# DESIGN AND DEVELOPMENT OF A QR CODE APPLICATION AS A READING ASSISTANCE FOR VISUALLY IMPAIRED USERS OF AN ANDROID-BASED LIBRARY

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**Abstrak**

Penyandang tunanetra menghadapi berbagai hambatan dalam mengakses informasi, khususnya di perpustakaan kampus yang minim layanan inklusif. Penelitian ini bertujuan mengembangkan aplikasi baca berbasis Android untuk pengguna tunanetra dengan mengintegrasikan teknologi Quick Response (QR) dan text-to-speech. Aplikasi dirancang agar ringan, mudah digunakan, kompatibel dengan perangkat lama, serta memanfaatkan penyimpanan awan untuk mengatasi keterbatasan ruang penyimpanan lokal. Informasi koleksi perpustakaan disediakan dalam format audio, yang dapat diakses melalui kode QR. Hasil penelitian menunjukkan bahwa aplikasi memenuhi kebutuhan pengguna dengan menyediakan akses mudah terhadap koleksi perpustakaan. Namun, kendala terkait stabilitas koneksi internet mengindikasikan perlunya dukungan infrastruktur tambahan. Aplikasi ini diharapkan menjadi solusi inklusif yang dapat meningkatkan aksesibilitas dan kualitas layanan perpustakaan bagi penyandang tunanetra.

**Kata kunci** : *Android;* Aplikasi Baca; Perpustakaan Inklusif; *QR Code;* Tunanetra.

*Abstract*

*Blind people face various challenges in accessing information, particularly in campus libraries that lack inclusive services. This study aims to develop a reading application based on Android for visually impaired users by integrating Quick Response (QR) and text-to-speech technologies. The application is designed to be lightweight, user-friendly, compatible with older devices, and to utilize cloud storage to overcome local storage limitations. Library collection information is provided in audio format, accessible via QR codes. The study results indicate that the application meets user needs by providing easy access to library collections. However, challenges related to internet connection stability highlight the need for additional infrastructure support. This application is expected to serve as an inclusive solution to enhance the accessibility and quality of library services for visually impaired individuals.*

*Keywords: Android; Reading App; Inclusive Library; QR Code; Blind.*

## I.    Introduction

Blind people with disabilities are people who have partial or total visual impairment, which makes it difficult for them to see as well as they should. According to information from the Republic of Indonesia's Ministry of Health, 1.5% of the population is visually impaired. With 250 million people living in Indonesia now, there are approximately 4 million blind people, with 40% of them currently students of school or college age (Imran, 2024).

According to Ministerial Regulation Number 46 of 2007 and Law Number 8 of 2016, the college or university, as the center for academic and higher education activities, must offer inclusive services for students. Individuals with disabilities are entitled to Persons with disabilities have the appropriate education, gain academic services, and access library services. This is in line with the Social Inclusion-Based Library Transformation Program (TPBIS) of the National Library of Indonesia (Husna et al., 2021). Inclusion services in campus libraries, especially for visually impaired people, are still restricted making it difficult for them to obtain information from library reference collections, particularly older collections that are not yet available in digital form.

As technology developed, software programs that support everyday tasks, such as learning and educational activities for the blind and visually impaired, have also developed. Visually impaired people assist with the "Blind Learning Application" (Ranjan & Navamani, 2019), especially when identifying patterns and shapes. Audiobooks for visually impaired students at Anadolu University in Turkey represent another advancement (Ozgur & Gurcan, 2004). Additionally, Quick Response (QR) codes have been popular in Japan and have grown quickly. To promote learning and student activities at school, each student uses their device to complete scans that include information on plant and tree species, attendance, task fulfillment, simulations, and demonstrations, among other activities (Law & So, 2010). A reading application was created for visually impaired people in this study, specifically for library users. The application was created as an Android program that used a device to combine text-to-speech with QR code scanning technology.

## II.    Research Method

This research begins with a needs analysis, concept design, application creation, experiments, assessment, application refinement, implementation, and publication. Figure 1 shows the steps and flow of this research procedure in a systematic way.

