A Reliability Information Retrieval System for Visually Impaired People

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Article Info

Abstract

The Malaysian Association of the Blind (MAB) is a voluntary organization in Malaysia that provides services to the visually impaired. Achieving substantive equality in all aspects of life is one of the main principles held by MAB in fighting for the rights of the visually impaired community. At the same time, the MAB are also providing research information regarding the visually impaired studies conducted so that people in search of such information and research details will be beneficial. MAB does not have a repository website for research articles related to visually impaired people. In MAB only one device is allowed to manage the database. Due to this problem, only one authorized administrator can access and manage the data. There is a need for an information retrieval system which can keep the research information that can be retrieved by the user within or outside MAB. This system is targeted for researchers within MAB or common user in search of references and literature related to the visually impaired. The purpose of developing of the information retrieval system for MAB is to identify the constraints faced, to develop a systematic and efficient system to use, and to evaluate this system whether it need to be improved before making it available to user. This system uses the waterfall method which acts as a guide throughout the development of this project, the phases are such as analysis, design, implementation, testing, deployment and maintenance. phpMyAdmin as some of the related software used in the development process of the system alongside HTML and CSS. The development system was then tested with MAB Staff where 20 respondents participated in the process. The result of the testing shows that 85% of the users are satisfied and feel the system is easy for them to use and find information, with a layout interface and button design being satisfactory for half-blind users. Besides that, the system also allows the admin to always update the information in the system easily to be reached out to the users. As conclusion, the system is capable of being used for the MAB user and public that ease the process of retrieving information.

1. Introduction

The Malaysian Association of the Blind (MAB) was established in 1951 as a voluntary organization in Malaysia that provides services to visually impaired individuals, safeguarding the general well-being of the blind in the country [1]. MAB offers educational programmes, rehabilitation courses, vocational training, and job placement services to assist blind persons in finding employment and living independently [2]. Identifying information sources relevant to the target user community and analysing their content is one of the functions of this information retrieval system. In addition, it performs the function of representing the contents of sources that have been analysed and are relevant to the inquiries [3]. Definition of an information retrieval system, or Information Retrieval (IR), is a storage structure for all data, analysis, search, and retrieval of external information made in the aspect of information search [4]. Retrieval tools are essential for obtaining information for educational outcomes. Information search tools accordingly are simple mechanisms or tools that help library users to find, obtain and use the documents needed from the library or information from books or documents. This is in line assertion that the skills to obtain information needed by users include the skills to navigate, select, evaluate and reuse information [5].

This system was developed by addressing the problems faced by MAB. There are several problems encountered, namely that there is no platform that users can use to obtain research-related information from MAB. This is in line with the current trend where many platforms are designed and improved for most people without disabilities. However, those with impairments, such as visually impaired learners, face challenges when using such technology because they lack one of the most critical senses, sight [6]. MAB has a problem in that the information stored by MAB is not easily accessible, and the latest information cannot be used for research. or reference. Storing information is also a problem faced by MAB, as only one device is allowed to manage existing information such as storage, editing, and disposal of data. Due to this problem, MAB can only use one device to manage existing information which causes difficulties and takes a long time. This problem also carries a high risk if the device experiences issues such as damage, data loss or device virus infection.

MAB proposed building a platform and provided some recommendations. Among the recommendations is to emphasize the aspects of text size, button size, and colour contrast, which play an important role in the development of the platform [7]. MAB suggested building a platform and gave some recommendations. Among the recommendations is to emphasize the aspects of text size, button size, and colour contrast, which play an important role in the development of the platform. MAB also suggests adding features to search stored information, such as sorting features for year search, publication search, and category search. This can affect users. It is also part of Web Accessibility which aims to make the platform easy to use and accessible to all users, including those with disabilities [8].

The study was written to develop an information retrieval system for keeping and searching information related to visually impaired research. As a solution, the use of databases is included as a platform to retrieve information related to research. In addition, granting access to the MAB admin by logging in on other devices. The system enables the admin to organize, update, edit, and delete databases. The primary aim of this paper is to ascertain the purpose behind the development of the MAB System and explore the constraints encountered in the process. In addition, it seeks to establish a systematic and user-friendly administrative system for the MAB System, ensuring efficiency. Moreover, it aims to develop the MAB System and assess the need for any enhancements before its intended users can access it.

2. Methodology

The waterfall approach is being adopted because of its proven track record and centralized decision-making [9]. The generic character of the waterfall method makes it appropriate for building systems or software because it allows for the identification of all system requirements from the time that a public specification and research with the objective of creating a system from scratch are made public until the product is tested [10]. The waterfall model is a sequential development approach, in which development is seen as flowing steadily downwards as the waterfall through the phase of requirements analysis, design, implementation, testing, deployment, and maintenance.

