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RECOPTIC APPLICATION DEVELOPMENT WITH ARTIFICIAL INTELLIGENCE ON DRUG DETECTION FEATURE FOR VISUALLY IMPAIRED PEOPLE

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Abstract: Recoptic application is an optical recognition application. This application is equipped with TalkBack and the application of artificial intelligence so that the camera on the smartphone can detect and provide information about drugs, text, and objects. Recoptic is currently implemented on Android smartphones and applies the image-to-text converter technology with Optical Character Recognition (OCR). The camera can detect the text on the drug cover and the type of drug, and the application will read out the information with TalkBack. Recoptic has been tested with a user acceptance test (UAT) from experts in medical disciplines and potential users, namely blind people. Features in the application include a voice to guide users and drug detection to read and provide information with sound, objects, and text. The application has been tested and received input with the user acceptance test (UAT) method from experts and blind users. Based on the test results and data collected, as many as 923 drugs have been acquired, and the resulting more than 80% UAT is considered successful for the subject by blind people. Recoptic is implemented on Android-based smartphones.

Keywords: Recoptic, OCR, Drug, Android, Artificial Intelligence

INTRODUCTION

With a population of 255 million, Indonesia is the fourth most populated country on the planet. 6.4 million of these individuals are visually impaired [1]. Based on the interviews performed by the team, one of the issues faced by blind individuals is in the health sector, such as drug use. In one study, 89% of respondents were unable to read prescription labels, 58% did not know the name of the medication, and 96% did not inform health care professionals if they had trouble utilizing their medication [2]. 71% of blind persons rely on their caregivers to determine the dosage of a drug. At the same time, 4% cannot recognize the dosage, and the remaining 21% rely on coping strategies, such as using a brailler to add markers when touched [3]. The social environment responds in various ways to the obstacles and constraints faced by blind persons when carrying out activities. Nevertheless, with the aid of technology, blind people are able to carry out daily tasks like everyone else.

By integrating assistive technology with cellphones, the visually handicapped can acquire information and make decisions more quickly, enhancing their quality of life [4]. A blind person utilizes a screen reader application, such as TalkBack for Android, to access a smartphone [5]. *TalkBack* is an application that enables blind people to comprehend the content of their smartphone's display. TalkBack provides users with a voice navigation aid, reads results on the phone's display, and provides instructions on how to use an application [6]. This technology resulted in the Recoptic application, which is integrated with Talkback. Recoptic is derived from the combination of two words: recognition, which means recognition, and optic, derived from the name of the cranial nerve nervus Optus, whose role is to transfer all visual information. Recoptic reflects technology advancements that promote blind people's equality and fulfillment of the same

health demands. This aligns with the third goal (excellent health and wellbeing) and the tenth goal (reduced inequality) of the United Nations Sustainable Development Goals (SDGs).

Recoptic is able to recognize drugs, objects, and text in real-time. The team utilizes OCR (Optical Character Recognition) for drug detection and text recognition. OCR is computer software that converts scanned letters and numbers to text files. This letter recognition technology can enhance the intelligence and adaptability of computer systems [7]. Through OCR, Recoptic is able to detect a drug in front of the camera with an accuracy of 88.8%. Recoptic will provide comprehensive information regarding a drug's indications, usage guidelines, and dosage requirements, allowing the blind to discriminate between medications and take them appropriately. With the drug database in the application assets, Recoptic can continue to increase the amount of drug data that doctors have validated.

RESEARCH METHOD

In the Recoptic application's design phase, the prototyping process is utilized. End-users are presented with an executable model of the relevant system. They can test the model to determine if it meets their needs [15]. User-Centered Design (UCD) was utilized in developing the Recoptic application's interface. UCD is a design technique that considers users' wants, desires, and restrictions at every stage of the design process and development cycle. Following are the steps of the UCD method:

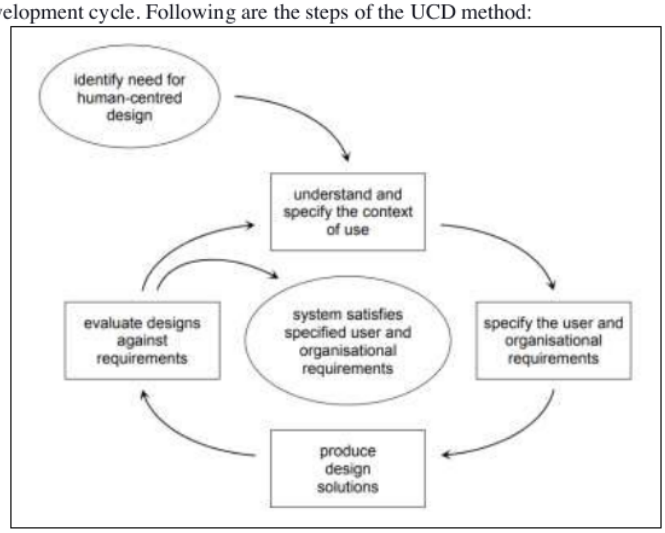

Figure 1. UCD Method [16]

