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Innovation in Medical Application based on Artificial Intelligence (AI) by Cutting-Edge Technologies

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ABSTRACT

Medical applications have become integral components of contemporary healthcare, leveraging advancements in technology to enhance patient care. This paper addresses the need for more efficient communication and decision-making between patients and doctors. The main objective of this research is to develop an AI-based application that serves as an intermediary between the patient and the doctor, streamlining their interactions. The proposed application operates in four phases. First, it collects comprehensive patient data, including test results, x-rays, and self-reported health status, and compiles it into a file stored in a database. Second, the application provides an initial diagnosis based on an AI model and advises whether a doctor's consultation is necessary. Third, if a consultation is recommended, the system includes the patient's file and diagnosis in the booking process. Finally, the data is emailed to both the patient and the doctor for reference. The results suggest that this medical application can redefine the doctor-patient relationship by improving communication, providing more consistent interactions, and enhancing diagnostic accuracy.

الابتكار في التطبيقات الطبية القائمة على الذكاء الاصطناعي (AI) باستخدام التقنيات المتطورة

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الكلمات المفتاحية:
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الملخص

أصبحت التطبيقات الطبية جزءًا لا يتجزأ من الرعاية الصحية الحديثة، حيث تستفيد من التقدم التكنولوجي لتحسين رعاية المرضى. يناقش هذا البحث الحاجة إلى تعزيز كفاءة التواصل واتخاذ القرارات بين المرضى والأطباء. الهدف الرئيسي لهذا البحث هو تطوير تطبيق قائم على الذكاء الاصطناعي يعمل كوسيط بين المريض والطبيب مما يُبسّط التفاعلات بينهما. يعمل التطبيق عبر أربع مراحل: أولاً، يجمع بيانات شاملة عن المريض، بما في ذلك نتائج التحاليل، صور الأشعة، والوضع الصحي المبلغ عنه ذاتيًا، ويخزنها في ملف بقاعدة بيانات. ثانيًا، يقدم تشخيصًا مبدئيًا بناءً على نموذج ذكاء اصطناعي ويحدد ما إذا كانت استشارة الطبيب ضرورية. ثالثًا، إذا تم التوصية بالاستشارة، يتم تضمين ملف المريض والتشخيص في عملية حجز الموعد. أخيرًا، تُرسل البيانات إلى كل من المريض والطبيب عبر البريد الإلكتروني كمرجع. تشير النتائج إلى أن هذا التطبيق الطبي يمكن أن يعيد تعريف العلاقة بين الطبيب والمريض من خلال تحسين التواصل، تقديم تفاعلات أكثر انتظامًا، وتعزيز دقة التشخيص.

1. Introduction

In today's rapidly evolving technological environment, the integration of artificial intelligence (AI) into medical applications has led to a dramatic change in healthcare services This collaboration between AI and cutting-edge technologies has triggered the edge of a new product that promises to change the footprint of various medical products. From assisting with research to optimizing treatments and beyond, the integration of AI into medicine has tremendous potential to increase efficiency, accuracy, and patient outcomes. This paper delves into AI-driven medical applications, exploring the intersection of advanced technology and dynamic healthcare communication. By exploring the latest innovations and developments, we aim to illuminate the transformative effects of AI on medicine [1]. Through a comprehensive analysis of current trends, challenges and opportunities, this study seeks to provide valuable insights into the sustainable development of health care delivery. Focusing on the convergence of AI and sophisticated technology, this review seeks to shed light on the groundbreaking developments that are changing the medical landscape. By identifying the fields of medicine that are powered by AI, we seek to highlight the broader implications for healthcare providers, patients, and society at large. As we move into this era of unprecedented innovation, understanding the potential and limitations of AI in medicine is essential to harnessing its full potential and ushering in a new era of healthcare excellence [2]. The key technical processes in the development of medical applications include:

Data Security and Privacy: Medical applications must priorities strong security measures like multi-factor authentication, advanced

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encryption, and access control lists due to the sensitive nature of patient medical records. These measures help prevent unauthorized access and guard against identity theft, discrimination, and even physical harm [3].

