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Mobile Application for Cataract and Conjunctivitis Detection

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Abstract:- This study introduces a cutting-edge mobile application that will revolutionize eye care. The program focuses on the detection and remote monitoring of cataracts and conjunctivitis by utilizing the capabilities of cell phones. Precise diagnostics are made possible by combining artificial intelligence, machine learning, and digital imagery. The possibilities, difficulties, and prospects of mobile-based eye problem detection are examined through a comprehensive literature analysis. The methodology, which includes image processing and deep learning methods for cataract and conjunctivitis identification, is described in depth in the publication. The app also includes a chatbot for user engagement and for users to acknowledge further needed information. The application also facilitates a channeling service and a treatment reminder service. The advantages of mobile-based detection, privacy issues, user-centered design, and the part played by international health organizations in technology adoption are all examined in the conversation. The conclusion highlights the application's transformational potential and urges continuous cooperation between medical experts, technologists, and policymakers.

Keywords*: cataract, conjunctivitis, digital imaging, remote monitoring, image processing.*

1. Introduction

A new era of technology has started since the smartphone was invented. Since then, there has been nothing but a huge advancement across various industries. The healthcare sector is no exception. This intersection of technology and healthcare has led to improved diagnostics, treatments, and patient care. The ophthalmology field focuses on eye disorders and relevant medicine. If someone has a smartphone, they can check their eyes for cataracts and conjunctivitis from home via this mobile application.

There are four main functions in this application, the first and main function is cataracts and conjunctivitis detection. It is a trained model to identify the mentioned eye disorders. It is done via image-analyzing technologies. Secondly, there is a channeling service integrated with the application. Where the users can book a channel with a doctor of their choice. The third one is the treatment reminder. Users can set reminders when to take their medication with the app. Finally, there is an Artificial Intelligence (AI) doctor who will provide users with the necessary information which users may require about eye care and this is a novelty feature.

Some of the previous attempts for such an application are mentioned here in this paper, as well as the problems users faced. In methodology, all four functions of the application are briefly explained from a developer's perspective. Used technologies, services, and some brief information on how the application is implemented.

2. Litreature Review

Common eye disorders are cataracts and conjunctivitis can impair vision and cause discomfort if left untreated. With the possibility for early identification and remote monitoring of various eye illnesses, mobile application integration into healthcare has gained traction in recent years.

Numerous studies have highlighted the utility of mobile applications in ophthalmology. Behnam Askarian, Peter Ho and Jo Woon Chong demonstrated the feasibility of using smartphone cameras for capturing high-quality images of the front view of the eye segment, enabling accurate cataract assessment [1]. Similarly, algorithms to

diagnose conjunctivitis through image analysis and layer recognition recognize the difference between two different objects, achieving a commendable accuracy rate of 90%. Few applications are available on the market, and many of them offer limited functionality, provide inaccurate results. Also have limited eye illness detections [2].

One of the most popular vision applications on the market is ICARE Vision Test [3]. It offers vision tests and details on only a small number of specific vision issues. ICARE Vision Test has a very poor user interface for offering six different vision tests. In this application main issue is lack of features and application limit only adults [4]. This issue of limitation was overcome by the Healthy Vision application.

Another program called Healthy Vision has three primary features: eye exercises, eye tests, and questions and answers about issues with limited vision. Both adults and children can use this application. B2 Eye test another app in the market. This application like a survey. The main downside of this application is lack of user-friendly and the application has limited functionality features.

Vision Test is another app in the market and it has main four features eye test, quiz, optician and eye advice. The main downtime is the application only target adults. Therefore, the amount of people who can benefit from this application is limited. Mainly app has considerable number of features that is the main good point [5].

Mobile-based eye illness detection has potential, but there are still problems. Wang and Zhan identified the need for robust algorithms to differentiate between various cataract stages and multi class classification of diabetic eye, as the disease's progression varies [6]. An experimental result show that image recognition technology based on machine learning can well identify white blood cells that are difficult to detect with the naked eye, with a recognition rate of up to 90% [7].

