Volunteer Recruitment Information System with Interview Scheduling Using Web-Based Greedy Algorithm

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ARTICLE INFO	ABSTRACT
	The rapid advancement of digital technology has significantly influenced the management of non-profit and educational organizations, including volunteer recruitment processes. Gerakan Sumut Mengajar (GSM), a volunteer-based educational movement in North Sumatra, still relies on manual tools such as Google Forms and WhatsApp for participant registration, file verification, and interview scheduling. This manual approach creates inefficiencies, scheduling conflicts, and delays that reduce the professionalism of the recruitment process. The main research problem addressed in this study is the lack of an integrated system capable of handling the multi-stage recruitment process, especially in automating interview scheduling, which is prone to human error and administrative overload. The objective of this study is to design and implement a web-based volunteer recruitment information system equipped with an automatic interview scheduling mechanism using the Greedy Algorithm. The system was developed using the Waterfall software development model, implemented with PHP Native and MySQL. The Greedy Algorithm, particularly the Activity Selection Problem approach, was applied to optimize interview scheduling by allocating available slots efficiently according to the number of interviewers and candidates. The results demonstrate that the system successfully automates registration, document verification, and interview scheduling while minimizing scheduling conflicts. Compared with manual methods, the proposed solution reduces administrative workload, enhances efficiency, and provides a more professional recruitment experience. This study contributes to the development of intelligent scheduling systems in volunteer-based organizations and highlights the applicability of heuristic algorithms in solving real-world scheduling problems.

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1. INTRODUCTION

The development of digital technology has brought significant changes in various aspects of life, including in the management of social organizations' administration and operations. Volunteering is one area that has been affected by this digitalization, where management, communication, and participant selection processes are now required to be more efficient and structured. Community participation in volunteer activities has also increased, involving various groups such as schoolchildren, university students, and the general public[1], [2]. This activity has made a significant contribution to national development, particularly in the education, economic, social, and business sectors[3]. This situation shows that digital transformation is no longer an option, but a necessity for social organizations to maintain the effectiveness and quality of their activities.

Gerakan Sumut Mengajar (GSM) is a social organization in the field of education that relies on volunteer participation to improve the quality of education in remote areas of North Sumatra[4], [5]. To date, the volunteer recruitment process at GSM is still done manually, using Google Forms for registration and Instagram and WhatsApp for communication and

announcements. This model has limitations, especially in conveying easily accessible information related to the registration process, selection criteria, and organizational values. These limitations can reduce prospective volunteers' understanding of the organization's goals and processes.

The main problem in GSM recruitment lies in scheduling interviews. After passing the administrative selection, prospective volunteers must join a WhatsApp group to wait for the interview schedule determined using Google Spreadsheet. This process is prone to scheduling conflicts, delays, and even volunteer withdrawals. With a large number of volunteers and a limited number of interviewers, this method is no longer adequate to address the complexity of selection requirements.

To address this issue, this study proposes the application of the Greedy Algorithm, a method known for selecting the best local option at each step to find a global solution that is close to optimal[6], [7]. Specifically, the Activity Selection Problem model is applied to automate the allocation of interview slots based on time availability. By developing a web-based system that integrates this algorithm, the recruitment process becomes more efficient, reliable, and structured.

Research on the application of greedy algorithms in scheduling has been conducted in various fields. Hayatun Nufus & Taufiq (2024) applied greedy algorithms in time and resource management, which proved to be capable of producing optimal work schedules and increasing efficiency. However, this research is limited to the context of work and resource management, and therefore does not consider its application in the selection of volunteers based on information systems[8]. Mawarni et al, (2019) developed a lecture scheduling information system using a greedy algorithm. This system successfully reduced schedule conflicts and accelerated the time allocation process. However, this study only focused on scheduling one type of activity, namely lectures, without involving multi-stage selection processes such as filing and interviews[9].