Utilized Technology

Table 1. Utilized Technology

No	Technology	Usability
1	Android Studio	As an Integrated Development Environment in android application development.
2	Cloud Meeting Zoom	As an intermediary for the research team to discuss.
3	Figma	As a prototyping tool to create the user interface of the application.
4	Github	As a cloud-based service to store and manage code, as well as document and control its changes.
5	Kotlin	As a programming language in application development
6	Lucidchart	As a visual workspace in creating flowcharts and diagrams.
7	ML Kit	As a mobile software development kit that delivers Google's machine learning technology on Android and iOS devices.
8	OneDrive	As cloud storage for data related to the application.
9	TalkBack	As a screen reader included on Android devices
10	Tensorflow Lite	As a set of tools that enable machine learning to help run tflite models on mobile devices.

State of The Art

Tabel 2. State of The Art

No	Application Name	Developer	Description	Year
1	Lookout	Google LLC	Features: Has the option to detect objects, documents, food barcodes, and money via video and can be integrated with TalkBack android. Drawbacks: No detailed description of the detected object.	2020
2	Envision AI	Envision Technologies BV	Features: Has the option to detect objects, text, documents, and colours through videos with detailed explanations and can be integrated with TalkBack android. Drawbacks: Need to pay to access the feature after the trial period (14 days).	2018
3	TapTapSee	CloudSight Inc.	Features: Detects objects with detailed explanations through photos and can be integrated with TalkBack android. Drawbacks: Objects can be analyzed after taking a photo with long processing time and no detection mode option.	2014

Novelty Value

The capacity of the Recoptic application to selectively identify medicines constitutes the unique innovation proposed in this PKM-KC. Users of the application will have access to extra information, including drug indications, usage guidelines, and dosage requirements. This is done to prevent medication errors among blind individuals.

Identification and Analysis of Problems

Due to the rapid growth of computer vision over the past several years and the significant number of blind people in Indonesia, researchers wish to assist blind people in utilizing computer vision technology through the Recoptic application. At this point, the team identified and assessed the problem utilizing the literature review technique conducted through books, journals, and internet articles. Based on the literature review, the researchers discovered that 89% of blind respondents were unable to read prescription labels, 58% did not know the name of the drug, and 96% did not report having trouble utilizing their medication to health care professionals (Balasopoulou et al., 2017). The team utilized this data to develop innovative features for the program that can detect drugs and provide precise information about them.

Research in Literature

Using secondary and primary data collection approaches, the team delved deeper into the topic based on the identified and assessed issues. 12,9% of visually impaired individuals require visual reading and identification tools, and 90% of the data utilizes visual identification software. In addition, to obtain more precise information, the team conducted interviews to collect primary data. On Friday, June 24, 2022, interviews were performed with blind persons as possible drug users in East Jakarta in order to limit the drug data that will be placed into the application and to determine the needs of blind people in carrying out their daily activities. After analyzing these requirements, the PKM-KC team incorporated them into the Recoptic program. Starting from the experience, interface, and system that is adjusted to fit the demands of blind individuals. The team intends to confer with professionals, in this case, health doctors, based on the analysis that has been conducted.

Creation of Concepts

The team developed an idea using secondary and primary data that had been collected and examined. Using flowcharts and use case diagrams created with Lucidchart, the overall application architecture is described.

Application UI/UX Development

Recoptic prototype was created using the user-centered design methodology. The team used Figma to design a wireframe containing usage requirements solutions, such as button positioning, navigation, and text. The team then created a high-fidelity prototype by paying close attention to the app's colors, icons, and typography. In designing the Recoptic application's UI/UX, the team prioritized the user experience over the application's interface because it was targeted to its end-user. In addition, the team examined integration with TalkBack accessibility to make the Recoptic app easier to use.

Creation of Prototype

At this point, prototypes were developed. The team designed the prototype using Android Studio and Kotlin. Tensorflow Lite was utilized to develop object detection features. To develop the drug detection feature, ML Kit was used to implementing OCR (Optical Character Recognition). ML Kit is also used to develop text detection capabilities. As a result of these technologies, the Recoptic application can identify objects, drugs, and text, displaying the results as TalkBack-read text. Integration is done to meet the needs of the intended users.

Testing for Bugs and Errors

At this point, the Recoptic application has been packaged as a *.apk file. The program is then subjected to a functional test to determine if there are any remaining bugs and errors.

Evaluation

At this point, discussions with experts and user testing were performed. In this instance, health expert dr. Evi Maryam, MARS. and dr. Nur Isaini Risna, Sp.M., provided professional assistance, and testing was carried out using the User Acceptance Test (UAT) method on blind users.

RESULT AND DISCUSSION

The results achieved in the development from June to September 2022 are Recoptic applications with drug, object, and text detection features.

Initial view of the app

When opening Recoptic for the first time, users will be greeted with a page showing the Recoptic logo. This page has been equipped with a voiceover that is prepared to greet users. Next, the tutorial page is presented to the user. The voiceover will be activated once more to read aloud the Recoptic application's features, along with the application's TalkBack optimization.