The purpose of necessities analysis is to determine the needs of library users, especially those who are visually impaired, as well as the library's necessities in order to enhance its services. Surveys were carried out at SLBN 1 Bogor City, SLB Bogor, SLB Sejahtera Bogor City, SLB Dharma Wanita Bogor City, SLB Mekar Sari Bogor, and the campus library of Ibn Khaldun University Bogor.
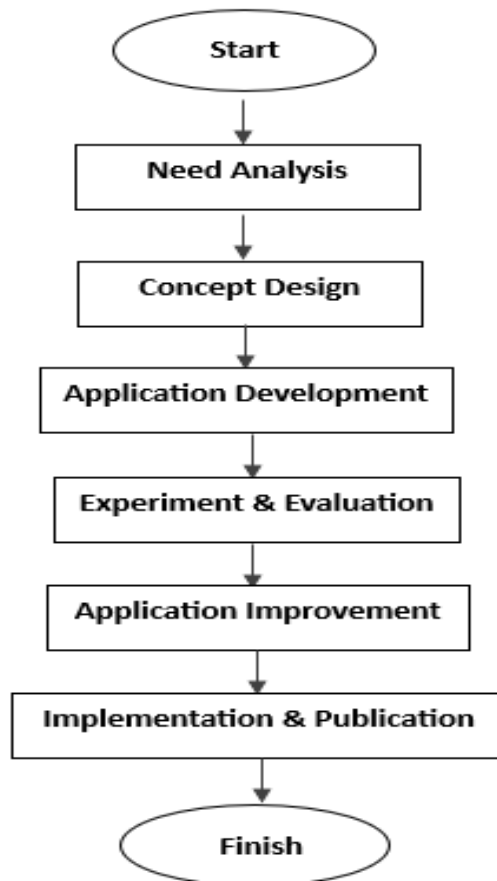
Picture 1. The stages of research activities

A program algorithm was created to design the application concept based on the findings of the needs analysis. The application program that is built must be as simple to use, as short as feasible, compatible with older device types, and also not use a lot of memory or storage. Additionally, the database and data storage system are determined. The concept of the developed application is also influenced by the availability of servers, networks, and cloud storage. The development and creation of the application are then completed based on this idea.

The application development activities consist of two main activities, namely the creation of the Android application program and the creation of the data or information to be presented. The creation of the Android application program is done using the Android Studio software. Android Studio is an Integrated Development Environment (IDE) provided for free by Google for Android application development (Esmaeel, 2015). The information presented by the developed application consists of audio files containing readings of each page of the book, stored in a database, and displayed in the form of QR codes. The creation of audio files for each page of the book is done using the Google text-to-speech feature.

The results of the development and creation of the predetermined concept were then tested and evaluated by internal campus users and librarians of Ibn Khaldun University Bogor before implementation. The testing is conducted based on the

alignment with the application needs and the predetermined concept. As well as inputs from several panels of prospective users. The results of the evaluation and testing serve as input for the improvement of the developed application program.

The completed application program is then implemented and published. This activity is carried out by involving the parties who were surveyed in the needs analysis process. Feedback on the application is the mismatch between user needs and the application that has been created. The changing needs of users, along with shifts in culture and lifestyle, necessitate the ongoing development and updating of applications.

### III.    Findings and discussion

Both library patrons and library administrators in educational institutions require reading aid applications for visually impaired library patrons, according to surveys of potential users. According to Figure 2, the majority of academics in the surveyed institutions have devices that are three to five years old (50%) and utilize Android devices (89%). This suggests that the application's original development was based on Android and called for minimal specifications for the operating system, data storage, and memory.
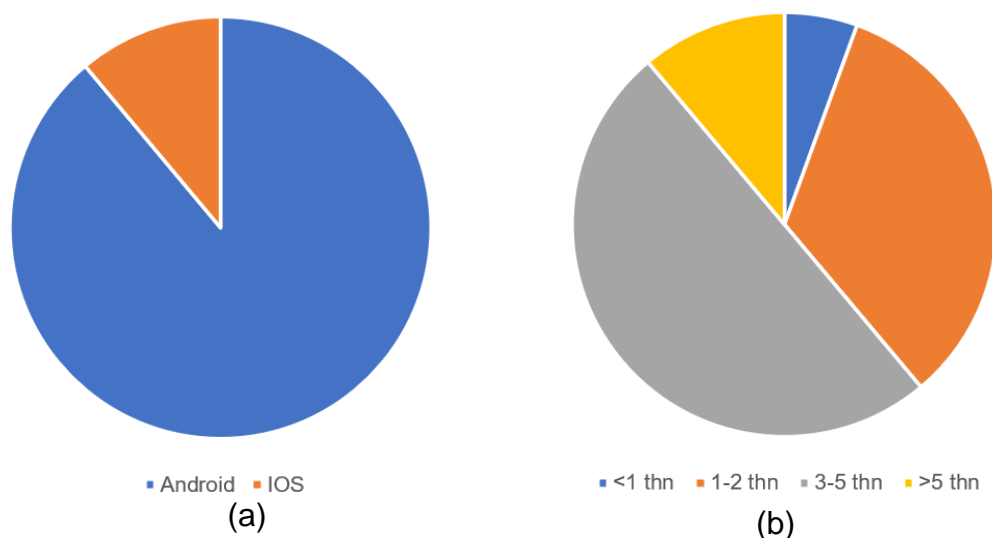