Meanwhile, Ramadhan (2020) designed an Android-based volunteer event management information system that facilitates organizers in managing volunteers, from recruitment to evaluation. However, this system still requires manual verification in file selection, so the potential for human error remains high and the process is not yet fully automated[10]. Another study by Putra & Amin (2017) developed a web-based Indonesian Red Cross volunteer information system (RAPALA) that allows people from 38 provinces to register as volunteers. This system is quite effective in facilitating broad community participation, but it does not focus on scheduling interviews or algorithm-based selection, so the volunteer recruitment process is still limited to initial registration[11]. On the other hand, Pardosi et al, (2021) highlight the role of students as volunteers in improving the literacy quality of 3T rural communities. This study shows the significant contribution of volunteers to education, but does not discuss aspects of recruitment management or the efficiency of volunteer selection based on information systems[1]. Yang & He (2025) use a combination of Greedy and Deep Reinforcement Learning for dynamic task scheduling in cloud-edge systems, showing improvements in latency and resource utilization[12]. This motivates exploring pure greedy approaches in simpler scheduling contexts such as interview allocation.

Therefore, this study aims to develop a Volunteer Recruitment Information System with Interview Scheduling Using a Web-Based Greedy Algorithm. This system not only provides organizational information in an attractive and structured manner through a web platform, but is also capable of automatically scheduling interviews based on the availability of interviewers. With this approach, the recruitment process at GSM is expected to become more efficient, integrated, and professional.

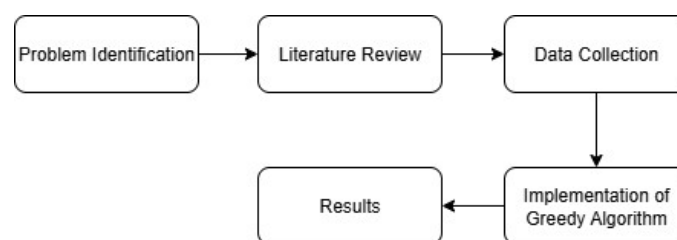## 2. RESEARCH METHOD
2.1 Research Stages

Figure 1. Research Stages

This study uses a qualitative method that aims to understand and analyze in depth the volunteer recruitment process at Gerakan Sumut Mengajar (GSM) and to design an information system-based solution that can automate interview scheduling. Qualitative methods are used to understand, investigate, and thoroughly analyze various complex aspects of human interactions, behaviors, and events that occur in society [13], [14].

The research steps were carried out through five main stages, namely:
1. Problem Identification
   Exploring problems in the GSM volunteer recruitment process, which is still carried out manually, especially in the document selection and interview scheduling stages.
2. Literature Review
   Conducting a review of various references related to recruitment information systems, Greedy algorithms, and supporting technologies for web-based system development.

3. Data Collection
   Data was obtained through interviews with the Executive Director, daily administrators, project teams, and GSM volunteers, as well as direct observation of the volunteer selection and interview process.
4. Implementation of Greedy Algorithm
   Data on prospective volunteers who passed document verification was used in the Greedy algorithm with the Activity Selection Problem approach. Interview slots were sorted based on the earliest completion time, and the system automatically set the schedule based on the order of passing and the availability of interviewers.
5. Results
   The system automatically displayed the final interview scheduling results. Testing was conducted using the black-box testing method to ensure that each feature functioned as intended.

2.2 System Development Method

In this study, the system development process was carried out using a modified Waterfall model. The methodology requires that each phase be fully completed before proceeding to the next, as the deliverables produced in one phase function as essential inputs for the subsequent phase[15]. In other words, the work must be done sequentially, so that the next step cannot be started before the previous step is completed[16], [17]. The stages of the Waterfall method are as follows:
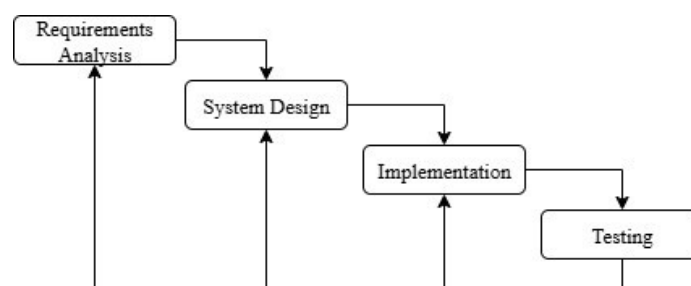

Figure 2. Waterfall System Development Method

1. Requirements Analysis, which is the identification of system features and constraints based on the results of data collection.
2. System Design, This is done by creating UML diagrams and diagrams such as use case, activity, and sequence diagrams.
3. System Implementation, Application development is carried out using native PHP and MySQL.
4. System Testing, conducted to ensure that the system functions according to specifications and is free from errors.

