

Smart Medicine Information Extraction and Management System

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Abstract

The Smart Medicine Information Extraction and Management System is thus an intelligent web application that will help to access medicine details through QR code scanning, AI text extraction and audio output. All users have to do is to scan a QR code to retrieve the medicine name, manufacturer, expiry date and main ingredients. While content on the website has been dynamically fetched using Selenium, the BeautifulSoup had been used to extract the relevant text. Different kinds of NLP are applied on this data using the Gemini API by Google and are simply reorganized in an easy-to-read format along with a brief and a user-friendly summary for a better understanding. Other types include the voice output of the medicines' information for the ease of the visually impaired people. All data is securely saved on Firebase to make it easy for accessibility and reference for the future. With a responsive interface, features such as QR code scanning, picture uploading, camera integration and audio output functions seamlessly. The utilization of AI combined with cloud storage together with an easy-to-use design enhances access to information on medicines through this system and thus helps patients, pharmacists, and health care providers make informed decisions and improve the transparency of healthcare.

Keywords: AI-Powered Text Extraction, Firebase Cloud Storage, Healthcare Technology, Medicine Information Management, Natural Language Processing (NLP), QR Code Scanning.

I. Introduction

The Smart Medicine Information Extraction and Management points like manufacturing and expiry dates, generic and brand names, and usage instructions with just a voice output. The system will use methods of web scraping, NLP, and machine learning to extract important medicine-related data. The user simply points the scanner at a QR code on the medicine packet, and crucial details like the manufacturing date, expiry date, generic name, brand name, and usage instructions will be extracted and narrated to him, supporting multiple languages, making the platform accessible to wide-ranging literacy levels and visually impaired individuals. For enhanced interactivity, the system hosts an AI-powered chatbot through the Gemini API.

The chatbot can understand and respond to questions at a high level of difficulty, allowing for detailed explanations about medicines, the use of the system, and other valuable insights. It is noted that while the chatbot supports only a single language, its responses are thoughtful, accurate, and considers the context of the queries, ensuring a smooth and reliable interaction. The voice output, meanwhile, allows users to hear the extracted details about the medicine in their language of choice, allowing for maximum accessibility and user comfort.

The backend is built using Flask for data extraction, API interactions, and voice generation, while Firebase is used for secure real-time data storage and management. With Gemini API, this architecture provides a perfect and intelligent user experience Providing instant and voice-guided access to critical medicine information without any delay. The Smart Medicine Information Extraction and Management System merges QR code scanning, multilingual voice output, Gemini-powered chatbot assistance, and real-time data management that connects complex medical information with end-users. This supports health literacy, independent medication management, and enables the individual to make informed healthcare decisions with an easy-to-use and accessible platform.

II. System Model

The Smart Medicine Information Extraction and Management System can be structured with the following components under the system model:

1. Input Layer QR Code Scanning: The system accepts scanning of a QR code with a smartphone or webcam to capture details of the medicine.
2. Image Upload & Camera Integration: Users can upload an image of the medicine, or take a picture with their device camera for text extraction of the medicine.

3. Processing Layer AI-Powered Text Extraction: The system uses Selenium and BeautifulSoup to scrape data from a website, and return product information, which may include medicine information.
4. NLP & Summarization: The system uses the Google Gemini API to process the scraped text, summarize the information product.
5. Audio Conversion: The details about the product will be converted to audio to assist users with visual impairments so they can hear the product details.
6. Data Storage Layer Firebase Cloud Storage: The details about the medicine will be stored on Firebase so that users can return to this information at a later time, in a convenient manner.
7. Output Layer Web Interface: The medicine information will be displayed in a user-friendly format for interface users to view easy.
8. Voice Output: The user has the option to convert the medicine detail to audio, so it can be read aloud.
9. Security & Accessibility Secure Data Storage: Firebase can also ensure integrity and availability of the data.
10. User Authentication (Optional): the login/signup feature can be implemented if user wants to log in and pull data from previous entries.
11. Cross-device support: The system can be utilized on mobile device or desktop for accessibility.

III. Methodology

The creators of the Smart Medicine Information Extraction Management System include features such as easy access, safety, usability for the aged regarding medicinal needs, and accessibility needs for people with visual impairment and low literacy levels. QR code scanning and data extraction are the main technical methodologies used. Selenium is a web automation testing tool for processing the web content first before further cleaning for better presentation, and then BeautifulSoup is used. Key information about the whole drugs are taken out using the Natural Language Processing technique supported by the Gemini API while irrelevant entities are filtered out. It instantaneously recognizes the product name, manufacturer, date of manufacturing, and expiry date of the product with the support of Gemini API.

The scraping process outputs the raw data which is then cleaned into structured JSON format from where insights may be extracted. Firebase Firestore is used to store the products with NoSQL documentary. For each medicine entry in the repository, a unique identification is present. Further in support of its access for the common man, the product has a feature of automated description generation where once summarised a few words for the layperson by the Gemini API, that being said general information entails what it is for and the expected questions during use. It also has added features of translation and the speaking of the text through TTS in many languages to further support people with accessibility. The product description has been translated into several other languages like English, Telugu, and Hindi for further understanding; the gTTS library also allows translating this text back into an audio file for the presentability of information and for the ease of listening to the users about the medication.

