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Efficient and accurate reader, meaning, and recommendation systems for blind persons

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Abstract

Many systems are available to help the blind person in his life. This paper aims to prove the specific proposed audio reading, meaning, and recommendation system are efficient and real-time for the blind person. These systems are tested and discussed from the aspects of real-time, efficiency, accuracy, and reliability. The dataset is images with different text font sizes and views which is used in testing these three systems.

Subject Classification: *34C20, 37A60.*

Keywords: *Audio reading system, Meaning system, Recommendation system, Blind person.*

1. Introduction

A camera is utilized as the input chip and a audio speaker is used as the output chip in the same this system, which aids the blind person in reading the text. The text from the input image was retrieved using the OCR algorithm by the system, and the text was then spoken out using the Text-to-Speech algorithm. There are three basic steps in the audio reading system: the input step to capture an image, the processing step to apply the OCR algorithm, and the output step to convert extracted text into the corresponding voice [1][2].

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Recommendation and meaning systems are also helping the blind person to recommend a new book and get the word's meaning. Book Recommendation System is a system that can offer a reading list to a reader, the reading list based on his prior favorite books and the preferred reading lists of a society whose opinions he respects are similar to his [3] [4]. Meaning system is employed to determine the mean of words that appear maximum repeat in the current words.

Paper structured as: In section 2 shows the previous works. Then the systems will be described in section 3. The experimental result and discussion part are shown in section 4. The conclusion will be presented in section 5.

2. Related Work

2.1 *Audio Reading System*

In [5] (2019) employs image capture to focus on reading product names. In [6] (2019) focuses on creating an Intelligent Book Reader that will aid blind users of the Internet of Things (IoT) in reading text. In [7] (2020) Create and deploy an Android app with an assistive text reading system so that persons with vision impairments may read the text labels on the Prescription. In [8] (2020) presented A intelligent reader system that incorporates both a page-turning motor and a full-text read-out system. In [9] (2020) Utilizing the Raspberry Pi, this system was created utilizing the PyTesseract package, Python, and Google Text-to-Speech (GTTS).

2.2 *Recommendation System*

In [10] (2016) proposed an algorithm for a recommendation system to overcome the disadvantage of the Apriori algorithm. In [11] (2018) predict user ratings for new users by designing training and testing models used in the recommendation system. In [12] (2019) design a hybrid recommendation technique of college libraries based on personalized recommendation.

3. Audio Reader, Meaning, and Recommendation Systems

3.1 *Audio Reading System [13]*

First, use a Raspberry Pi camera to take an image of some text on the client side. Next, apply a page localization algorithm to verify the page's location. Send a picture to the server in the third step. Run the modified

EAST procedure on the incoming image to detect word on the cloud side (server side) first. Second, text recognition is accomplished by extracting the text using the OCR technique. Apply the text-correction step to the wrong text in the third stage. Return the text to the client side and use a text-to-speech algorithm to voice it.

3.2 *Meaning System [14]*

The Term Frequency algorithm receives the text output by the audio reading system and selects the words that occur most frequently. The meaning of the chosen word can then be determined using the dataset. The audio reading system will get the meaning result from the server and speak it using a speaker device.

3.3 *Recommendation System [14]*

The book's title, which serves as a recommendation for new books, was read aloud by the audio reading system. For two different categories of recommendations, our algorithm recommends two books (Content-based and Collaborative) (Figure 1).

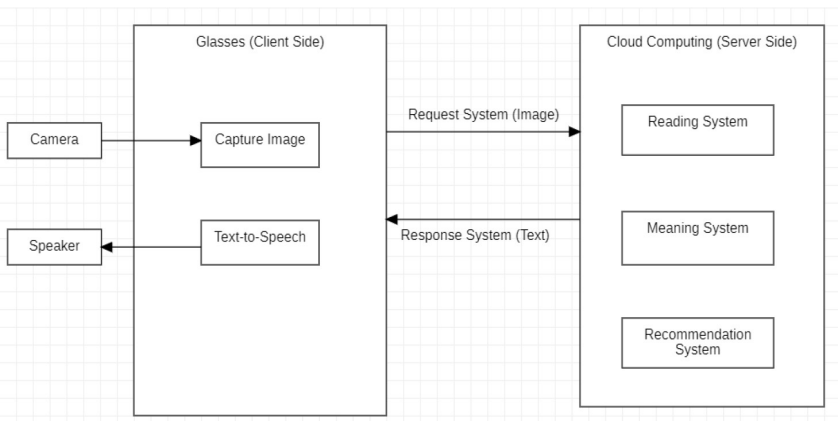

Figure 1

General View of these Systems

4. Result and Discussion

To prove the efficiency and accuracy of these systems, the result will be viewed and discussed for each step.