Usability and Accessibility: Because a lower adoption rate corresponds to a complex user interface, it is critical that medical applications are accessible to people of all abilities and user-friendly. Before all else, the application's design should priorities accessibility and usability [4].

Performance and Reliability: Medical applications need to be dependable and capable of performing optimally even under high demand. Rigorous testing of the application is crucial to ensure it meets the necessary performance and reliability standards Here are some specific technical considerations to bear in mind when developing medical applications for the two key stakeholders in the medical work environment. the medical staff and the patient. For the medical staff are the application should be intuitive and easy to navigate, even in high-pressure situations. And, it should provide access to the necessary information and tools that enable the medical staff to perform their duties effectively. Ensuring security is paramount. The application must safeguard patient data against unauthorized access. Also, for the patient are the application should be user-friendly and easy to navigate, catering to individuals who may not be tech-savvy. And, it should provide information and resources tailored to the patient's needs. Just like for medical staff, security is crucial. The application must protect patient data from unauthorized access [5][6].

This paper outlines the important contributions of this work as follows: Initially, an overview of artificial intelligence (AI) in the medical application is presented. Then, it is proposed that an application structure based on artificial intelligence (AI) be applied to medical treatment. Finally, we end by describing how the integration of state-of-the-art technology will enable the innovation of medical applications to become smarter.

This paper is organized as follows. Section 2 introduces the proposed Framework for Advancing Medical Healthcare Application. Section 3 demonstrates Cut-ting-edge Technologies for Developing the Proposed Application. Finally, the paper is concluded in Sect. 4.

2. The Proposed Framework for Advancing Medical Healthcare Application

This section introduces the proposed framework application based on artificial intelligence (AI) to medical healthcare. Fig. 1 shows the workflow of AI in medical application with two parts doctor and patient. We integrate current technologies. Those technologies are discussed below.

1. *The Patient Part*

The patient phase empowers users to take an active role in their initial health assessment. This is achieved through a user-friendly interface that provides three key features:

a. **Secure X-Ray Analysis with TensorFlow:** To enhance the initial

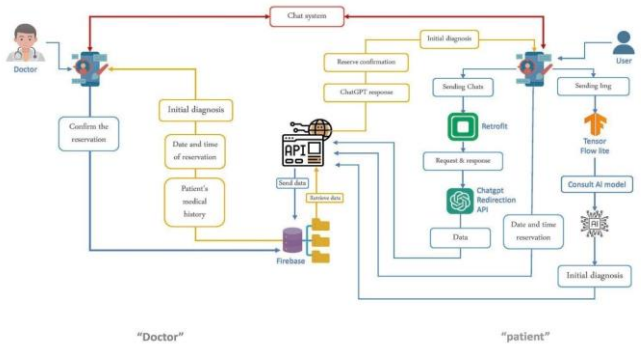

Fig. 1. The Proposed Framework for Advancing Medical Healthcare

diagnosis process, patients can securely upload X-ray images. It is considered during the first phase of proposed application. These images are then routed to a powerful TensorFlow-based system. TensorFlow, a leading open-source machine learning library, houses a specifically trained AI model. This model, adept at identifying patterns in medical images, analyzes the uploaded X-ray to detect potential abnormalities or highlight areas of concern. This AI-powered analysis assists in streamlining the diagnostic journey, paving the way for a more efficient evaluation by healthcare professionals. It's important to remember that this analysis serves as a preliminary assessment, and a qualified medical professional should always be involved in the final diagnosis. After the initial diagnosis is generated with the assistance of TensorFlow, it is securely transmitted to Firebase using an API. This ensures the data remains encrypted throughout the process, preparing it for use in other phases and features of the application.

b. **Intelligent Chatbot Consultation**: Patients can interact with a chatbot equipped with medical knowledge and decision-making capabilities. This chatbot leverages a powerful backend infrastructure facilitated by Retrofit, a networking library, to seamlessly integrate with advanced AI capabilities. It is considered during the second phase of proposed application.