Fig. 1 shows that this methodology consists of 6 phases that are required in software development which involve requirement analysis, system design, implementation, testing, deployment, and maintenance. Phases are established, done sequentially, and only proceed if the previous phase is finished [11]. Because the results of the first step serve as input for the following stages, each stage must be completed correctly [12].
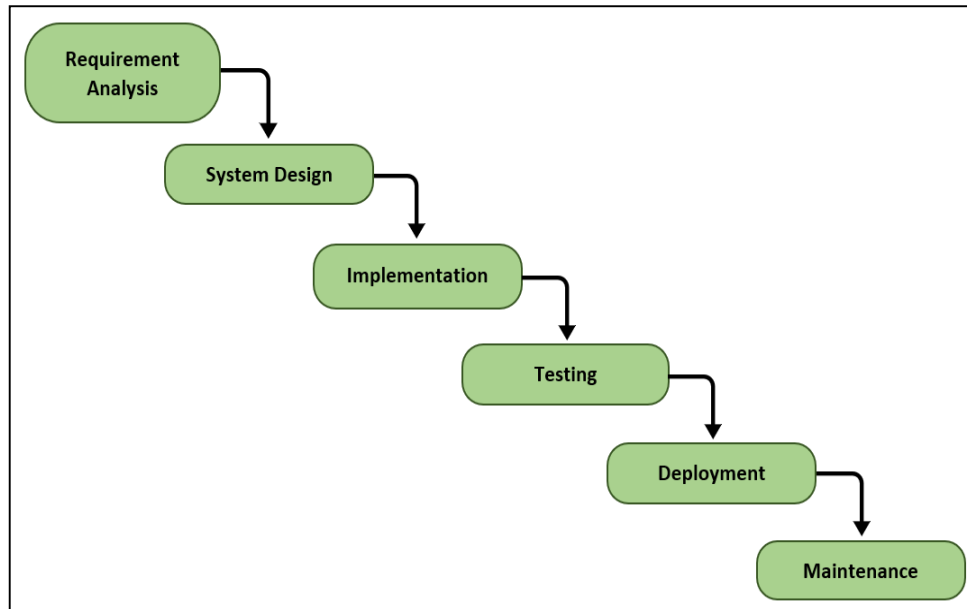
Fig. 1 *Waterfall methodology*

The waterfall model is one of the software developments that was a success, and many development companies and industrial manufacturers have used it as their primary development framework [11]. The waterfall methodology is a suitable method for this case study because it has work stages that are carried out consecutively, meaning that it cannot move to the next work step if the first stage is not completed. The waterfall approach was a series of logical phases in which progress flowed from one to the next [11].

2.1 Requirement Analysis

A thorough and detailed explanation of the behaviour of the programme to be built is contained in the specification, which is frequently referred to as the software requirements. To identify non-functional needs and functional requirements, analysts and the system must work together. Functional requirements are those that describe how users interact with the software. Included in this group are properties like dependability, scalability, testability, availability, maintenance, performance, and quality standards [10]. This phase involves tasks like problem identification, analysis, and prediction of prospective system-related issues that may surface in the future. To continue this project, we must do some research of the necessary elements. Additionally, learn several software and computer languages to make our system beneficial for (MAB).

An interview with MAB has been conducted to gather data such as problems that occurred at MAB's environments, requirements feature on the website, and possible features that can be added to the website. MAB parties explained the issues where they had difficulty in storing the data that related to the visually impaired and wanted to develop a website where outside users could browse and find research articles about the visually impaired. MAB also talked about the struggle where they only had one device to store the data on research articles. With the fully developed website, MAB believed that it would be efficient to store the data without limit on one device. Other than that, one of the requirements on the website is that users can search for research articles through various sorting types. For instance, users can browse through by year, subject area, and author. MAB also would like the website to have an admin page where only admins can log in and manage the data on the website. Admins can manage the data by adding new articles, editing articles, and deleting articles. The features that MAB suggested was that the website has a screen reader feature. Aside from that, MAB also mentioned that the colour for the website needed to be contrast colour and the font size was larger than usual so that it was user-friendly for half-blind people. With all these requirements, the website can be efficient in terms of searching for research articles and managing the articles on the website.

