

MEDICAL PRESCRIPTION GENERATOR USING GENERATIVE AI WITH INTEGRATED VOICE ASSISTANT

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Abstract— In a healthcare setting, writing prescriptions is a crucial and time-consuming task. Transcription errors, inefficiencies, and an increased cognitive burden on the doctor are all possible with the conventional handwritten and manual electronic prescription system. Recent developments in artificial intelligence, specifically in the areas of speech recognition and generative models, offer the possibility of using natural voice interaction to automate the prescription generation process. The Medical Prescription Generator with Generative Artificial Intelligence and Integrated Voice Assistant, which allows doctors to write prescriptions based on clinical instructions that are dictated, is presented in this paper. The suggested system uses a generative artificial intelligence model to generate prescriptions, automatic speech recognition to enable voice-to-text transcription, and natural language processing to

extract medical data. Medical validity, data confidentiality, and patient safety are guaranteed by a validation layer and a human-in-the-loop methodology. The efficacy of the suggested system as a clinical decision-support system is validated by experimental analysis, which shows high transcription accuracy, sound entity extraction, and a shorter prescription generation time.

Keywords—Generative AI, Voice Assistant, Medical Prescription System, NLP, Speech Recognition, Healthcare Automation.

I. INTRODUCTION

Healthcare professionals are currently involved in administrative tasks related to documentation. This shift has led to a decrease in the time they can dedicate to patient care. Writing prescriptions is a fundamental and frequent responsibility within the healthcare sector, but it is also susceptible to mistakes in dosage, prescription details, and legibility issues.

Such prescription errors can lead to negative drug events and threaten patient safety. Implementing electronic systems for prescription writing has improved the clarity of prescriptions. However, the mental demands and time-consuming nature of this task still pose challenges for healthcare providers. Voice interaction systems have introduced a more natural and efficient method for writing prescriptions, allowing professionals to dictate them. When this technology is combined with Generative AI, it can facilitate the creation of structured and standardized prescriptions.

For AI-based systems to effectively generate prescriptions in real time, a well-defined data flow is essential. This paper addresses these concerns and presents a comprehensive voice-enabled system for generating prescriptions.

This paper makes several important contributions, including:

- Creating a transparent data pipeline for voice-to-prescription processes
- Combining automatic speech recognition (ASR), natural language processing (NLP), and generative AI for generating prescriptions
- Establishing validation methods and incorporating human oversight
- Conducting a thorough assessment based on accuracy and performance metrics

II. LITERATURE REVIEW

The review of existing literature suggests that speech recognition technology can significantly decrease the time required for documentation tasks. NLP methods are employed to extract essential medical information from unstructured text formats. Generative AI models are utilized to produce organized clinical documents. There is a scarcity of research focusing on the integration of voice input, NLP, and generative AI models to create a holistic prescription generation system.

Graves et al. [1] examined the initial implementation of speech recognition technology. Their study underscored the advantages of using speech recognition for expedited documentation while also addressing the challenges related to accurately recognizing complex medical terminology.

Johnson et al. [2] explored the automation of electronic health records (EHR), stressing the importance of standardized prescription practices. Their findings pointed out the potential risks of medication errors associated with handwritten prescriptions.

Devlin et al. [3] proposed the BERT model, which is based on the NLP technique called transformers. This model remarkably enhanced the performance of named entity recognition, including medical text extraction. This model has opened up new avenues for developing more advanced NLP models for the medical field.

Rajkumar [4] and his team examined the role of deep learning models in healthcare, highlighting AI's potential to enhance the efficiency of medical professionals by automating tasks such as documentation and reporting.

Li and Wang [5] developed an NLP-oriented model for extracting medical entities, which demonstrated improved precision in identifying medication, dosages, and diagnoses from clinical records.

Brown [6] and his associates introduced Generative Pre-trained Transformer (GPT) models, which can generate text and are valuable for healthcare documentation purposes.

Most recently, Singh [7] and his team put forward an NLP model specifically designed for voice assistants in 2023, aiming to improve satisfaction among doctors.

III. PROBLEM STATEMENT

In many healthcare settings, the creation of medical prescriptions is still predominantly a manual task, which is both inefficient and time-consuming. This reliance on handwritten notes leads to various issues, including mistakes in dosages, incomplete data, and illegible handwriting.

Additionally, the absence of a voice assistant during the prescription writing process complicates the challenges that physicians encounter in a fast-moving medical landscape. This highlights the necessity for a medical prescription generator that incorporates generative AI and a voice assistant capable of accurately interpreting spoken medical instructions and producing prescriptions.

