls or chats, and offers various features such as maps with nearby facilities, voice and speech recognition, nutritional advice, and cancer prevention techniques.



4.4 Deployment View – PART-B

The deployment of a conversational healthcare voice AI with NLP and ML, integrated with frontend frameworks, involves several crucial steps. First, the backend infrastructure is prepared, including server setup and database configuration. NLP libraries like NLTK are integrated for natural language understanding. Machine learning models are developed using libraries like scikit-learn or TensorFlow, trained on healthcare-related data. Frontend frameworks such as React or Angular are chosen for building the user interface. Voice integration is implemented using Web Speech API or specialized speech recognition frameworks. APIs are developed to enable communication between frontend and backend components. The user interface is designed to incorporate speech input/output and provide a seamless experience. Integration testing ensures the accuracy of model predictions and system responsiveness. The system is deployed on a hosting platform or cloud service, with continuous monitoring and maintenance. Privacy and security measures are implemented to protect user data. User feedback drives iterative improvements, with collaboration from healthcare providers for domain-specific knowledge. Performance optimization techniques are applied, and user training and support materials are provided. Continuous innovation keeps the system up to date with emerging technologies and trends in healthcare AI.


HTML
CSS
JAVASCRIPT
BOOTSTRAP
HANDLES THE CLIENT REQUEST
ALLOWS USER TO ACCESS VBOT BROWSER
WEB SERVER
INTERGRATION SERVICES
BACK END SERVER
SPEECH RECOGNITION SERVER
NLP SERVER
DATABASE SERVER
LOCATION DATA
MY SQL
STORE THE DATASET
APPOINTMENT BOOKING INFORMATION

5 Alternative Solutions Considered – PART-B

During the development of the conversational voice AI solution, several alternative architectural solutions were considered. Each alternative was carefully evaluated, and the rationale for selecting the current solution is explained below.

Pre-built Chatbot Frameworks: One alternative solution considered was the utilization of pre-built chatbot frameworks or platforms. These frameworks offer ready-made solutions with built-in natural language processing and conversation management capabilities. However, after careful analysis, it was determined that these frameworks may not provide the level of customization and specific functionality required for the healthcare domain. Therefore, a more tailored approach was deemed necessary.

Voice Recognition APIs: Another alternative was to rely solely on voice recognition APIs provided by major cloud service providers. These APIs offer voice-to-text conversion functionality, which could be integrated into the solution. However, this approach presented limitations in terms of customization and control over the voice recognition process. Additionally, there were concerns about potential data privacy and security issues when relying on third-party APIs for sensitive healthcare data.

Traditional Rule-Based Systems: Traditional rule-based systems were also considered, where predefined rules and patterns are used to generate responses based on user inputs. While these systems are relatively straightforward to implement, they lack the flexibility and adaptability required for a conversational AI solution. Healthcare queries often involve complex and context-dependent responses that cannot be easily captured by static rules.