Design and Implementation of an Android-Based Scholarship Search Application Using Web Scraping Techniques

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Keywords	Abstract
Android; Firebase; Google Cloud Function; Scholarship; Web Scraping. ***Corresponding Author:*** *diah@ubhinus.ac.id*	Education is a vital need for humans; however, high education costs often become a barrier for students, particularly those from underprivileged backgrounds. Although scholarships offer an alternative solution, scholarship information is commonly scattered across multiple platforms and difficult to access efficiently. This study aims to design and implement an Android-based scholarship search application using web scraping techniques to integrate and centralize scholarship information from various reliable sources. The main contribution of this research lies in the application of automated web scraping using Google Cloud Function to support a mobile-based scholarship information system, enabling periodic data collection and real-time access to updated scholarship data. The scraping process runs every 24 hours and stores structured data in a Firestore database, which is then presented through an Android application developed using Kotlin and Jetpack Compose. Analytical results from usability testing indicate that 90% of users rated the application as easy or very easy to use, while system performance evaluation shows that all core features functioned successfully with fast data retrieval and display. Black-box testing confirms that searching, filtering, sorting, and favorite management features operate as expected. This application provides an effective solution for students to efficiently search and manage scholarship information through an integrated platform. Future development may focus on improving scraping performance, enhancing the user interface, and adding notification features for newly available scholarships

1. Introduction

Education is a fundamental necessity for every individual in developing human resource potential [1]. Through a systematic process involving teaching, training, and research, education aims to enrich an individual's mental, emotional, social, and physical capacities, enabling them to actively contribute to society. One of the critical aspects influencing the quality of education is educational cost, which includes various components such as tuition fees, books, and transportation. In Indonesia, educational costs tend to increase annually in line with inflation and technological advancements, which often become an obstacle for students from underprivileged

families. In facing these challenges, many students seek alternatives in the form of scholarships to help finance their education.

Scholarships, which may be provided by the government, private institutions, foundations, international organizations, or higher education institutions, constitute an important form of financial assistance in reducing the burden of educational expenses, increasing learning motivation, and expanding opportunities for self-development. However, information dissemination regarding scholarships is often scattered across various media such as websites, social media, emails, and brochures, making it difficult for students to find and compare scholarships that match their needs. The scholarship application process also requires considerable time and effort, as students must collect various documents and fulfill requirements set by the scholarship providers.

In response to these issues, this study aims to develop an Android-based scholarship search application using web scraping techniques. This application is designed to assist students in finding scholarship information quickly, easily, and accurately. By utilizing web scraping techniques, the application will automatically collect data from various trusted websites and present it in a format that is easy for users to understand and search [2][3]. It is expected that this application will not only simplify the process of searching for scholarship information but also serve as a communication and collaboration platform among students, scholarship providers, and higher education institutions.

Several previous studies have discussed various aspects related to scholarship search and information management. Noviyanti investigated the issue of information overload caused by the abundance of scholarship data sources and developed a web-based information system using scraping techniques to address this constraint[4]. Runtuwene focused on the scholarship application system at De La Salle Catholic University of Manado, which faced challenges in managing alumni data and transfer proof documentation [5]. Widianto et al. developed the COSYCALSHIP application using the waterfall method for Android-based scholarship management[6], while Mulyani et al. applied web scraping in an Android-based digital media application using the Rational Unified Process (RUP) methodology[7]. Meanwhile, Indra et al. explored the development of an Android application for video game news using web scraping techniques, providing a foundation for applications that aggregate information from multiple sources[8].

However, despite the contributions of these studies, several limitations remain. Most existing scholarship information systems still rely on limited data integration, infrequent automation of data updates, and insufficient mobile accessibility. Many systems collect data from single or manually updated sources, which may lead to outdated information and reduced usability for students who predominantly use mobile devices. To address these gaps, this study proposes an Android-based scholarship search application that integrates automated web scraping with scheduled data collection using Google Cloud Function. The system focuses on improving data integration, automation frequency, and mobile accessibility to provide more efficient and up-to-date scholarship information

This study seeks to fill the existing gap by developing an Android-based scholarship search application that not only collects data from various reliable sources but also presents it in a user-friendly format. Therefore, this application is expected to provide significant benefits for students in conducting an effective and efficient scholarship search process.

2. Research Methode
This research aims to develop an Android-based scholarship search application utilizing web scraping techniques. The research method implemented comprises several key stages, which are described as follows:

2.1 System Development Process
This study employs a development research approach to design an Android-based scholarship search application[9], [10], [11]. The system development process consists of automated data acquisition, information processing, information integration, decision support, and user-oriented outcomes. Automated data acquisition is implemented using web scraping techniques through Google Cloud Function, which runs

periodically every 24 hours to collect scholarship data from multiple trusted websites. The collected data are processed and structured before being stored in a Firestore database to ensure consistency and efficiency. Information integration is achieved by consolidating data from various sources into a centralized database. Decision support is provided through search, filtering, sorting, and favorite features that assist users in selecting relevant scholarships. User-oriented outcomes are reflected through a mobile-friendly interface and usability evaluation using questionnaires and black-box testing[12], [13]

2.2 Characteristics of Respondents
The respondents in this study were students who used the Android-based scholarship search application. The characteristics of the respondents included age, major, year of study, and evaluation of the application. The respondents' ages ranged from 21 to 25 years, with the majority coming from the Informatics Engineering major (60%). Most respondents were in their fourth year of study, indicating that they were final-year students actively seeking scholarship opportunities. The evaluation of the application showed a high level of satisfaction, with most respondents reporting that they were very satisfied or satisfied with the application's features and ease of use[14].