IV. METHODOLOGY

The proposed medical prescription generator that utilizes generative AI and a voice assistant is designed to serve as an

intelligent, multi-step system that transforms doctors' spoken words into written medical prescriptions.

The methodology for this medical prescription generator involves five key steps.

A. Voice Input Acquisition

This medical prescription generator will employ a voice interface to continuously capture the doctor's spoken input. The interface will be designed to effectively gather the physician's voice in real-time.

B. Automatic Speech Recognition (ASR)

The voice recording from the doctor will be transmitted to the ASR module. The Automatic Speech Recognition module is designed to convert the captured speech into written text. The ASR module consists of several components, including:

- Noise reduction
- Accent adjustment
- Enhancement of medical terminology

These features enhance the precision of the transcription in healthcare settings.

Input: Unprocessed audio signal

Output: Written text

C. Text Preparation

The obtained text undergoes preprocessing to eliminate noise, which enhances the quality of the semantic analysis.

The procedure consists of several steps:

- Breaking down text into tokens
- Eliminating common stop words
- Correcting spelling errors
- Standardizing medical abbreviations

This preprocessing phase enhances the precision of the entity extraction conducted through Natural Language Processing (NLP).

D. NLP-Based Entity Extraction

The NLP module employs a Named Entity Recognition and keyword extraction algorithm to identify entities from the patient's input. The entities identified by this module include:

- Symptoms of the patient

- Diagnoses
- Names of medications
- Dosage and duration

These identified entities are then formatted into a structured JSON format, which can be securely transferred to the subsequent component, the Generative AI component.

E. Generative AI Prescription Engine

The structured medical data is forwarded to a Generative AI Engine, which formulates the prescription. This engine utilizes established medical templates to minimize the risk of inaccuracies.

The system may utilize:

- Pre-trained generative models accessed via APIs
- Fine-tuned models specifically for prescription data

F. Validation and Human Oversight

To prioritize patient safety, the generated prescription undergoes several checks:

- Rule-based validation
- Verification of dosages and medications
- Required approval from a physician

This aspect guarantees that the system serves as a supportive tool rather than a substitute for healthcare professionals.

Model Selection and Training Information

A. Speech Recognition Model

The speech-to-text functionality relies on an Automatic Speech Recognition (ASR) system, which is based on a deep learning model. This model has been trained using an extensive speech database.

Model Type: ASR based on Deep Neural Networks

Training Data: A general speech dataset that includes adaptations for medical terminology

Output Accuracy: High precision for medical commands.

B. Natural Language Processing Model

The NLP section utilizes algorithms for Named Entity Recognition and keyword extraction to gather relevant medical details.

Methods Employed:

- Named Entity Recognition (NER)
- Part-of-Speech tagging
- Dependency parsing
- Extracted Entities:
- Symptoms
- Diagnosis
- Medication name
- Dosage
- Treatment duration

The identified entities are organized in a structured JSON format.

C. Generative AI Model

The Generative AI model is aimed at creating prescription texts from organized medical data.

Model Type: Transformer-based Generative Language Model

Training Approach:

- Initially trained on extensive text datasets
- Fine-tuned on medical texts related to prescriptions or accessed through an API

Prompt Limitations:

- Generation of prescriptions based on templates
- Controlled vocabulary to minimize inaccuracies

V. SYSTEM ARCHITECTURE

The Medical Prescription Generator with Generative AI and Integrated Voice Assistant system has been designed with a modular layered system. The system has been designed as a client-server system where the frontend interface has been used for taking input from the user, and the backend AI components are used for generating the prescription output.