2.2 System Design

The system design is the phase where all the necessary requirements are converted into a Design Document that can act as a guide and be used throughout the development phase. Before developing the website design, the study needs to be sketched the Data Flow Diagram (DFD), Entity Relational Diagram (ERD), and Use Case Diagram based on Fig. 2 to fully understand the operations flows of the website.
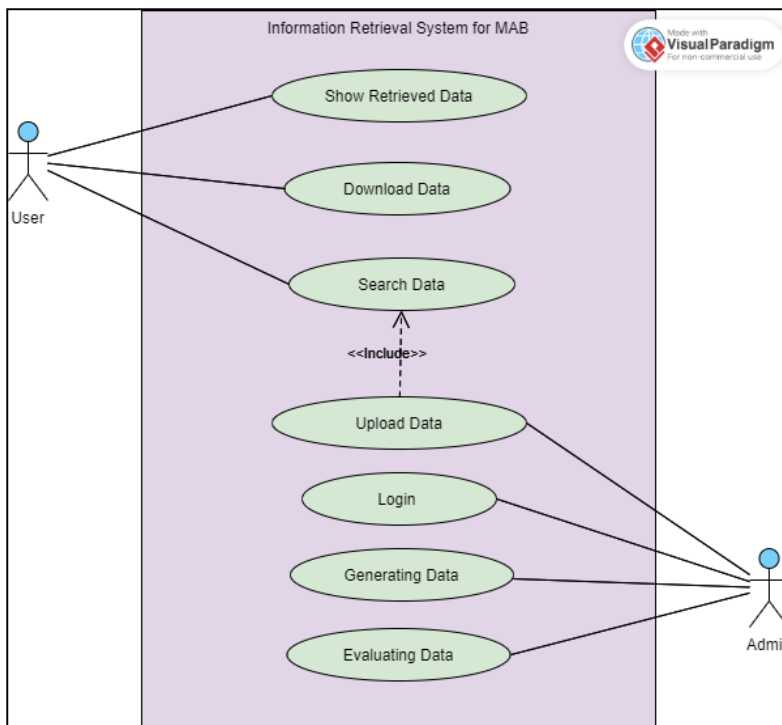
Fig. 2 *Use case diagram*

The equipment or software that has been used to develop a website are Visual Studio, XAMPP/WAMP, and phpMyAdmin. For the use of computing languages are HTML, CSS, PHP, and JavaScript. In this phase, the front-end design of the website is developed in HTML and CSS. The animations and behaviours of the website were integrated with JavaScript's language. While for the database, phpMyAdmin has been used for database expansion and storing the data through it. To integrate the website, PHP and MySQL have played the main role in the back-end system to make sure the website functions properly.

2.3 Implementation

The Information Retrieval System was created during the development phase according to the requirements set and the design guidelines requested by the organization. Activities involving coding are part of this phase. Based on system design standards for existing systems, IRS data components and software were created. The system is created by integrating many software modules. This involves making sure parts communicate effectively, data flows correctly and the system works as expected. Documentation is produced throughout the development period to record system architecture, design choices, code comments, and any additional relevant data. This documentation is used as an instruction manual for future improvements and maintenance.

Based on Fig. 3, users will be directed to this page and be able to browse articles based on normal search, author name, year, subject area, and international or local resources. Besides users, administrators also can direct themselves to the admin page by clicking on the admin button on the right to manage the research articles.

Fig. 3 *Main page interface*

2.4 Testing

A system was created to assess the capacity to obtain relevant information accurately in response to user queries. There are many types of questions tested, such as keyword searches, author name queries, year queries and more difficult questions. The same activities and continuous user scenarios are used to evaluate system response time, processing speed, scalability and system efficiency. To improve overall system performance, performance bottlenecks have been fixed and improved.

In usability testing, the system's user interface and overall user experience are evaluated. Case studies are produced to evaluate the system's usability, ease of use, and efficiency in guiding users to find the information they are looking for quickly. Documentation is constantly updated during the integration and testing process, capturing test cases, test results, known issues, and implemented changes. A comprehensive test report summarizing test operations, results, and recommendations for further development is produced. After the testing phase is complete, online questionnaires are distributed to the selected users to get their honest opinions on the website via "Google Forms". The questions are based on the system's functions, usability, and designs. The demographic of users is also contained in the questionnaires to evaluate their opinions based on their demographics. After completing the questionnaire, the evaluation of the website's performance can be analysed, and improvements can be made to the website.

2.5 Deployment

Users are given the necessary training and user support while the system is in use to ensure they know how to use the information retrieval system efficiently. User guides and support channels are provided to address user queries, aid and foster efficient use and use of the system. The information retrieval system must be continuously monitored after deployment to guarantee that it maintains its performance, stability and availability. System smoothness, irregularities and potential problems are all detected using the monitoring tools and procedures provided. To keep the system up to date, routine maintenance procedures such as software upgrades, bug fixes and security patches will be carried out.

