

Compressed QR code-based mobile voice guidance service for the visually disabled

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Abstract— This Study is about automatic reading of text for visually disabled persons or children. Usually, they often have difficulty reading letters even if they understand and know the language. Though this research, Using QR code and text compression algorithm SMAZ and TTS, it is possible to develop a system that automatically reads storybooks, location information guides, etc. to improve the learning effect of children and improve the living quality of visually disabled people.

Keywords— Visually Disabled, QR code, TTS, SMAZ, Short Text Compression

I. INTRODUCTION

In this study, QR code is used as a medium for storing texts. QR codes can add as many as 10 times as many characters as bar code schemes, and also provide the ability to encrypt and compress more data. Also, it is resistant to damage, and it can be used by adding many symbols[1]. The texts in the QR code are read using the TTS program of the smart device. In the case of the TTS program, it is possible to provide services in various languages and voices, so that text can be provided in voice, thereby providing convenient services for the disabled. In the process of generating or reading the QR code, the QR code is recognized by the mobile phone camera using the ZXING[2] program, the texts are compressed and encrypted through the SMAZ[3], and it is designed to read it using the TTS library. Also, the QR, which provides a simple encryption and compression function, is used to provide a variety of information provided by text alone. By providing a voice reading service for infants and visually disabled people who can't read the text through a generalized smartphone application, we can expect improvement of learning ability and expect improvement of quality of life for visually disabled people

II. METHOD

In this study, two processes of text message compression QR generation and mobile scanning are implemented on the web and mobile app platforms, respectively. In the voice QR generation phase as shown in Figure 1 below, The recipient scanned the generated QR code to reproduce the voice.

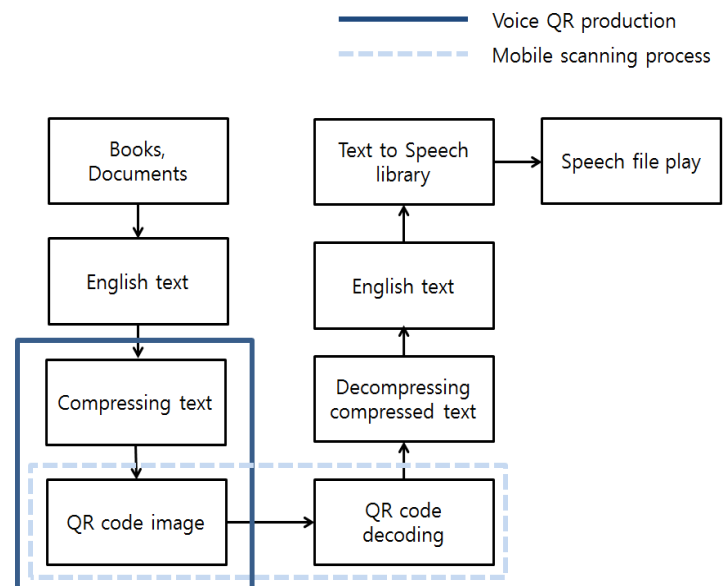


Figure 1. Research process design

A. Generating QR codes from English text for the visually impaired

The QR code generation library was created using the Messaging Toolkit QR library. In order to apply the research results to the blind people in the world quickly, we decided to include the English sentences in the QR code. At this time, when the QR code is recognized quickly and the printing environment is considered, the QR code version is 13 and the error recognition level is H (30% error recovery rate).

In version 13 of the QR code, alphabet letters can contain 259 letters at the error recognition level H level [1]. Although it is not a small amount, it can notify only relatively small information at the level of a normal article or document. Therefore, it adopts SMAZ English text short message compression algorithm [2] to perform compression of 40 to 50% or more, And to increase the information transfer rate to the disabled. Figure 2 below is a schematic diagram of the process of generating a compressed QR code

Goryeo celadon, which began to be made in the 9th or 10th centuries, has been developed since then, and at the end of the 11th century, it has been diversified in variety, shape, pattern, and baking techniques....

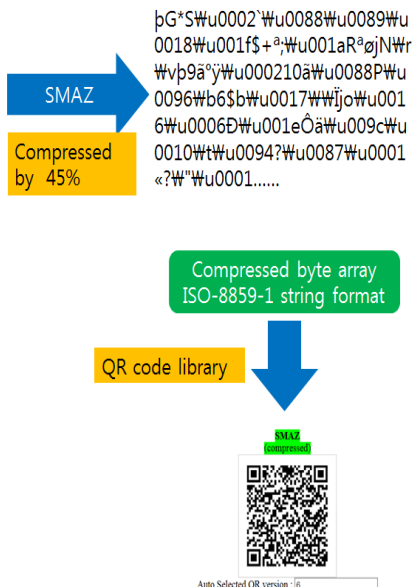


Figure 2. QR code generation process by compressing English message with SMAZ algorithm

B. QR code scanning and original message restoration

The QR code generated by the above process is read by the Android mobile application, then decompressed by the SMAZ algorithm and restored. The QR code scanning library uses Zxing android ver 3.3.0. When the QR code of Fig. 3 is read by the Zxing library as shown in figure. 3 below, the result is type of an ISO-8859-1 character set string. Using Java “getBytes” function and decompressing this byte array type function into the original text using the decompress function of the SMAZ library.