4.1 *Audio Reading System*

4.1.1 *Page Localization Step*

Figure 2

Set of views for the same image (A, B, C, D) (720 * 720)

In the page localization, two conditions should be checked. These conditions are: complete page view (contain 4 corners) and page area in the image is larger or equal than the threshold value (50000 pixels). Table 1 shows the status for each image and the execution time shown in Table 2 for each image in Figure 2.

Table 1

Details of images

No	No of Corners	Area (pixels)	Status	No	No of Corners	Area (pixels)	Status
A	4	62453.5	**Success**	C	0	0	Failure
B	4	43447.5	Failure	D	0	0	Failure

Table 2

Execution Time of Page Localization step

No	Execution Time (second)	No	Execution Time (second)
A	0.8425183296203613	C	0.8867278099060059
B	0.9057033061981201	D	0.86745285987854

4.1.2 Text Detection Step

A set of images will be tested and compared between the original EAST and modified EAST algorithms. Three images with the same text but different in font size and views; Figure 3 show these images. Result of the Original EAST algorithm on Image A shown in Figure 4. Result of the Modify EAST algorithm on Image A shown in Figure 5. Finally, Table 3 shows the execution time of these algorithms on these images.

Figure 3

A: font size = 22, B: font size = 26, C: font size = 30

Figure 4
Original EAST algorithm on Image A

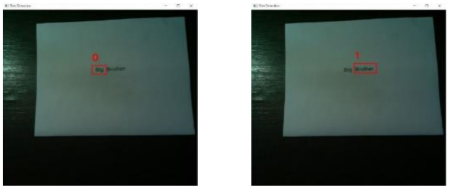

Figure 5

Modify the EAST algorithm om Image A

Table 3

Execution time of Original EAST and Modify EAST on the images

Algorithm Name	Time on Image A (Second)	Time on Image B (Second)	Time on Image C (Second)
O-EAST	0.416085004806	0.359383106231	0.356115818023
M-EAST	6.485617637634	6.322096347808	6.327051877975

4.1.3 Text Correction Step

This step is used for spelling correction for the output of the OCR step based on the candidate words and damerau-levenshtein distance. The result of the OCR step is, we add (w) to indicate word =" Test(w) Messoge(w) This(w) Text(w) is(w) used(w) to(w) Test(w) the(w) audio(w)

reading(w) system(w) for(w) blind(w) peisons(w)" when the input image is shown in the Figure 6.

The output of this step: **Tokenization:** {"Test(w)", "Messoge(w)", "This(w)", "Text(w)", "is(w)", "used(w)", "to(w)", "Test(w)", "the(w)", "audio(w)", "reading(w)", "system(w)", "for(w)", "blind(w)", "peisons(w)"}. **Spelling correction:** "Test(w) Message(w) This(w) Text(w) Is(w) Used(w) to(w) Test(w) The(w) Audio(w) Reading(w) System(w) For(w) Blind(w) Persons(w)". **Time Execution:** 1.677710 seconds.

Figure 6

Input Image to OCR algorithm with font size = 22

4.2 *Meaning System*

4.2.1 Text Pre-Processing step

Example 1: Input Text: Test(w) Message(w) This(w) Text(w) Is(w) Used(w) To(w) Test(w) The(w) Audio(w) Reading(w) System(w) For(w) Blind(w) Persons(w). **Tokenization:** { "Test(w)", "Message(w)", "This(w)", "Text(w)", "Is(w)", "Used(w)", "To(w)", "Test(w)", "The(w)", "Audio(w)", "Reading(w)", "System(w)", "For", "Blind(w)", "Persons(w)" }. **The result after Stop Words are removed is:** { "Test(w)", "Message(w)", "Text(w)", "Used(w)", "Test(w)", "Audio(w)", "Reading(w)", "System(w)", "Blind(w)", "Persons(w)" }

4.2.2 Feature Extraction

Example 1: Input Text: the result of example 1 in the 4.2.1 step. **Term Frequency Output**: "Test(w)". **Output Meaning System:** "Meaning of Test word is: to evaluate a thing's effectiveness or quality". **The Execution Time of the Meaning System (Total) is** 0.7610211372375488 seconds.