Similarly, the recognition accuracy rate of the system for the hidden layer reaches more than 90%, according to Xi'an Technological University experimental result [8]. With the conclusion of both identifications, the obvious theory is that these image processing situations have some effectiveness involved. User acceptance and accessibility are important factors in this area. A study by Medical Informatics emphasized the importance of a user-friendly interface and clear instructions for capturing users' needs accurately [9].

Progress in Retinal and Eye Research by World Health Organization (WHO) confirmed WHO started developing digital innovation and technology in healthcare. And it will help researchers and specialists encourage their motion [10].

3. Methodology

The main goal of this research is to create an intuitive application that can detect eye diseases including conjunctivitis and cataracts. With the help of Google's TensorFlow and other cutting-edge technologies, such as image processing and convolutional neural networks (CNNs) [11], the application is designed to provide users with a smooth and cutting-edge experience. In addition to its main function of detection, the program incorporates other features including medication reminders, a channeling service that facilitates access to medical professionals, and the introduction of an AI doctor that offers intelligent medical insights.

The main goal is to identify eye problems and to offer a comprehensive support system for healthcare. The app's extensive features include the ability to identify eye disorders, send out timely medication adherence reminders, facilitate simple communication with medical specialists, and integrate an AI doctor to provide tailored medical advice and improve the user experience overall. By using this novel strategy, the research aims to smoothly incorporate state-of-the-art technology into a user-friendly, easily available application that provides ongoing medical consultation and help, going beyond simple detection. Fig. 1 shows the Unit testing results for data extraction and classification.

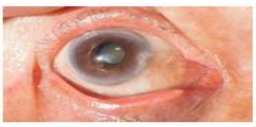
Image	Actual Situation	Cataract and Conjunctiva
	Normal eye	Negative
	Detected Cataract	Conjunctivitis Positive
	Nuclear Cataract	Positive
	Detect Cataract	Cataract Positive

Fig.1 Various eye types

A. Detection of cataracts and conjunctivitis

This is the main function of the application. A trained AI model is used to detect disorders of the eye. These deep learning methods are implemented using TensorFlow, a free library which is provided by Google. The TensorFlow model is built by using the Keras library, TensorFlow excels at fast debugging, image noise reduction, and image analysis because it uses Keras high-level APIs. Fig. 2 shows the overall flow chart for eye illness detection.