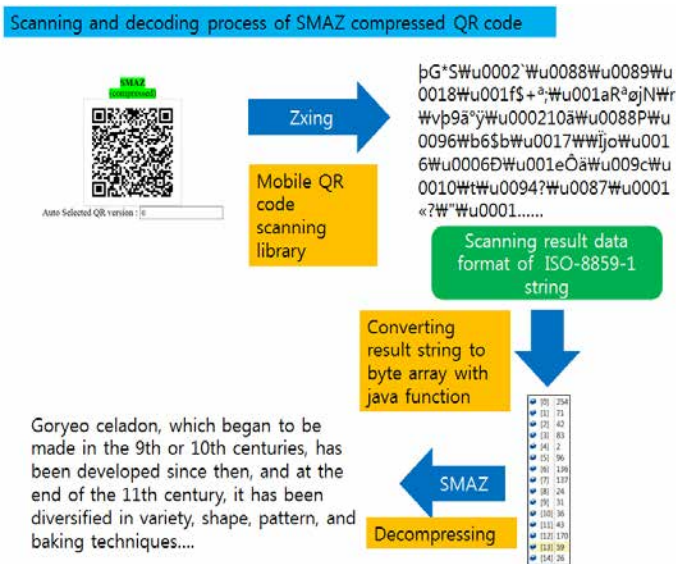


Figure 3. The process of scanning the compressed QR code to mobile and then restoring the original text

C. TTS(Text To Speech) Speaking process

The compressed QR code is restored to the mobile application and the speaker can speak by using the TTS library so that the visually impaired hearing can listen to the QR code

III. RESULT

A. Development of compressed QR code generation web page using SMAZ after inputting English

We developed QR code generation web page for general purpose to generate compressed QR with SMAZ compression algorithm easily for various contents to read to the visually impaired. If the QR code size, the error correction level, and the QR code image output format are specified after inputting the English text, the corresponding compressed QR can be generated as an image, downloaded and utilized for various print media.



Figure 4. QR code production web site for SMAZ compressed text

B. Development of mobile application to recognize compressed QR code as mobile scanner and read it as TTS

Developed a mobile application that recognizes the compressed QR code generated from the web page as a mobile scanner and reads it as TTS. It can automatically recognize, decompress and speak at the same time using the Zxing library, SMAZ library and TTS library So that voice messages can be conveniently presented to the visually impaired.

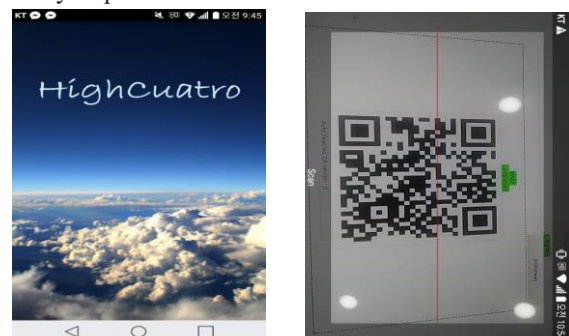


Figure 5. QR scanning mobile app launch screen for the visually impaired

VI. CONCLUSION

Advantages of using mobile TTS for the visually impaired using the compressed QR code proposed in this study

- 1) It is possible to read the document contents to visually impaired people quickly by using QR which is very fast recognition speed.
- 2) Stickers and other stereoscopic QR prints make it easier for the visually impaired to find QR codes, making accessibility easier.
- 3) Anyone can easily convert the contents of a textbook into a compressed QR code and print and attach a sticker, so that a general booklet can turn into a book for the visually impaired.
- 4) Utilizing text compression technology, more information can be read to a visually impaired person in a limited space, so that information transfer ability can be increased.

it improves the learning effect of the textbooks for the lower age group, and it can be used as the data that can experience the outdoor classroom as the textbook in the classroom. In the classroom class, the learning effect of children of the lower age group such as English.

In addition, it is possible to achieve the goal of making it available to all places where digital contents education is performed [4-5]. Especially, if multi-lingual compression technology is applied to not only English characters but also multi-lingual contents can be heard audibly, compression can be applied to Frame QR [6], and QR codes including visual effects such as various icons can be maintained at a stable recognition rate. It is expected to be able to provide it in the state.



Jung Hoon Kim
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Bachelor of Pharmacy, Seoul National University (2002), Master of Health Science, Graduate School of Public Health, Seoul National University (2010), Completed Ph.D. in Health Science, Graduate School of Public Health, Seoul National University (2013), Master's course (2017) of Software Convergence, KyungHee University, CEO of BinaryLab (Electric prescription QR code compression company, 2016~)

Mr. Jung Hoon Kim is a specialist in short message compression technology that developed a compression barcode technology for electronic prescription.

He has been involved in research and commercialization for more than 13 years in the fields of pharmacy, healthcare and medicine. He has been working as a consultant for statistics on drug DB and drug use in BITCOM, KIMS, and IMS Healthcare.



Min Seo Kim
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In this study, Mr. Min Seo Kim analyzed the QR code compressed by SMAZ with ZXING and developed Android application that can read it by TTS. He is an excellent science and engineering high school student with a strong interest in mobile application development and algorithm research.

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Taejun Yang
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In this study, Mr. Taejun Yang conducted preliminary research on open source algorithms and planning and development of applications for the visually impaired. He is interested in researching application software using Python.



Insu Kim
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In this study, Mr. In Soo Kim conducted a preliminary literature survey on the types and problems of visually impaired users and the points necessary for the visually impaired to use QR codes.



Jun Seo
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In this study, Mr. Jun Seo performed UX / UI test and exception handling / bug test in development of application for the visually impaired.



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