c. **Friendly Reservation**: The proposed application empowers patients to seamlessly schedule follow-up appointments. After a consultation, you can easily specify the desired date and time for your next visit with a specialist suited to your needs. This request is then sent electronically and awaits confirmation from the selected doctor. The system generates an initial diagnosis based on the processed data. This diagnosis, along with the filtered data, is then sent to a secure backend using a source request to a dedicated API. Finally, the API transmits the combined data to Firebase for further analysis or storage. Once complete, the processed data and initial diagnosis are sent back to the user interface (UI) for display, allowing the patient to review the information. It is considered during the third and fourth phase of proposed application.

3. Cutting-Edge Technologies for Developing the Proposed Application

In this paper, we explore the challenges of integrating novel technologies into the development process of the proposed application. We aim to elucidate the transformational potential of these technologies in healthcare by conducting in-depth research on the latest innovations and techniques.

1. *Retrofit*

Retrofit is a third-party Android library that we will utilize as our HTTP client to manage the RESTful API requests of the ChatGPT API [7]. Retrofit transforms your HTTP API into a Java interface. Each call from the created service can execute a synchronous or asynchronous HTTP request to the remote web server [8]. When sending a GET request, we must first provide a model, written in pure Java, to receive the data from the request as JSON. This data is then parsed into a Java class using the 'GsonFactory' Converter class, which is included in the Retrofit dependency.

2. *TensorFlow Lite Model*

TensorFlow Lite is a suite of tools designed to facilitate on-device machine learning. It assists developers in running their models on mobile, embedded, and edge devices. It is the most commonly used method for deploying machine learning models in mobile applications [9]. Typically, the input to TensorFlow Lite, known as tensor input, is one of the primitive data types, often an image. The output of TensorFlow Lite, referred to as tensor output, is usually an array of primitive types such as byte or float [9].

You can use it with android by following these steps:

• Create and train a standard machine learning model using Python in Jupyter Notebook or Google Colab.
• Convert this model into a TensorFlow model using the TensorFlow converter library.
• Transform the resulting TensorFlow model into a TensorFlow Lite mod-el.
• To import the model into Android Studio, right-click the app folder, select New > Other > TensorFlow Lite Model.
• Select the location of the .tflite model file.
• The Android Studio IDE will automatically create a file named 'ml' and will include your .tflite model inside it.
• The Android Studio IDE will provide you with a sample code to use when you click on the .tflite model file.
• Use this code and modify it as needed.

Now, you have successfully used and deployed your pre-trained machine learning model into your Android application.

3. Firebase

Google delivers a full set of backend cloud computing services and application development platforms. These services contain databases, authentication, and integration for a varied range of applications, including but not limited to An-droid, iOS, JavaScript, Node.js, Java, Unity, PHP, Flutter, and C++ [10][11][12].

Connecting mobile app to Firebase for data using API involves these steps:

• Set up Firebase project: Create a project in the Firebase console and enable the desired Firebase services like Realtime Database or Cloud Firestore.

• Integrate Firebase SDK: Add the Firebase Android or iOS SDK to your mobile app project, following the platform-specific instructions.

• Authenticate (optional): Depending on your data security needs, implement user authentication in your app using Firebase Authentication.

• Build the API call: Utilize the Firebase SDK to construct API requests for sending or receiving data. This involves specifying the data path within your chosen Firebase service and the data itself.

• Execute the API call: Make the API call using the mobile app's networking libraries. The Firebase SDK handles communication with Firebase servers.

• Handle response (optional): For receiving data, implement logic to process the response received from the Firebase API within your app.

4. ChatGPT API

The ChatGPT API is a RESTful API that links to OpenAI's GPT-3 and GPT-Neo language models [13]. It allows developers to simply integrate these strong language models into their apps and services without dealing with the intricate technological intricacies. The ChatGPT API supports numerous functions, such as text production, summarization, and question-answering. It supports numerous programming languages, including as Python, Node.js, and Java, and works with popular web frameworks like Flask and Django. The ChatGPT API can help developers design conversational AI products and services more efficiently [14].