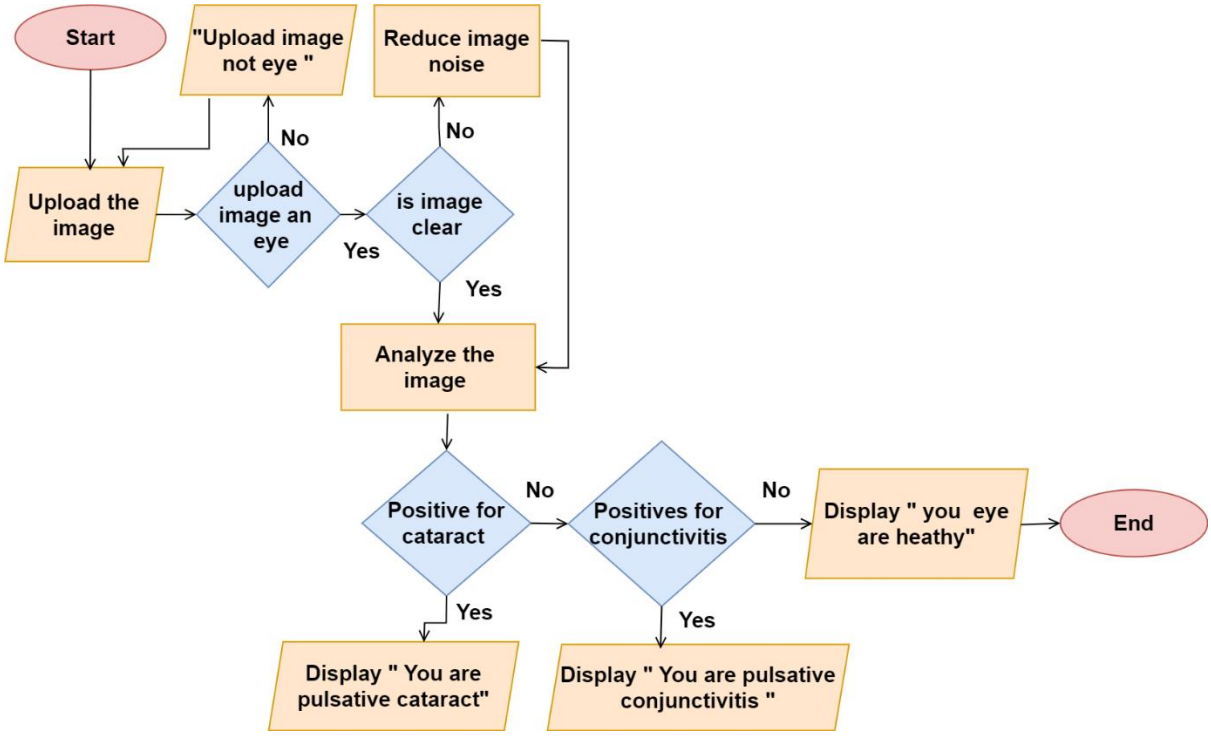


Fig.2 Flow Chart of eye illness detection

B. Channeling doctors

Users are facilitated with a channeling service. If a user has the need to channel a doctor about an eye disorder. The users can book a channel with the best available doctors via this application. This will be a simple procedure with the CRUD operations included. Although users can book a channel via the app, payments cannot be made through the app.

C. Treatment reminder

This feature revolves around creating medical treatment reminders. It initiates notifications even if the users are inactive, offering adjustable settings for notification intensity and vibration. These notifications emulate system alerts, enhancing user engagement and helping users to get their medication on time. Recycler View components enable efficient data management and CRUD operations. Motivational messages will be shown to users to encourage them even more. The colour scheme, designed for diverse eye illnesses, employs blue and orange hues [12]. This application shows the potential to improve medical adherence and advance user-centered healthcare technology. Fig. 3 shows the suitable colour schema for application.

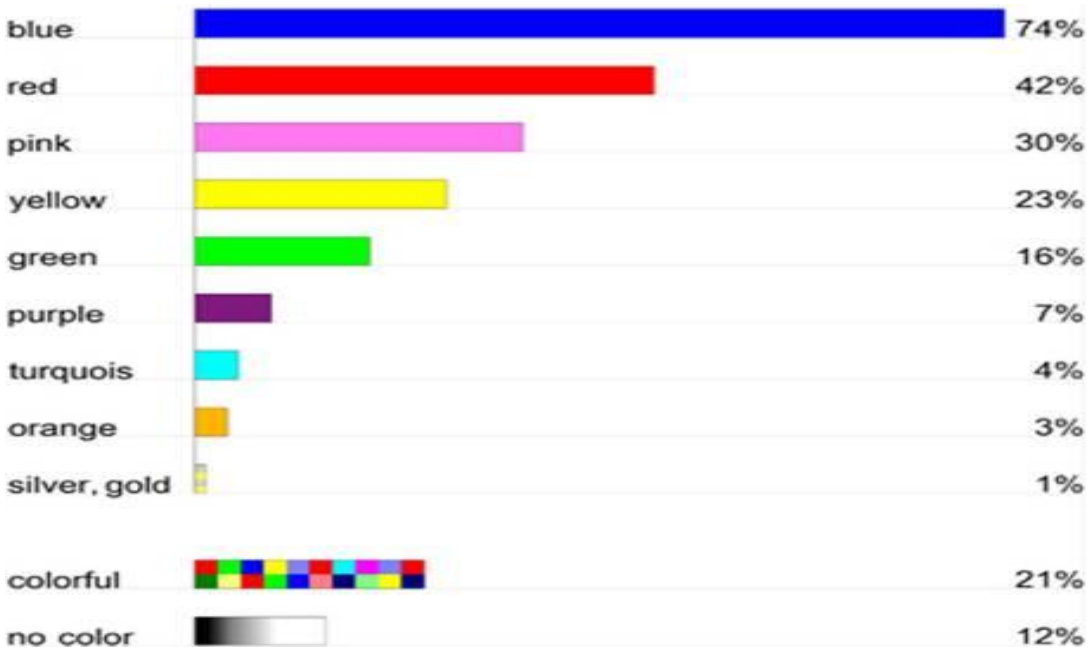


Fig.3 Suitable Color scheme for cataract and conjunctivitis

Kotlin data retrieve components will be created using the Kotlin recycler view and Scroller view combination. Fig. 4 shows the how kotlin components involving.