2.3 Research Data
The research data are divided into two categories. Primary Data, Primary data were collected through questionnaires designed to evaluate students' needs, preferences, difficulties, and expectations in searching for scholarships. In addition, direct observations were conducted to understand the scholarship search process carried out by students in Malang City. Secondary Data, Secondary data were obtained from the official websites of scholarship providers, including those from government agencies, private institutions, and international organizations. These data include information on requirements, procedures, deadlines, and scholarship amounts. Existing scholarship search applications were also used as references for comparison and for the development of the proposed application.

2.4 Data Validity Tes
Qualitative validity analysis in this study was conducted through data triangulation and consistency checking. Questionnaire responses and observational data were examined to ensure alignment with the research objectives and system functionalities. The validity criteria used included data relevance, consistency of user responses, clarity of information obtained, and alignment between user feedback and system performance. This approach ensured that the collected qualitative data accurately reflected user experiences and the effectiveness of the proposed system.

3. Result and Discussion
To emphasize key insights rather than detailed numerical values, the questionnaire results were summarized based on major evaluation dimensions and visualized using a bar chart
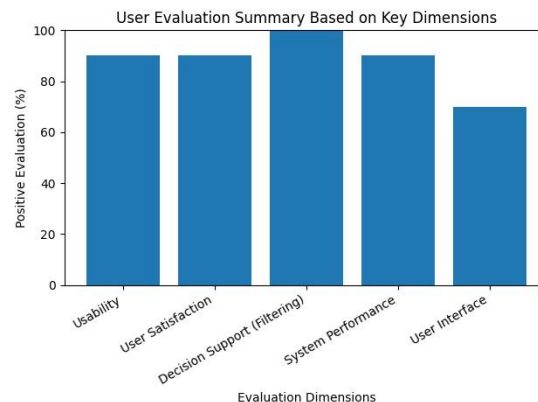

Figure 1. User Evaluation Results Across Key System Dimensions

The findings of this study indicate a high level of user satisfaction with the proposed application, particularly with regard to the scholarship filtering feature. Users perceived the filtering mechanism as highly useful in simplifying the scholarship search process and reducing information overload, thereby enabling more efficient decision-making. These findings are consistent with previous studies by Noviyanti and Widianto et al., which emphasized that unstructured and excessive scholarship information can hinder effective scholarship searching[4][6]. By offering structured filtering options based on education level, funding type, and destination country, the proposed system enhances usability and supports more targeted information retrieval.

Furthermore, the positive user responses align with the work of Mulyani et al. and Indra et al., who demonstrated that integrating web scraping techniques into mobile applications improves information accessibility and retrieval efficiency[7][8]. The Android-based implementation in this study further strengthens mobile accessibility, which is essential for users who predominantly rely on smartphones. Overall, the evaluation results suggest that the proposed system effectively supports users in searching and managing scholarship information, while also indicating areas for future improvement, particularly in user interface enhancement. Table 1 presents the results of the black-box testing conducted on the application, which included various testing scenarios to ensure the proper functionality of the application.

Tabel 1. System Evaluation Result based on Functional Dimensions

Evaluation Dimension	Evaluation Focus	Key Finding
Core System Functionally	Reliability of core process	Core system functions operated reliably without major errord
Information Retrieval	Accuracy and Relevance of search results	The System consistenly displayed relevant scholarship information
Decision Support Capability	Effectiveness of filtering and sorting	Decision support mechanism improved efficiency in identifying relevant scholarships
Data Integration	Consistency of data from multiple sources	Integrated data were presented consistently across the application
System Responsiveness	Application response time	The system responded quickly during scholarship search and navigation
System Stability	Error and crash occurrence	No critical system failures were observed during testing

The black-box testing results indicate that all main features of the application functioned as expected. Users were able to open the application, register, log in, perform searches, and utilize features such as filtering, saving favorites, and sorting without experiencing significant issues. In addition, the functionalities for viewing scholarship details, editing user profiles, and navigating between pages also performed properly. Therefore, this application is expected to assist students in finding scholarships that meet their needs, reduce the burden of educational costs, and enhance their opportunities to continue their studies.

4. Conclusions and Future Works

This study successfully developed an Android-based scholarship search application that employs web scraping techniques to provide accurate and up-to-date scholarship information for students. The automated scraping process is executed every 24 hours using Google Cloud Function programmed in JavaScript, with the extracted data stored in a Firestore database. Black-box testing results indicate that all core system functionalities operated as expected, enabling efficient and accurate presentation of scholarship information. Questionnaire findings further reveal a high level of user satisfaction, particularly with the filtering feature and user interface, which support efficient scholarship searching and decision-making.

The primary contribution of this research lies in the integration of automated web scraping within a mobile-based scholarship information system. Nevertheless, this study represents an initial evaluation, as the assessment was conducted with a limited sample of users. Therefore, the findings do not support broad generalization. Future research is recommended to involve more diverse user groups and extended evaluation methods to further validate the system's effectiveness across different contexts and user profiles

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