The stages in this model proceed sequentially, starting from planning to the maintenance stage. However, because this study does not focus on the maintenance stage, the author modified the Waterfall model to suit the research objectives, which are to develop and test the system without covering post-implementation maintenance.

2.3 Greedy Algorithm

A greedy algorithm is an approach in programming that solves optimization problems in a seemingly greedy manner. This approach focuses on making decisions in the present with the hope that each step will bring us closer to the optimal final solution[18], [19]. The Greedy Algorithm is well known for its simplicity and efficiency in solving optimization problems. However, similar to feature selection algorithms on high-dimensional data, the main challenge lies not only in accuracy but also in the stability of the results. Algorithmic stability plays an essential role in ensuring consistent solutions when data conditions change[20].

In this study, the type of greedy algorithm used to solve the interview scheduling problem is the Activity Selection Problem (ASP)[21], [22]. The main principle of ASP is to select activities with the earliest finish time, so that the number of activities that can be executed without overlap is maximized. The same principle is adapted in this study to solve the problem of scheduling volunteer interviews. In the context of this study, interview slots are viewed as activities that have start and finish time attributes, while volunteers are viewed as entities that need to be placed in those slots. Thus, the earliest finish time strategy is applied to select the slots that finish the fastest globally.

The general steps for applying the greedy algorithm are:

1. Sort the interview time slots $S = \{ s_1, s_2, \ldots, s_k \}$ based on completion time ($s_j.end$) in ascending order.
2. For each volunteer ($r_i \in R$), the system will search for available slots ($s_j \in S$).
3. If found, the pair (r_i, s_j) is entered into the schedule J, and the slot s_j is marked as used.

Mathematically, the objective of this algorithm can be stated as "Maximize $|J|$ such that each $r_i \in R$ is scheduled only once, and each $s_j \in S$ can only be used by one volunteer".
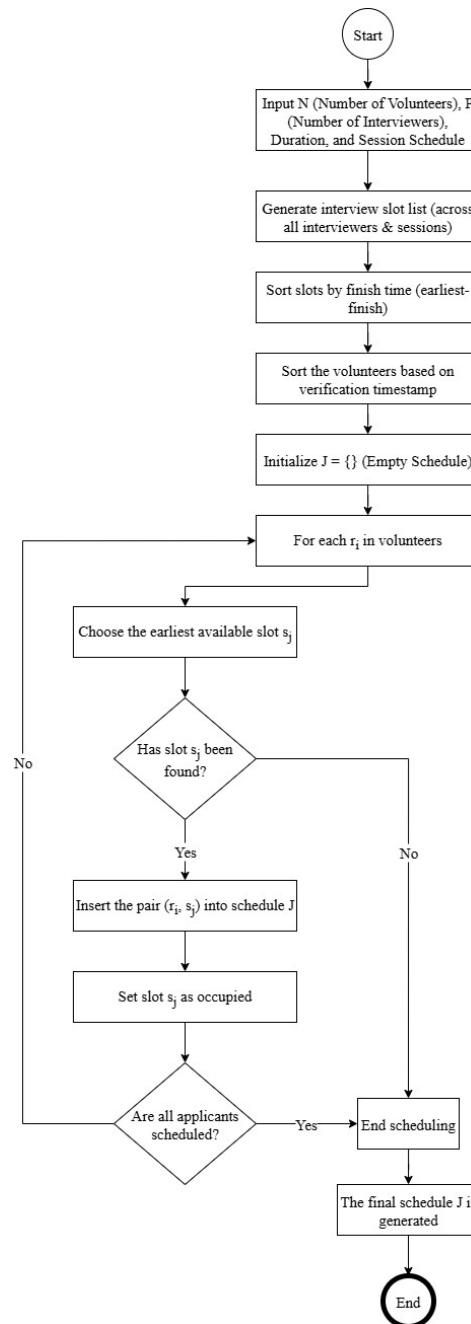
Figure 3. Stages of the Greedy Algorithm

Here is an explanation of the steps for applying the greedy algorithm in this study:

1. The system receives input consisting of N (the number of applicants who passed administrative selection, in this study N = 237), P (the number of interviewers available, which is 7), Duration (the length of each interview, set to 20 minutes), and Interview Sessions (three daily sessions: 10.00–12.00, 13.00–15.00, and 16.00–18.00).