Picture 2. Survei Results (a) type of operating system, (b) the age range of devices used by employees, lecturers, and students.

Based on the findings of the 2018 BPS education survey, only 5.48% of Indonesians ages five and older with disabilities continue to remain in school, 23.91% did not take school, and 70.62% have stopped attending school. These numbers are supported by the survey results, which indicate that, as shown in Figure 3(a), there are  7 and 10 visually impaired people at each respondent institution, totaling up to 50% (high school/university level). Lack of parental support is the primary cause of the low number of visually impaired students. The condition of children with special needs

can be difficult for some parents to accept because Many of these children receive subpar treatment because of the financial, psychological, and mental pressures it set on them (Rahimi & Bahri, 2019). Additionally, because of their restricted capacities, parents' support for learning facilities is often typically insufficient. According to Figure (3(b)), only 50% of schools do not yet have a library, whereas learning facilities are dependent on those supplied by the school. Considering
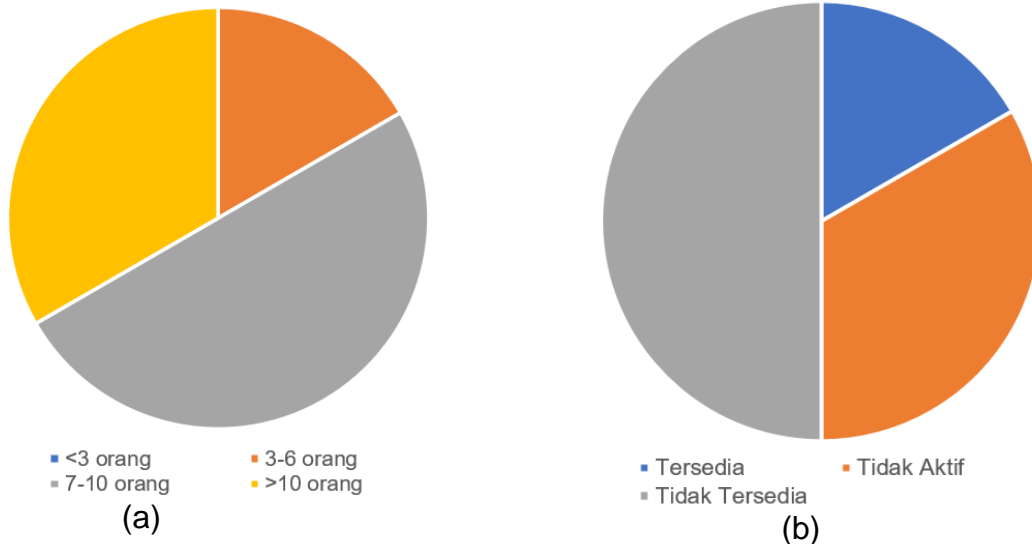


Picture 3. Survei results (a) the proportion of visually impaired learners in high school and college, (b) the availability of the library at the respondent's special needs school and on-campus