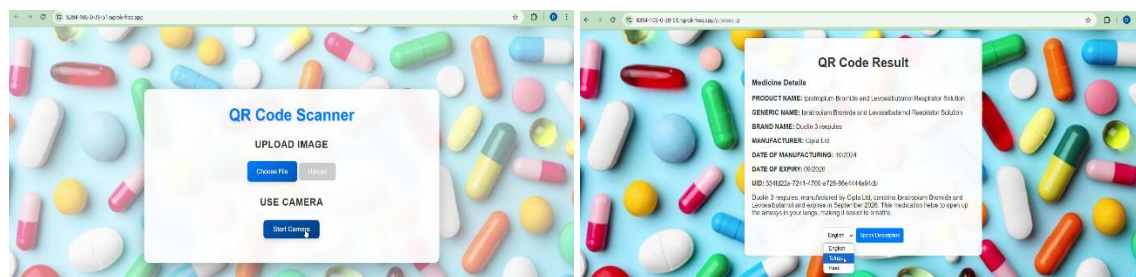
- A. **QR CODE SCANNING AND DATA EXTRACTION:** The system starts with users scanning a QR code that bears a URL leading to a webpage that contains the details of the medicine. For the extraction of this information, Selenium, a web automation tool, is deployed to navigate to the specified URL and to extract the contents of that page. The extracted HTML is cleaned and parsed using Beautiful Soup by removing scripts and styles and ensuring that the relevant content is only kept for further processing.
- B. **NATURAL LANGUAGE PROCESSING FOR DATA EXTRACTION:** The unstructured data obtained from the webpage text is processed using the Gemini API to extract essential medication details like product name, manufacturer, date of manufacture, and expiry date. The information extracted is embedded into a structured JSON object, facilitate its storage, retrieval, and processing in future endeavors.
- C. **DATA STORAGE AND RETRIEVAL:** In light of the need to ensure secure and efficient management of information relating to medicines obtained, structured records are held in Firebase Firestore-NoSQL cloud database. Identification of medicines records-UIDs-were user-friendly for users to refer to later whenever required. This holds important information of the medicine in the future without any need for further scans.
- D. **PRODUCT DESCRIPTION GENERATION:** The API Service uses Gemini to create a summary of the product description that is short and user-friendly, incorporating important details about the medicine: name, manufacturer,

expiry date, etc., and brief notes about the purpose and application of the medicines. The resultant concisely guaranteed description enhances readability while allowing easy identification of the medication by users.

- E. TRANSLATION AND TEXT-TO-SPEECH ACCESSIBILITY:** This system's medication information has, therefore, been enhanced for inclusiveness and accessibility through multilingual translation and TTS features. In this case, when the user selects the language, it can translate the product description through the Gemini API into a range of languages: English, Telugu, and Hindi. Thereafter, the text translated is expedited to an audio file using gTTS, which is a marvelous TTS library extension from Google. This gives a unique facility for the listening of the very details of the medication by a user, thus avoiding the task of reading those medications. This has particular benefits for people who are blind and those who cannot read.
- F. CHATBOT INTEGRATION FOR REAL-TIME ASSISTANCE:** Working in unison with the Gemini API, an interactive chatbot shall enable its users to receive instantaneous assistance, by means of text or speech, on any inquiries they have syntactical workings concerning medicine, dosages, or general healthcare in nature. Along with Natural Language Processing, the chatbot dissects the questions and provides in return an answer that is accurate and befittingly contextual so that the information surrounding medicines is conversation-driven and approachable.

IV. Results

The Smart Medicine Information Extraction and Management System implements a concept to extract, treat, and present the details of any medication in a systematic way - most importantly, extract these key pieces of information: product name, manufacturer, and expiry date from pages connected through printable QR codes - and store them securely in Firebase Firestore for real-time access. The plug-in also accommodates multilingual translation and TTS, making it more powerful for the visually impaired and people with limited literacy. Majorly it translates information into English, Telugu, and Hindi. An NLP-powered chatbot aims to provide answers to real-time queries related to medicines and dosages. User interaction is made possible using QR code scanning, language selection, and by enabling chatbot integration using intuitive HTML, CSS, and JavaScript Interfaces. This goes to enhance the reach and safety of medicines and provide a reliable easy-to-use healthcare management solution.



V. Conclusion

Through QR code scanning, AI-powered text extraction, and voice output, Smart Medicine Info Extraction and Management System makes all relevant medication information easily available. Main information such as manufacturing date, expiry date, generic name, brand name, and usage are provided, and voice assistance will help visually impaired users. The system supports voice output in Hindi, Telugu, and English for accessibility purposes. Built on Google's Gemini API, Flask, and Firebase, it delivers fast, reliable information that allows the user to understand and access medications instantly.

The QR codes may, in the near future, be printed onto each single dose of tablets so that players could access particular information pertaining to each dose without an outer pack. With it comes multimodal support, which includes issuing alerts during chemical incompatibility, offline access, prescription management, among others. Adding more functionalities provided by integration with some wearable devices, AR interfaces, blockchain security, and other advanced systems

would further revolution act the platform into a parade of confections for safe, informed, and personalized management in healthcare.

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