2. Based on the combination of interviewers and interview sessions, the system generates all available interview slots. Each session lasts 120 minutes, which allows 6 slots per session (120 ÷ 20 = 6). With 3 sessions per day, each interviewer has 18 slots. Since there are 7 interviewers, the total number of slots available per day is 126 slots.

3. All interview slots are sorted based on their finishing time, prioritizing the earliest-finish slot. This greedy principle ensures that the scheduling process starts from the earliest possible slot, reducing potential conflicts and maximizing efficiency.

4. Applicants are sorted according to the order in which they completed their verification process. Those who verified earlier are scheduled first, ensuring a fair and systematic process.

5. The system prepares an empty set J = { } to store the final schedule, which consists of applicant–slot pairs.

6. For each applicant, the system selects the earliest available slot. If a slot is found, the applicant is assigned to it, and the slot is marked as occupied. If no slot is available, the scheduling process is stopped.

7. After scheduling one applicant, the system checks the condition "Are all applicants scheduled?". If yes, the process proceeds to the final result. If no, the system returns to the next applicant and continues the scheduling process.

8. Once the process is complete, the system produces the final schedule represented as pairs (r_i , s_j), ensuring that each applicant is assigned exactly one slot, each slot is occupied by only one applicant, and no conflicts occur among interviewers.

9. The scheduling process ends with the output of a complete and conflict-free interview schedule that accommodates the total number of applicants, interviewers, and available sessions.

3. RESULTS AND DISCUSSION

3.1 System Design

The system was designed using Unified Modeling Language (UML), which describes the roles of users in recruiting and scheduling interviews with prospective volunteers in a structured, systematic, and object-oriented manner[23]. UML consists of various types of diagrams, including Use Case Diagrams and Activity Diagrams[24].

Use Case Diagram

Use Case Diagrams are used to show interactions between users (actors) and systems, including the main functions provided by the application. Use Case Diagrams represent system functions from the user's perspective and describe how users interact with the system[25].
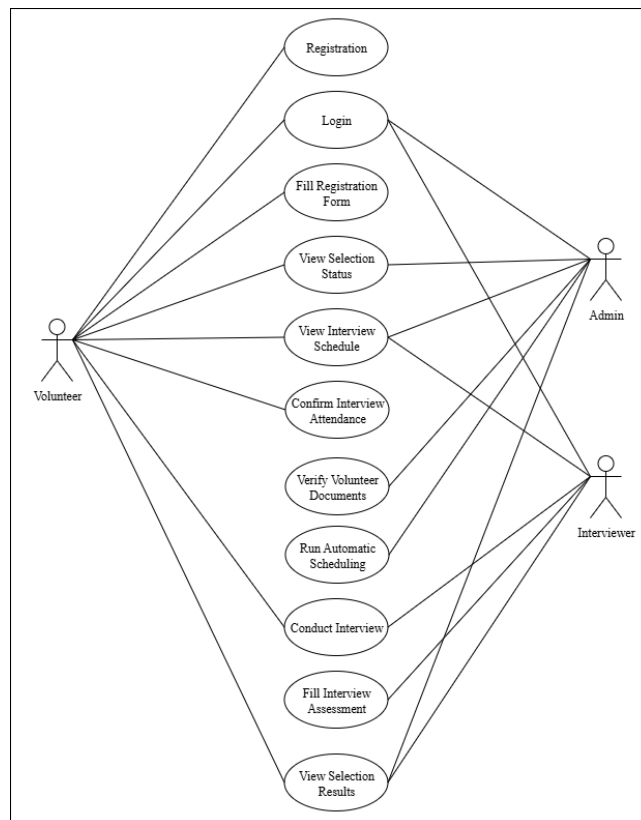

Figure 4. Use Case Diagram

The use case diagram shown in Figure 4 illustrates the interaction between three primary actors: Volunteer, Admin, and Interviewer, within the volunteer recruitment system. This diagram is designed to represent the system's functional requirements based on the roles and responsibilities of each actor.