A large quantity of storage space is needed for saving audio data for library book collections. According to the audio data production results, 1-2 GB of storage is needed for audio data for a single book title with 300 pages. Only 32–64 GB of data storage is often accessible when taking into account the average age of the respondents' devices, which is 3-5 years, as indicated in Figure 2(b).
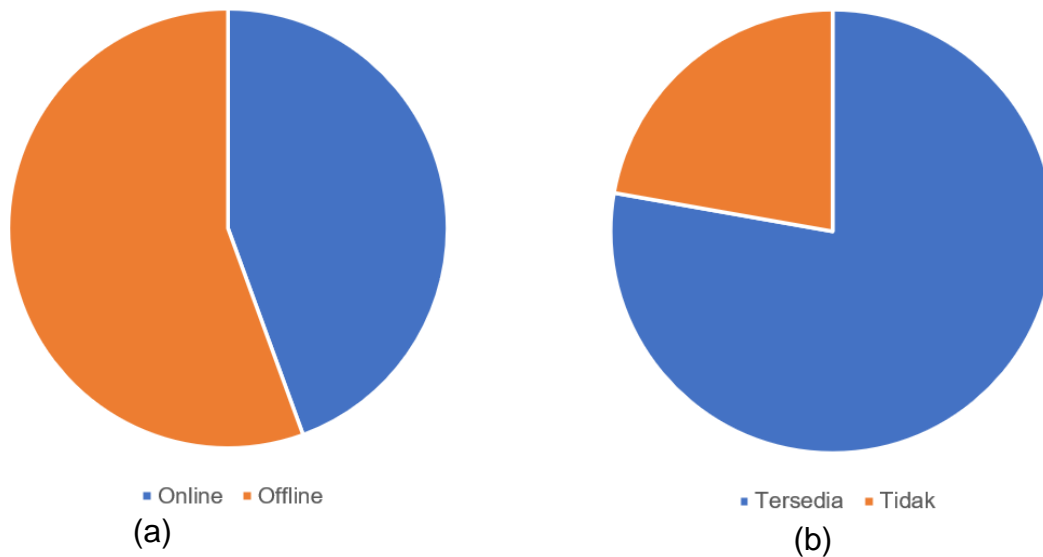


Picture 4. Survei Results (a) the program operates online, (b) the availability of device's data quota

Among the data storage options available to get around device storage capacity constraints is cloud storage (Basry, 2015). The user's device plays the audio data accessed through the internet network and stored in cloud storage. According to the respondents' poll (Figure 4(a)), most of them desire the produced application to be user-friendly and to offer comprehensive information on the contents of the book pages. Furthermore, 56% of applications could be used offline on devices; nevertheless, Figure 4(b) demonstrates that 78% of respondents had data availability. As a result, when creating this application program, audio data storage is done using cloud storage.
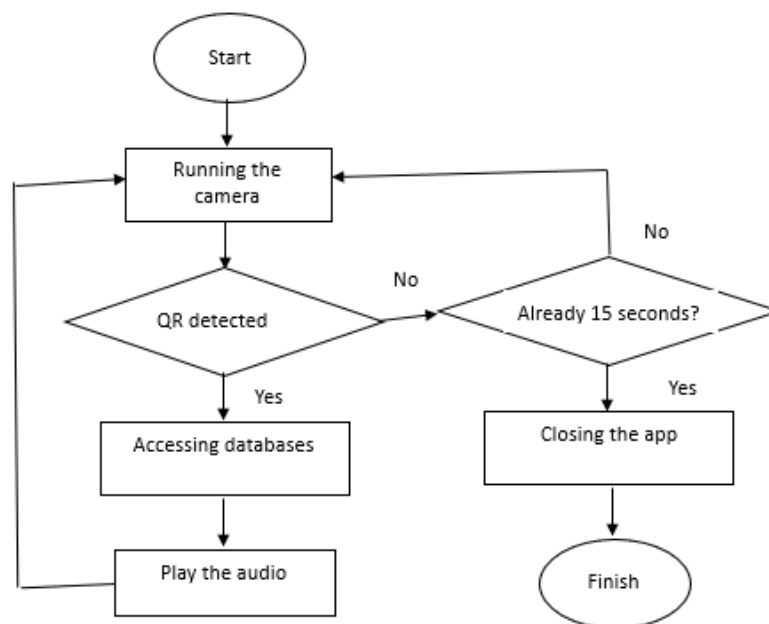