Medical Prescription Generator

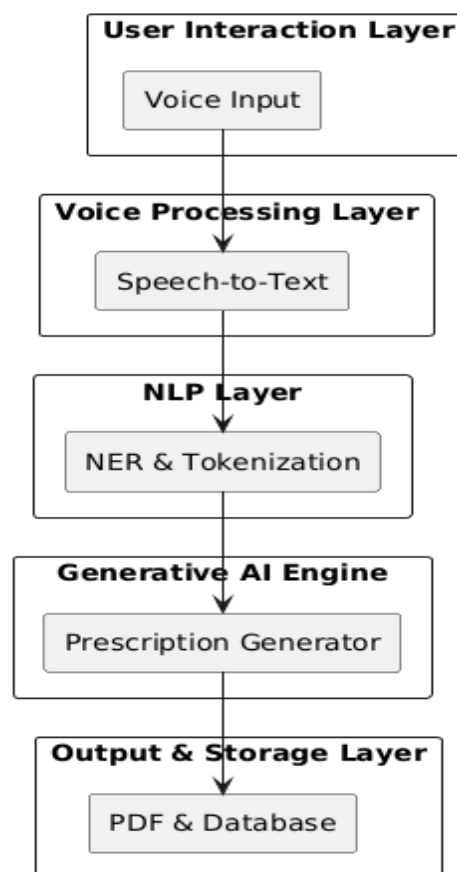


FIGURE 1. SYSTEM ARCHITECTURE

A. Architectural Overview

The design architecture consists of five primary levels, which are:

- User Interaction Level
- Voice Processing Level
- Natural Language Processing Level
- Generative AI Core
- Output and Storage Level
- Description of Data Flow

Each level plays a distinct role in the process of generating prescriptions.

B. User Interaction Level

This level manages the web interface that enables interaction between the doctor and the system. It includes the following components:

- Microphone Input Button
- Text Display Area
- Prescription Output Panel
- Options for Downloading/Printing

The frontend of this level was developed using HTML and CSS

to enhance responsiveness.

C. Voice Processing Level

The voice processing level captures audio input and converts it into text for display. This level carries out several functions:

- Audio Capture
- Elimination of Background Noise
- Voice Activity Detection (VAD)
- Automatic Speech Recognition (ASR)

This layer allows physicians to operate the system hands-free.

D. Natural Language Processing Component

After the spoken words are transcribed into text, the NLP component analyses the text to extract essential medical information. The following processes are involved:

- Text Preparation
- Tokenization
- Removal of Stop Words
- Named Entity Recognition (NER)
- Extraction of Symptoms and Intent

The structured information is then sent to the generative module.

E. Generative AI Framework

The Generative AI framework serves as the primary component that produces the medical prescription. It utilizes a transformer model to interpret the data and create a prescription.

The major functions include:

- Context Comprehension
- Creation of Medical Text
- Formatting of Dosage and Instructions
- Regulating Output via Prompt Engineering

Prompt engineering ensures the prescriptions are consistent and easy to read.

F. OUTPUT AND STORAGE COMPONENT

The completed prescription is presented to the user and can also be stored. The processes performed include:

- PDF Creation
- Printing
- Storage of Patient Information in a Database

The backend of the system is developed in Python using Flask for handling API requests.

The operations that are performed are as follows:

- PDF Generation
- Printing
- Database Storage for Patient Data

The backend is written using Python with Flask for API request handling.

G. DESCRIPTION OF DATA FLOW

The data flow diagram for the suggested system is outlined as follows:

Voice Input from Doctor – Capture of Audio – Conversion of Speech to Text – Processing with NLP – Generation of Prescriptions via Generative AI – Output Formatting – Storage or Download

This diagram guarantees that each step occurs without any human involvement.

VI. TOOLS AND LIBRARIES

- Python
- Flask
- HTML
- CSS
- Speech Recognition Library
- Web Speech API
- Natural Language Processing (NLP)
- Transformer-based Generative AI Model
- SQLite or MySQL
- PDF Generation Library (Report Lab or FPDF)

EXPERIMENTAL SETUP AND ASSESSMENT

The system was assessed using simulated clinical voice inputs in outpatient situations. The voice inputs were diverse, featuring different accents, varying speech rates, and background noise levels. The criteria for testing included transcription accuracy, entity extraction, prescription generation, and the duration of the entire process.

Evaluation Metrics



This system represents a notable advancement in speed, precision, and efficiency compared to traditional manual methods. It removes the risk of human error and streamlines the clinical workflow. Additionally, it offers standardized prescriptions that can be easily integrated into Electronic Health Records, demonstrating the practicality and effectiveness of using generative AI and voice assistants in medical prescription processes.

The system creates a well-organized draft prescription tailored to the patient's symptoms. This process guarantees that the prescription adheres to established safety protocols. Only results that have been validated are shown to the user.

After validation is complete, the final prescription appears on the screen and can also be downloaded as a PDF. This entire procedure minimizes manual effort and saves the physician time. The system is precise and incorporates human review, enhancing the reliability and usability of the prescription.