2.6 Maintenance

The performance of this system should be monitored regularly, and relevant data should be logged. Monitoring helps in the detection of errors, efficiency degradation, and potential system bottlenecks. In addition to bug fixes, we also need to take care of reported system problems and crashes. When working with information retrieval systems, users or administrators may encounter problems. It is important that we have a procedure to receive and analyse issue reports, see the cause of the issue and implement the necessary patches or alternatives based on the system condition. The technique for user feedback and analysis is stereo. Identify and collect user input to understand their expectations and experiences. User needs, usability problems and possible areas for improvement can all be better understood with the help of feedback.

3.   Result and Discussion

This section presents the results and discussion of survey and the developed system.

3.1 Results

The goal of this system's evaluation is to examine the results, and stakeholders in MAB have been requested to participate in a questionnaire. The main objective of this survey is to gather opinions and expectations from users regarding the usability, functionality, and overall performance of the Information Retrieval System for MAB. However, some improvement can be made in the future according to the results of this questionnaire.

For this questionnaire, there are 2 divisions, namely section A and Section B. For Section A, there are questions about User Requirements. It is to understand user needs, increase user satisfaction, inform product development, identify new opportunities and validate assumptions. It is a critical step in creating products and services that truly meet MAB's needs. Section B is about Admin Requirement where it is related to administrator requirements, improving administrative efficiency, ensuring system usability and improving system functionality. This feedback-driven approach can lead to better designed systems, better user satisfaction and more effective system administration.

Fig. 4 shows the staff's opinion about the contrast between the text and the system background due to the colour selection for user requirement. The majority, up to 50%, strongly believe in the sufficient between text and colour selection. Around 6 people from the staff stated that they were very comfortable with the use of this system, representing 30%. While about 15% of them said that this system is easy for users to use. As for the rest, there is one staff member who says he is not satisfied, which represents 5%.
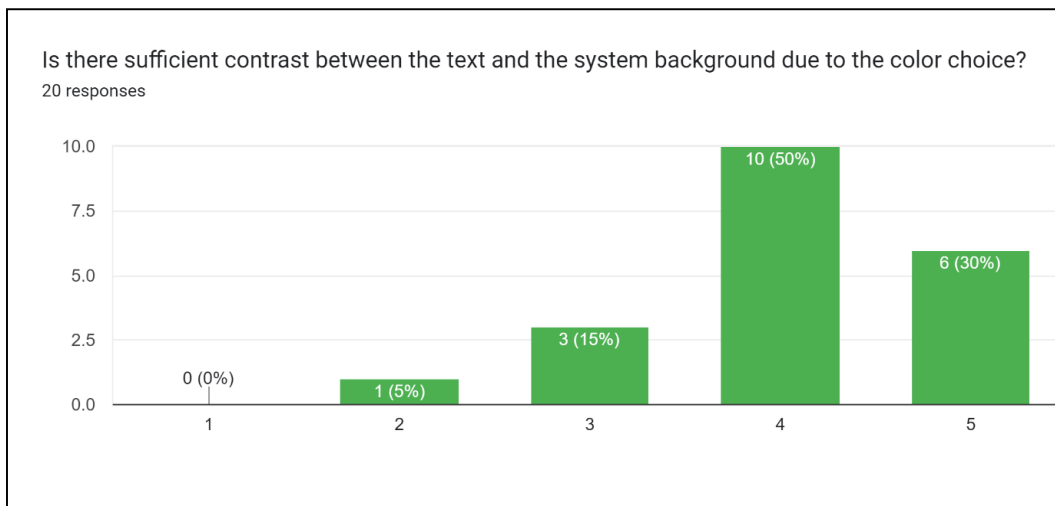
Fig. 4 *Contrast colour between text and system background*