Picture 5. Application program algorithm

The application concept, including the developed application algorithm, is developed based on the findings of the survey conducted among possible users. When the application is launched, the device's camera is turned on to allow the QR code may be scanned. The cloud storage page for the book page's audio data can be accessed using the QR code. The audio that matches the information on the book page is automatically played by the application. Even if the previous audio hasn't finished playing, the audio in the new link will start playing if the scanner picks up a new QR code. The application program will automatically terminate and close if it not used within 15 seconds of the audio ending automatically. Systematically, Figure 5 shows the program algorithm, and Figure 6 shows the generated application's interface.
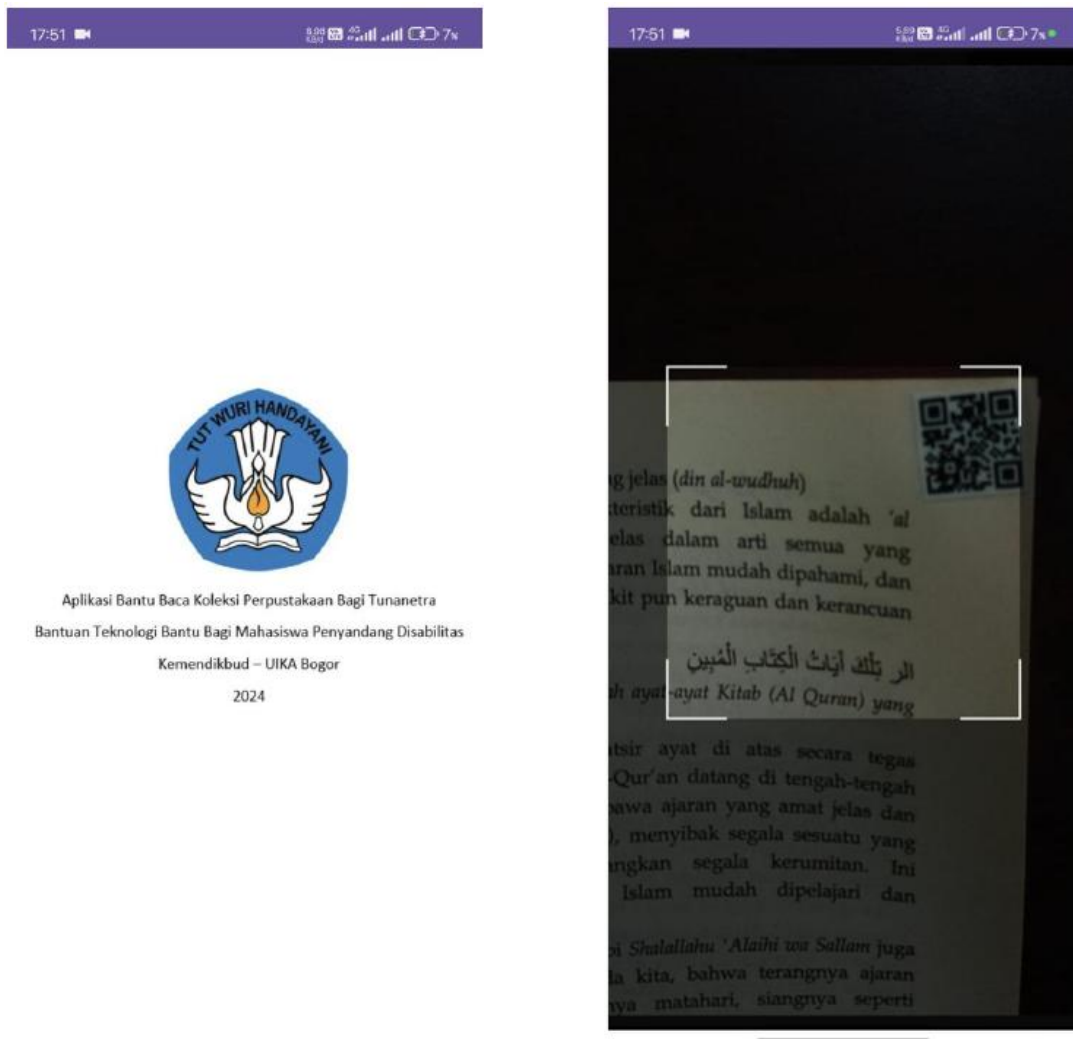
Picture 6. The application program's form that is currently active

The development team and user representatives test the application's functionality. The indications and application testing results demonstrate that the application can be operated and executed in accordance with the created design. A minimum Android operating system of Jellybean, 1 GB memory for RAM, and 1 MB of storage, along with an internet connection are needed to operate the application. While loading audio data is heavily dependent on the available internet speed, the average audio reading speed of a book page is 13.6 characters per second. The application needs a minimum internet speed of 0.1 Mbps to function. According to feedback from public testing, users generally thought the application's design, usability, and comfort were excellent, as depicted in Figure 7. Feedback from application experiments also shows users have trouble using the program when there is insufficient internet. This is a drawback of the application that makes use of a cloud storage database (Basry, 2015), therefore giving library administrators accessibility to the internet is one possible solution.

## IV.    Conclusion

The QR code application that has been developed can help students and students with visual impairments obtain information from reading books in the library collection. The application will be used in school and campus libraries to support inclusion services as mandated by law. The use of applications that are very easy and simple can help students understand the content of information in books.

## V.    Acknowledgments

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