The Volunteer actor interacts with the system through several main functions. The process begins with Registration and Login, which are prerequisites to access other features. After successfully logging in, the volunteer can Fill the Registration Form as part of the application process. The volunteer is also able to View Selection Status to monitor their progress and View Interview Schedule to check the scheduled interview date and time. To confirm attendance, the volunteer must perform Confirm Interview Attendance. Following the interview process, the volunteer can View Selection Results to learn the outcome of the selection.

The Admin actor plays a supervisory and administrative role in the system. Admin is responsible for Verifying Volunteer Documents, which is part of the administrative screening process. Admin also has the ability to Run Automatic Scheduling to

generate interview schedules based on predefined rules and available data. Additionally, the admin can access View Selection Status, View Interview Schedule, and View Selection Results to monitor the overall progress of the recruitment process.

The Interviewer actor is actively involved in the assessment phase. The interviewer can View Interview Schedule to see assigned interview sessions, Conduct Interview with assigned volunteers, and Fill Interview Assessment to record evaluation outcomes. Interviewers also have access to View Selection Results for final review and decision-making.

3.2 Implementation of Greedy Algorithm for Gerakan Sumut Mengajar System
System Home Page Display

Figure 5. System Home Page Display

Figure 5 shows the main page of the system, which contains information that can be accessed publicly, ranging from the registration process, the impact of the movement, the growth of volunteers per batch, to the impressions of volunteers who have served. Those who are interested can immediately register by first creating an account and then logging in to proceed to the next stage.

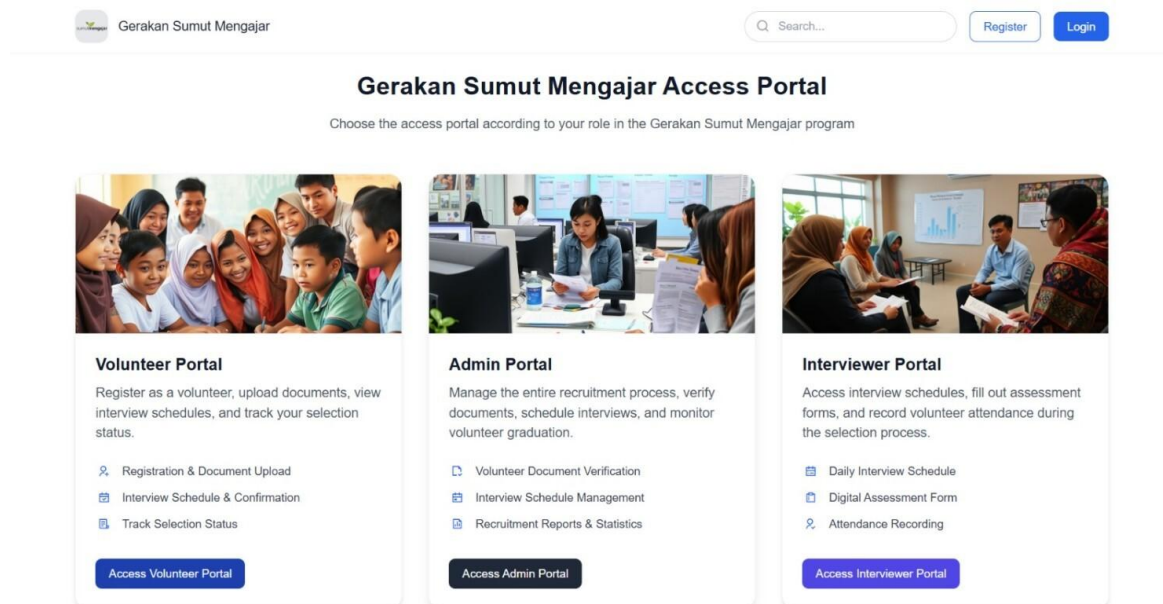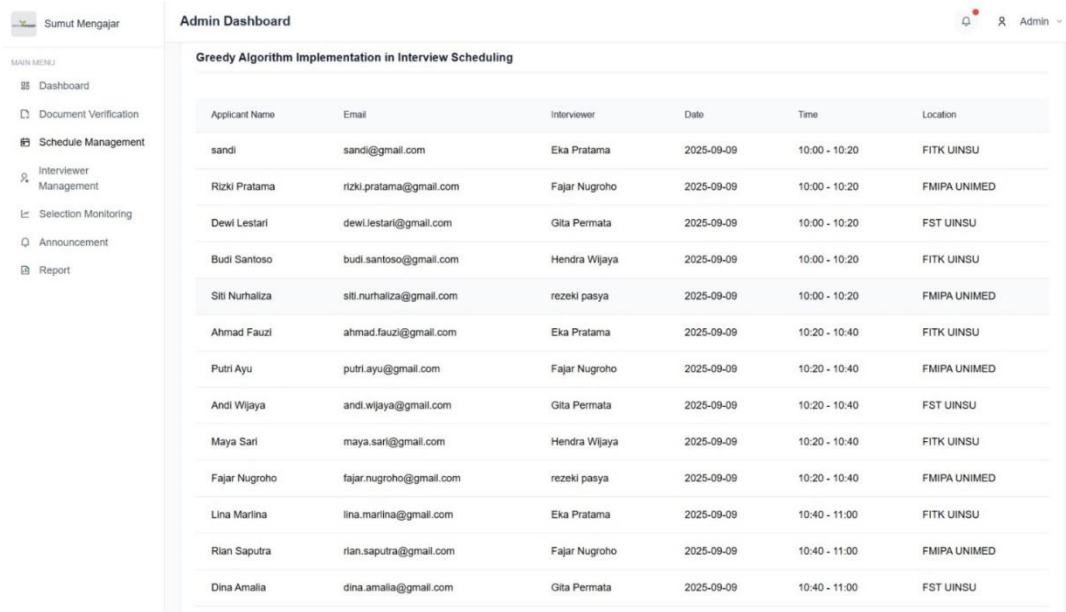**Account Access Portal Display**