Fig. 5 shows the staff's perception on the management and storage of data related to MAB admin requirement. Up to 45% of respondents strongly support the useful data storage and management method. About 8 staff members, or 40%, said the website were extremely useful for MAB administration. The remaining 3 MAB employees, or around 15% of them, said that this system is just nice for administrators to use.
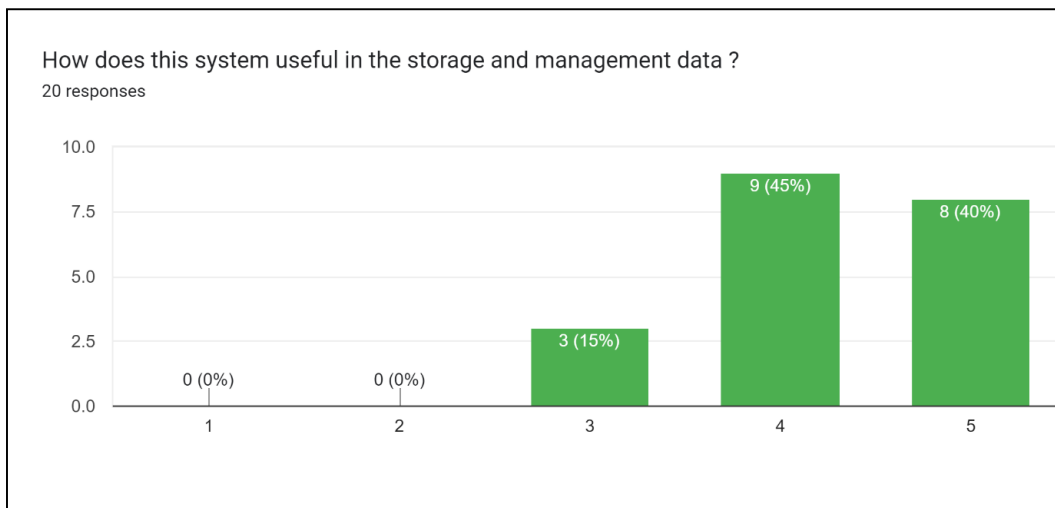

Fig. 5 *Useful of storage and management data*

The system was then tested with MAB users as there are the main user of the system. The system was well received and enable to be used internally for their information storing especially related to research on blind people.

3.2 Discussions

The capabilities and achievements of the system to the MAB were surveyed in the development of this study, which was effective. According to the test results, 85% of participants are satisfied with the system and think it is useful for them to gain information about research articles. Additionally, most of the participants are really satisfied with the layout interface, especially for the half-blind people. For instance, most of the colour on the interface was mainly green and white. Thus, this can help users to read text even better with the text colour's black or white. The participants also informed their satisfaction in button design on this website which was mostly bigger and visible to the users. Even though the information retrieval website for MAB received satisfaction from the participants, the normal users without any visually impaired will not be well satisfied with the website. It's because the website's interface was larger than the usual website to help users with visually impaired access to the website. Besides that, this website can operate effectively based on MAB's requirements but there could be some improvements that can be made in the future.

The website could add more sorting features that can improve the user's experiences, for instance, the advanced search feature. The advanced search feature can assist the user to browse research articles by inserting

the requirements on articles manually. Depending on the admin page, by displaying the updated activities log on to each admin that accesses through the website would be another feature that can develop when the time comes. This feature can help the main administrator to monitor changes that have been made to the articles through the activities log. Depending on what is needed, this system can yet be improved. This system was more thoroughly explained in the testing phase with relation to the request, and MAB approved of it. In conclusion, the fact that this system is fully functional to both the public and MAB users facilitates the process of obtaining information on research articles.

4. Conclusion

In conclusion, the objective of developing this system was successfully achieved. The goals of the MAB has been successfully developed, which are to identify the purpose of developing the MAB System and the constraints faced, to create a systematic and efficient system that admin is easy to use for the MAB system and to develop the MAB System and determine whether it needs to be improved before making it available to its intended customers. Next, this system managed to have a better storage place, which is the use of a database. It can store a lot of data that they need. Finally, system users can search through this system for literature review purposes. The system provides search features to help users save time by quickly filtering out irrelevant results and focusing on the specific information they are looking for. Instead of sifting through many pages of search results, it allows users to determine relevant content more efficiently. The developed system was then tested with the MAB staff and user where 30 users participated in the process. The result of the testing shows that 85% of the users are satisfied and feel the system is easy for them to use and find information. Besides that, the system also allows the admin to always update the information in the system easily to be reached out to the users. As conclusion, the system is capable of being used for the MAB user and public that ease the process of retrieving information.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

*The authors confirm contribution to the paper as follows: **study conception and design, data collection, draft manuscript:** Nur Amylia Wahida Mat Ayob, Muhammad Syahrul Syazwan Ahmad Jamel, Muhammad Shukri Aman; **draft manuscript preparation:** Nur Amylia Wahida Mat Ayob, Muhammad Syahrul Syazwan Ahmad Jamel, Muhammad Shukri Aman, Shelena Soosay Nathan. All authors reviewed the results and approved the final version of the manuscript.*

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