Fig. 4 Prototype example of Kotlin recycler components

Component are not static the components are created according to dynamic manner like a to-do list. And it was also created according to the above color scheme. More than vector asset it's good to use a few large words for

these cataracts and conjunctivitis situations. Hence this eye disease is commonly found in people aged 61-71 and as a percentage it is too large [13]. Fig. 5 shows the most accurate rate of age for application users.

Age group in years	Male	Female
16-20	9	2
21-30	11	3
31-40	13	3
41-50	17	4
51-60	47	29
61-70	58	27
71-80	21	11
81+	3	0
Total	179	79

Fig. 5 common age range of eye disease

Rather than a firebase, a SQL room database is good for this notification situation because it can reduce the lag of firing notifications because it works locally. If the firebase database is used, then after a few minutes, the alarm and notification will fire because it's processed too much longer than the room database. And this scope is not interacting with other scopes, a SQL room can apply as a reminder's database.

D. AI doctor

The proposed application's unique feature revolves around creating medical an AI doctor. A trained AI chatbot will be available to users. An already available chatbot such as chat GPT or Google Bard will be connected to the app via an API. So, the users can know more about their illnesses and what are the available treatments. Kotlin and Firebase will be used to implement the mentioned chatbot. Mainly going to design two types of chatbots FAQ chatbots and dynamic chatbots. FAQ chat bots only answer static questions. The team is going to plan some common question and answer scenarios. And the dynamic chat bot is going to plan according to dynamic questions It is only based on cataract and conjunctivitis scope. If users' questions are out of bounds, then the system will perform some encouragement messages to the user to get the scope.

Static chatbots can be structured on Firebase, then chatbot can create different nodes for two different options, such as cataracts and conjunctivitis, and the Firebase SDK can be integrated into Kotlin apps to retrieve according to user queries. For dynamic situations, NPL libraries can take user inputs, and Firebase's real-time database can hold sessions and contextual history. And also, Firebase cloud functions can handle complex logic and backend processing. TensaFlow can create a module, train it, and use that model to execute chat bots. It's like the detect cataract and conjunctivitis. According to the model, it can use the TensaFlow Lite interpreter. Fig. 6 shows the overall flow chart for AI Doctor.