Figure 6. Account Access Portal Display

Figure 6 shows the main page, which also displays the account access portal. This page displays three different portals according to the user's role in the system, namely the Volunteer Portal, Admin Portal, and Interviewer Portal. This structure ensures a clear separation of functions and efficient workflows between the various parties.

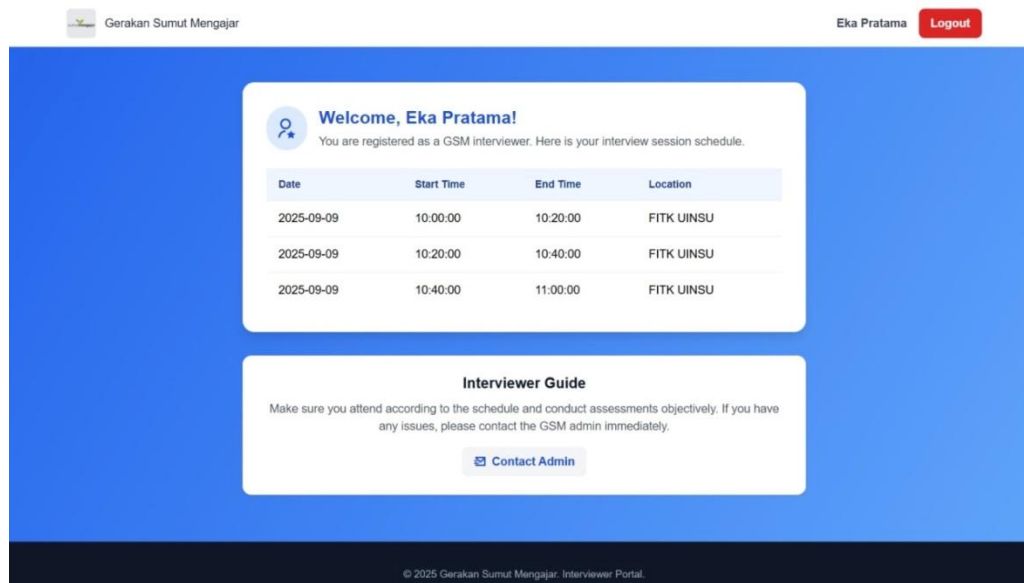**Interview Schedule Results Display (Admin View)**

Figure 7. Overall Interview Schedule Results

Figure 7 shows the Interview Schedule Results display in Admin. This dashboard displays a complete summary of all scheduled interviews, including the names of volunteers, email addresses, assigned interviewers, dates, times, and interview locations. This menu allows administrators to efficiently monitor and manage interview schedules, ensuring that all volunteers are correctly assigned to interviewers and that there are no overlapping time slots.