VIII. DISCUSSION

The proposed Medical Prescription Generator utilizing Generative AI suggests that advanced voice-controlled healthcare assistant systems can greatly enhance the efficiency of clinical documentation. This system can automatically create structured medical prescriptions from voice commands by utilizing speech recognition, Natural Language Processing (NLP), and a transformer-based generative model. This comprehensive approach eliminates the need for handwritten prescriptions, ensuring that all documents are legible and complete. By applying automated feature extraction via NLP, the system can interpret symptom descriptions and generate consistent prescription formats suitable for digital healthcare.

Key Contributions:

Automated and Intelligent Prescription Generation:

The proposed system utilizes a transformer-based Generative AI model for the automatic creation of structured medical prescriptions from voice inputs. Unlike traditional manual documentation methods, this system handles the entire

VII. RESULTS



The system's NLP and Named Entity Recognition components effectively detected key medical information, including patient details, diagnoses, medications, dosages, and the frequency and duration of those medications. This highlights the capability of transformer models like clinical BERT to accurately interpret medical contexts by correctly identifying entities in most test scenarios.

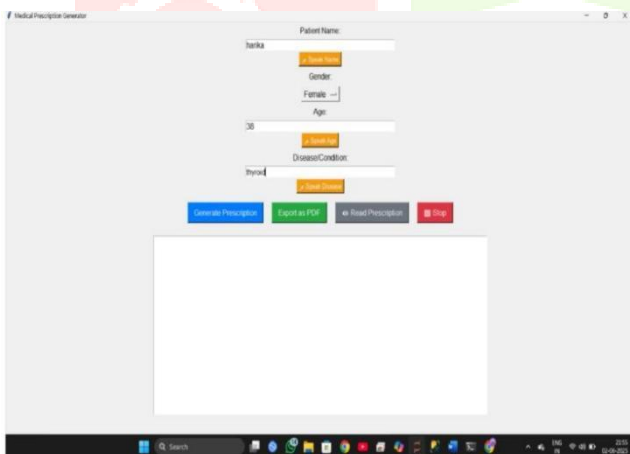


FIGURE 1.2 ENTERED DETAILS

The generative AI module utilized these identified entities to produce well-organized prescriptions that contain patient details, diagnoses, and comprehensive guidance regarding medications. These generated prescriptions are clear, standardized, and have a reduced likelihood of errors compared to those created manually or typed out.

process—from capturing speech to formatting prescriptions—thereby minimizing human involvement and improving clinical workflow efficiency.

Optimized voice to prescription processing:

The integration of Automatic Speech Recognition (ASR) and NLP allows the system to accurately interpret voice input related to clinical data. Its multi-layered architecture enables smooth data transfer from speech input to entity extraction and the eventual generation of prescriptions.

Final Thoughts

Enhanced Model Optimization and Deployment:

Future developments of this project may involve training the generative model on more extensive medical datasets, improving inference speed through GPU acceleration, and enhancing validation methods.

SECURITY, VALIDATION, AND CONSIDERATIONS

Given its connection to medical data, the project adheres to stringent security and ethical standards:

There will be no long-term retention of patient data, and all communications between system components are encrypted, complemented by role-based access controls. The project features a rule-based validation system to ensure dosage limits, medication consistency, and completeness. Additionally, it mandates physician approval, thereby ensuring ethical standards and compliance with patient care.

It is crucial to recognize that this project is designed solely for clinical decision support and is not a substitute for qualified medical professionals. The project has a rule-based validation process for dosage limits, consistency of medication, as well as completeness. It also has a mandatory process for physician approval, ensuring ethical and patient compliance. It is important to note that the project is simply for clinical decision support, as it is not intended to replace actual human medical professionals.

IX. CONCLUSION

The Medical Prescription Generator utilizing Generative AI presents an effective solution for automating the prescription procedure within the healthcare sector. The system integrates speech recognition, Natural Language Processing, and a transformer model to facilitate prescription generation from spoken medical content in a straightforward manner. Its layered design allows for efficient real-time voice-to-prescription processing on a web platform. This innovation reduces documentation time, eliminates errors caused by illegible handwriting, and ensures consistent record-keeping. While serving as a support tool within the medical field, it is not meant to replace professional medical advice, yet it holds significant potential for enhancing digital healthcare processes.

Future Directions

Integration with Electronic Health Records:

The system could be further improved by linking it with hospitals' Electronic Health Records, providing deeper insights into clinical situations.

Multilingual Voice Support:

The speech recognition component can be upgraded to accommodate various regional languages, increasing its utility in the healthcare sector.

Enhancement of Clinical Decision Support System:

Integrating the system with medically validated knowledge databases could enhance its efficiency in delivering accurate prescriptions.