Welcome page Tutorial page

Figure 2. Initial View of The App

Drug Detection

The user is given a scan view ready to detect drugs on this feature page. Users can access drug indications, usage rules, and dose information pages on this menu. With a choice between yes and no, the team designed the drug menu page and its derivatives with a sequential structure to make it simpler for users. If yes, the user will proceed to the following page; otherwise, the user will return to scanning new medicine.

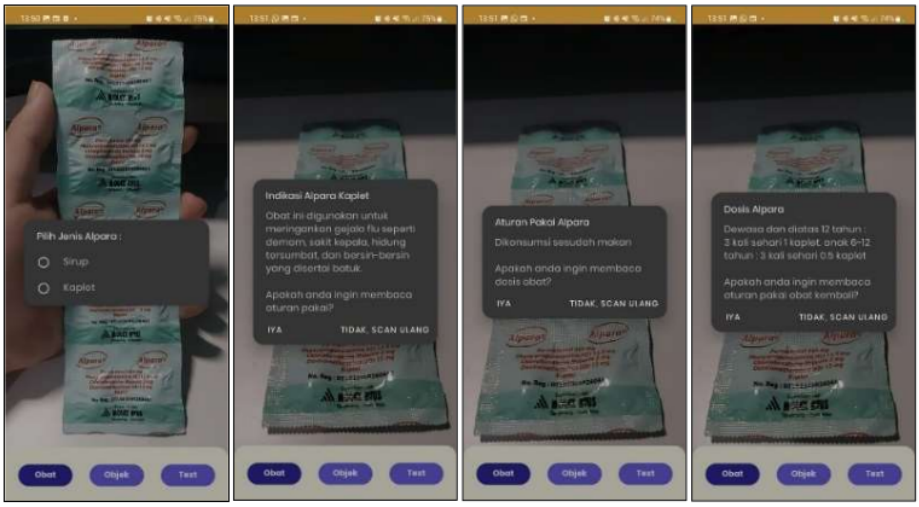

Figure 3. Drug Detection

Object Detection

The camera can detect every object on the scanning camera in the object menu. After the camera successfully detects the objects, the names of the detected objects are displayed on the application to be read out by TalkBack.

Figure 4. Object Detection

Text Detection

In the text menu, the camera can recognize text taken by the scanning camera. When the OCR technology detects text, it is displayed for TalkBack to read aloud. If the following detection result has a 90% resemblance to the previous detection result, it is not reread.

Figure 5. Text Detection

Drug Detection Sensitivity

After the prototype is complete, Recoptic is deployed while creating an .apk file that is user-ready. The team then conducted a User Acceptance Test (UAT) with subject matter experts and actual users. This is done to verify whether the Recoptic program has satisfied user needs and can accommodate all user scenarios. Prior to conducting the UAT, the team validated 923 medications alongside several doctors.

dr. Evi Maryam, MARS, and dr. Nur Isnaeni Risna Sp.M. assisted the team during the UAT with specialists. In this test, Recoptic was able to detect eight of the nine drugs that were found. In addition, five blind individuals participated in the second UAT alongside the team. Recoptic was able to detect eight out of nine drugs throughout the study. Through the calculation of the data from the two UATs conducted, the team found that the accuracy of drug detection by Recoptic was 88.8%.

Special Potential

Patent Potential

The Recoptic app has an excellent feature for drug detection. This app is an innovation that brings benefits to the visually impaired in helping them. The team has the chance to get intellectual property rights to safeguard this idea against piracy as a result of the creation of this application. This prototype is prepared to be submitted/registered to get Intellectual Property Rights (IPR) for copyright at the Directorate General of IPR of the Ministry of Law and Human Rights (https://www.dgip.go.id) via Gunadarma University as a computer program.

Scientific Articles

Publication of articles or journals on a drug, object, and text detection with optical character recognition (OCR) combined with the application of information technology using artificial intelligence single short detection (SSD) algorithms and mobilenetv1 models, along with the use of smartphones in the detection process, can inspire the development of more modern facilities for the world of health in the Scientific Journal of Computing (https://journa.co/sjc/).

CONCLUSION AND SUGGESTIONS

Conclusion

Drug, object, and text detection are the three primary functions of the Recoptic app. In drug detection, the Recoptic app can be used effectively for the visually impaired to provide precise information on the

indications, usage guidelines, and dosage so that the visually impaired can differentiate and take medications appropriately. Together with multiple doctors, the team has verified 923 medicines. After that, the researchers conducted UAT with doctors and five visually challenged patients. Based on the results of this test, Recoptic's drug detection accuracy was 88.8%. The outcomes of creating this PKM-KC output are Recoptic apps that have been successfully compiled into an application with a size of 69.60 MB.

Suggestions

The Recoptic application is anticipated to be more developed with solutive characteristics, such as the ability to detect pharmaceuticals based on the shape and color of medications without packaging and the ability to determine the exact packaging position in real-time. Furthermore, the Recoptic app is also expected to be used by iOS users.

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