Interview Schedule Results Display (Interviewer View)

Figure 8. Interviewer Interview Schedule

Figure 8 shows the Interview Session Schedule display for Interviewers. This dashboard shows interview schedule information that has been set for users registered as GSM interviewers. The information displayed includes the date, start time, end time, and interview location for each scheduled session. In addition, there is a brief reminder for interviewers to ensure they arrive on time and conduct assessments objectively. A "Contact Admin" feature is also provided to make it easier for interviewers to contact the admin if any problems arise. This display helps interviewers monitor and manage their interview schedules effectively and in an organized manner.

Interview Schedule Results Display (Volunteer View)

Figure 9. Volunteer Interview Schedule

Figure 9 shows the Interview Schedule Results from the Volunteer View on the Sumut Mengajar portal. This dashboard provides volunteers with information about the status of their interview schedule, including the volunteer's name, email, interviewer's name, interviewer's email, date, time, and interview location. In this example, a volunteer named Sandi has been scheduled for an interview with Eka Pratama on September 9, 2025, from 10:00 to 10:20 WIB at FITK UINSU. The system also provides a green notification stating that the volunteer has been scheduled for an interview, making it easier for volunteers to clearly and systematically understand the status and details of their scheduling.

3.3 Discussion

The implementation of the proposed system demonstrates an effective solution for managing the multi-stage recruitment process of GSM, particularly in interview scheduling. Compared to the manual method that relies on Google Forms and spreadsheets, the system successfully minimizes scheduling conflicts, evenly distributes interview sessions, and reduces the administrative burden on organizers.

When compared with Mawarni et al, (2019), who developed a scheduling information system for lectures using the Greedy Algorithm, this study provides a broader scope by handling not only single-activity scheduling but also multi-stage processes involving file verification and interview management. Similarly, the study by Nufus & Taufiq (2024) applied a Greedy Algorithm for resource allocation, but their focus was limited to workplace task scheduling, while this research applies the algorithm to volunteer recruitment, a field with higher complexity due to the large number of participants and limited interviewers.

In another related study, Ramadhan (2020) developed an Android-based volunteer event management system, but manual file verification was still required, leaving room for human error. In contrast, the system developed in this study integrates full automation from registration to interview scheduling, eliminating unnecessary manual intervention. Furthermore, Putra & Amin (2017) built a volunteer information system for the Indonesian Red Cross that was effective in broadening participation, but it lacked algorithm-based interview scheduling, which is the key contribution of this research.

Similar to its application in flow-shop scheduling problems[26], the Greedy approach in this study proved effective in minimizing conflicts and ensuring efficient interview allocation. Therefore, this study not only validates the efficiency of the Greedy Algorithm in solving scheduling conflicts but also extends its application to the context of social organizations with multi-stage recruitment requirements. This finding highlights the novelty of integrating heuristic algorithms into volunteer recruitment management, which has rarely been explored in previous research.

4. CONCLUSION

This study developed a web-based volunteer recruitment information system specifically designed to support the selection process in Gerakan Sumut Mengajar. The system integrates multiple recruitment stages, including registration, document verification, interview scheduling, assessment, and final result announcements. The implementation of the Greedy Algorithm in interview scheduling proved to provide a more efficient solution compared to the previous method. This is evident from the more balanced distribution of interview schedules, more optimal time utilization, and reduced administrative workload for organizers in managing interview schedules. Furthermore, the availability of the recruitment information system for administrators, interviewers, and volunteers ensures a more structured process and facilitates each stakeholder in accessing relevant information according to their roles. From an academic perspective, this research contributes novelty by extending the application of the Greedy Algorithm from single-activity scheduling to multi-stage volunteer recruitment within a social organization context. For future work, further research is expected to explore the development of more advanced intelligent scheduling approaches, such as hybrid heuristic algorithms or machine learning methods, to enhance optimization. Additionally, extending the system to mobile platforms and integrating real-time notifications could further improve accessibility, security, and user engagement. Therefore, this system is not only efficient but also adaptive and has the potential to support the sustainability of volunteer recruitment processes in a professional manner.

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