4.3 *Recommendation System*

The result of this system is shown in Table 4.

Table 4

Result of the recommendation system (Server Side Only) for the set of input text (book title). (Time in Second)

No	Input Text	Category	Content-based Recommendation	Collaborative Recommendation	Execution Time
1	Big Brother	Romance	Brother Odd	Archer is Voice	0.7857
2	The Appeal	History	Fracture (Blood & Roses)	Archer is Voice	0.5348

5. Conclusion

After comparing and discussing these systems, we concluded that the system proposed in papers [13][14] are reaches to real-time with cloud computing, efficient, more reliable, and high accurate.

References

[1] Shirke, S.I. and Patil, S.V., Portable Camera-Based Text Reading of Objects for Blind Persons. *International Journal of Applied Engineering Research*, 13(17), pp.12995-12999 (2018).

[2] Goel, A., Sehrawat, A., Patil, A., Chougule, P. and Khatavkar, S., Raspberry Pi Based Reader for Blind People. *International Research Journal of Engineering and Technology*, 5(6), pp.1639-1642 (2018).

[3] Vaz, P.C., Ribeiro, R. and de Matos, D.M., July. Understanding temporal dynamics of ratings in the book recommendation scenario. In Proceedings of the 2013 international conference on information systems and design of communication (pp. 11-15) (2013).

[4] Crespo, R.G., Martínez, O.S., Lovelle, J.M.C., García-Bustelo, B.C.P., Gayo, J.E.L. and De Pablos, P.O., Recommendation system based on user interaction data applied to intelligent electronic books. *Computers in human behavior*, 27(4), pp.1445-1449 (2011).

[5] Rathi, A. and Nikalje, A.V., Portable Camera-based Assistive Text and Label Reading for Blind Persons (2019).

[6] binti Harum, N., Zakaria, N.A., Eimran, N.A., Ayop, Z. and Anawar, S., Smart Book Reader for Visual Impairment Person using IoT Device (2019).

[7] Sahu, N., Raut, A., Sonawane, S. and Shaikh, R., Prescription reading system for visually impaired people using nlp (2020).

[8] Ravi, A., Khasimbee, S., Asha, T., Joshna, T.N.S. and Jyothirmai, P.G., 2020. Smart Reader For Blind People.

[9] Kurlekar, S., Reading Device for Blind People using Python, OCR and GTTS (2020).

[10] Devika, P., Jisha, R.C. and Sajeev, G.P., December. A novel approach for book recommendation systems. IEEE international conference on computational intelligence and computing research (ICCIC) (pp. 1-6). IEEE (2016).

[11] Sabitha, S. and Choudhury, T., Proposed approach for book recommendation based on user k-NN. In Advances in computer and computational sciences. Springer, Singapore. (pp. 543-558) (2018).

[12] Tian, Y., Zheng, B., Wang, Y., Zhang, Y., and Wu, Q., College library personalized recommendation system based on hybrid recommendation algorithm. Procedia CIRP, 83, pp. 490-494 (2019).

[13] Mohammed, M., Hussein, K., Al-Hassani, M. Real Time Mobile Cloud Audio Reading system for blind persons. Webology, 19(1) (2022).

[14] Mohammed, M., Hussein, K., Al-Hassani, M. Book recommendation and meaning systems for blind persons. *International Journal of Nonlinear Analysis and Applications*, 12(Special Issue), 2019-2023 (2021). doi: 10.22075/ijnaa.2021.5982.

[15] Poonam Singh, Sachin Ahuja, Vanita Jaitly & Shaily Jain. A framework to alleviate common problems from recommender system : A case study for technical course recommendation, *Journal of Discrete Mathematical Sciences and Cryptography,* 23:2, 451-460 (2020), DOI: 10.1080/09720529.2020.1728899.

[16] Debaditya Barman, Ritam Sarkar, Anil Tudu & Nirmalya Chowdhury. Personalized query recommendation system : A genetic algorithm approach, *Journal of Interdisciplinary Mathematics*, 23:2, 523-535 ((2020)), DOI: 10.1080/09720502.2020.1731964.

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