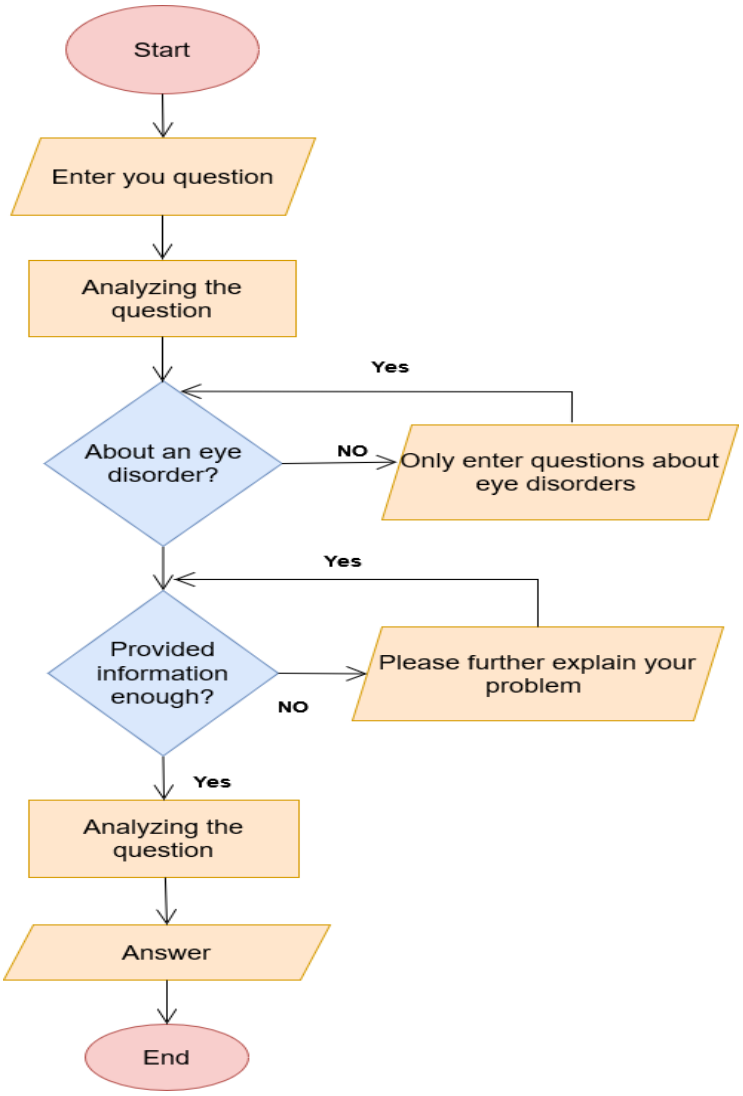


Fig. 6 Flow Chart for chatbot

4. System Overview

In the system overview, the system will be described from the user's perspective. Which means how the user will interact with the system. When utilizing cataract and conjunctivitis detection, users have the option to either upload a photo taken at the moment or select a previously captured image from a higher-quality device. Following the photo upload, the system promptly provides results. Users also have the convenience of booking appointments through the app, with a focus on addressing eye disorders by connecting them with top-rated eye specialists. Users can select their preferred location, and the app displays the available slots.

The standout feature of this application is the AI doctor. Users can leverage the AI doctor to access comprehensive information about their eye disorders. AI doctors offer insights into home-based treatments, eye care tips, and a wealth of additional information. Additionally, users can create and personalize medication reminders to suit their needs. The user can specify the reminder time, enter medication details, and even select the type of alert, whether it's a ring, vibration, or a combination, depending on the situation.

The system provides a user-centric experience, offering cataract and conjunctivitis detection, appointment booking with leading eye specialists, customizable medication reminders, and a standout AI doctor feature that empowers users with valuable information about eye disorders, home treatments, and eye health maintenance tips.

5. Discussion

Conjunctivitis and cataracts are frequent eye conditions that can be detected and monitored early on, even at a distance, with the development of a smartphone app. After looking through a number of research and articles on the subject, we can see that these apps have advantages as well as disadvantages.

Positively, having an app like this may help identify eye problems early on, which is crucial. It's similar to having a quick and simple method for routine eye exams. This could be especially beneficial for people who might find it difficult to get frequent eye exams. On the other side, there are difficulties. The program may fail to detect all issues or occasionally it may indicate an issue when none exists. Therefore, even though it's a great idea, it's imperative to ensure that the app functions properly and doesn't raise any unwarranted concerns. Examining all of these benefits and drawbacks enables us to create the most dependable and beneficial app possible.

A. Future direction

Research should concentrate on improving algorithms going forward in order to increase accuracy and dependability. Additionally, addressing privacy issues and making sure of legal compliance will promote user confidence and legal approval. Realizing the full potential of mobile-based solutions for cataract and conjunctivitis diagnosis requires collaboration between medical practitioners, technologists, and policymakers. The main discussion points for this research are the advantages of mobile-based detection, privacy and data security, user-cantered design, and accessibility. Another crucial point is that when field experts and major social communities, like the WHO, get involved with this technology that is driven by the future, it indicates that this bubble has a strong future.

6. Conclusion

In the context of rapidly changing technology, this study presents a cutting-edge mobile application that has the potential to transform the field of eye healthcare. Detection and remote monitoring of cataracts and conjunctivitis are now possible thanks to the combination of smartphones, AI, and deep learning. The research shows that, despite issues with algorithm accuracy and data security, mobile-based detection and diagnosis have significant advantages. Accessibility is guaranteed by the user-centered design, and the future potential of this innovation is highlighted by partnerships with groups like the WHO. The ultimate goal of this research journey in order to fully realize the potential at mobile based solutions in revolutionizing eye healthcare with continued cooperation between medical experts' technologies and policy makers.

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