5. Information Security and Confidentiality Strategy

The Information Security and Privacy Policy outlines policies and procedures to protect sensitive medical information used by AI-powered applications. This process ensures that patient information is secure, confidential, and inaccessible to unauthorized persons, thus supporting trust and compliance with privacy laws in healthcare. take into consideration when designing our application, which is more data secure and data privacy. And do those within the four phases of the proposed application by using the following strategies:

a. **Two-Factor Authentication (2F):** 2F authentication aims to enhance resilience of password-based authentication by requiring users to provide an additional authentication factor, e.g., a code generated by a security token. However, it also introduces non-negligible costs for service providers and requires users to carry out additional actions during the authentication process. In this paper, we present an exploratory comparative study of the usability of 2F technologies. First, we conduct a pre-study interview to identify popular technologies as well as contexts and motivations in which they are used. We then present the results of a quantitative study based on a survey completed by 219 Mechanical Turk users, aiming to measure the usability of three popular 2F solutions: codes generated by security tokens, one-time PINs received via email or SMS, and dedicated smartphone apps (e.g., Google Authenticator). We record contexts and motivations, and study their impact on perceived usability. We find that 2F technologies are overall perceived as usable, regardless of motivation and/or context of use. We also present an exploratory factor analysis, highlighting that three metrics ease-of-use, required cognitive efforts, and trustworthiness– are enough to capture key factors affecting 2F usability.[15] 2F provide us the assurance we need to authenticate, A user that might use an invalid email Due to massive explorations in Internet technologies the security issues and authentication issues are nowadays are now a very important challenge in all spheres of our life. Especially in Banks, Government offices, healthcare industry, defense organization, educational sectors the authentication of user is now a most vital issue. Government organizations are setting standards, passing laws and forcing organizations and agencies to comply with these standards with non-compliance being met with wide-ranging consequences [16]. Both corporate and personal assets are at risk against people trying impersonating users and stealing money and information. So, we need security. For providing better security into someone's account the idea of authentication is introduced. Authentication is done to identify whether a person is genuine or not if she/he is genuine then grant the access of the system otherwise denied it. An authentication factor is a piece of information and process used to authenticate or verify the identity of a person or other entity requesting access under security constraints. In the proposed application will be deploy the SMS Verification Type to achieve 2F authentication, SMS, or text messaging, can be used as a form of two-factor authentication when a message is sent to a trusted phone number. The user is prompted to either interact with the text or use a one-time code to verify their identity on a site or application [17].

b. **Data Encryption**: The proposed healthcare application prioritizes user privacy and data security. Patient and doctor information is highly sensitive, particularly health data. To ensure the strongest protection. Therefore, an ethical penetration test was conducted on the database to ensure its strength, and the result was that the stored data is not secure enough, especially since Firebase only cares about securing private passwords. Every user and the rest of the data can be seen, which is not good. We've tried a too many solutions and this is the best we've found. To ensure the highest level of data security for our users, we've implemented robust data encryption using the Advanced Encryption Standard (AES). This industry-standard encryption scrambles patient and doctor information before it's stored in our database. This added layer of security protects sensitive data from unauthorized access, even by administrators, ensuring that only authorized personnel can decrypt and view the information [18].

4. Conclusion

This paper significantly adds to the ongoing transformation within modern healthcare, contributing valuable insights to propel innovation in the field. Consequently, the integration of state-of-the-art technologies such as Firebase, TensorFlow Lite, Retrofit, and the ChatGbT APl establishes a solid base for the creation of an advanced healthcare application. This paper was a proposed medical application to help both patients and doctors get accurate diagnoses. As the healthcare landscape continues to progress, in addition, this paper provides a sneak peek into the potential of technology-driven applications that could transform patient care, medical record management, and communication within the healthcare ecosystem.

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