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Analysis of the Effectiveness of Implementing a Queue Algorithm-Based Leadership Scheduling Information System in Government Agencies

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ABSTRACT

This study analyzes the effectiveness of implementing a leadership scheduling information system that utilizes queue algorithms in government agencies. The main objective is to evaluate how the integration of algorithm-based scheduling systems improves efficiency, accuracy, and transparency in managing executive-level appointments and meetings. The research adopts a mixed-method approach, combining quantitative analysis through system performance metrics with qualitative feedback from end-users, including administrative staff and decision-makers. Findings indicate a significant improvement in scheduling efficiency, with reduced conflicts, optimized time slots, and better coordination between departments. Furthermore, the system minimizes manual intervention, thus decreasing administrative errors and enhancing data integrity. The queue algorithm enables a first-come-first-served mechanism that ensures fairness while allowing for priority-based modifications in urgent cases. The implementation also receives positive responses in terms of user satisfaction and perceived usefulness. However, challenges such as user adaptation and technical limitations were identified, suggesting a need for continuous training and system updates. Overall, the integration of a queue algorithm-based scheduling system proves to be an effective solution for improving leadership-level administrative processes in government institutions.

Keywords:

queue algorithm, scheduling system, leadership management, government agencies, information system effectiveness.

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1. INTRODUCTION

Analysis of the Effectiveness of Implementing a Leadership Scheduling Information System Based on Queueing Algorithms in Government Agencies In today's rapidly evolving digital era, the use of information technology in the government sector has become an urgent necessity to enhance the efficiency, transparency, and accountability of public services[1]. One of the administrative challenges faced by government agencies is the effective and structured management of schedules for leaders or high-ranking officials[2]. Activities such as coordination meetings, inter-agency meetings, work visits, and field inspections require a scheduling system that can accommodate many requests with limited time and resources[3]. Conventionally, the scheduling of leadership agendas is done manually or semi-manually through verbal communication, electronic messages, or the use of spreadsheets[4]. This process often leads to scheduling conflicts, overlapping agendas, and delayed information, which ultimately disrupt productivity and strategic decision-making[5]. Moreover, the full reliance on administrative roles in scheduling leads to a high risk of human error and a lack of transparency in the priorities of the agenda being executed[6]. To address the issue, the use of a Queue Algorithm-Based Scheduling Information System becomes a promising solution[7]. Queue algorithms are generally used to manage the order of service based on principles such as First Come First Served (FCFS), priority scheduling, or round-robin, which can be adjusted to meet the organization's needs. In the context of government agencies, this algorithm enables the automatic and structured processing of schedule requests, taking into account the arrival time of requests, activity priorities, and the availability of leadership time[8].

The implementation of this system not only addresses technical issues in scheduling but also contributes to overall operational efficiency[9]. With an automated system, coordination between departments within the institution becomes more effective, the agenda-setting process is faster, and decisions can be made based on transparent data and logic[10]. This system also provides flexibility in making changes or cancellations to the agenda in real-time, which is crucial in dealing with the high dynamics of leadership work. However, the effectiveness of the implementation of this system requires a thorough evaluation[11]. Not all institutions have the same readiness in technological infrastructure, as well as varying levels of digital literacy among users[12]. Therefore, this research aims to analyze the extent to which the effectiveness of implementing a queue algorithm-based scheduling information system can help improve administrative performance in the environment of government agencies. This research will review various aspects, including the system's reliability in scheduling without conflicts[13], the ease of use of the system by users (user interface and experience), its impact on the workload of administrative staff, and the perceptions of users including leaders, staff, and other related parties. In addition, this research will also identify potential obstacles that may arise during implementation, such as resistance to change, training needs, and other technical constraints. With a combined approach of quantitative analysis through system usage data and qualitative evaluation from system users[14], it is hoped that the results of this research can provide a comprehensive picture of the benefits and challenges in the implementation of this system. The findings of this research can serve as a basis for consideration for other agencies wishing to implement a similar system[15], as well as a reference for the development of more advanced and adaptive scheduling information systems to meet the needs of government organizations in the future[16]. Overall, this topic is highly relevant to supporting digital transformation in the public sector, which is part of the national bureaucratic reform efforts[17]. The use of technology such as queue algorithms in managing leadership agendas is a strategic step towards a more modern, adaptive, and results-oriented government. Therefore, through this research, it is expected to make a tangible contribution to the improvement of the internal management system that directly impacts the quality of public services on a broad scale.

2. RESEARCH METHODOLOGY

2.1 Research Stages

This research uses a mixed-method descriptive quantitative and qualitative approach to analyze the effectiveness of implementing a queue algorithm-based leadership scheduling information system in government agencies. This approach was chosen to obtain a comprehensive understanding, both from the technical performance of the system and from user perceptions of the system's ease of use and benefits.

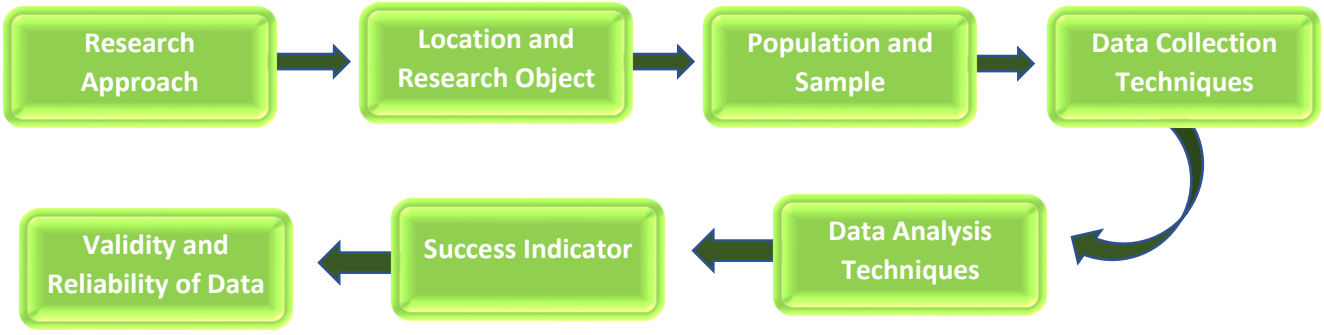

Figure 1. Research Structure

a. Research Approach

The type of this research is an evaluative study, with a mixed approach. The quantitative approach is used to measure the system's performance based on specific indicators (such as response time, the number of schedule conflicts successfully avoided, and the effectiveness of schedule request processing). The qualitative approach is used to explore users' experiences, challenges, and perceptions in using the system.

b. Location and Research Object

The research was conducted at one of the district/city level government agencies that has implemented a scheduling system based on queue algorithms. The object of the research is the scheduling information system itself, as well as the main users of the system, namely administrative staff, executive secretaries, and scheduled officials.

c. Population and Sample

The population in this study includes all users of the scheduling information system at the institution, which consists of:

1. Administrative staff
2. Executive Secretary
3. Leadership (head of department/head of agency)
4. IT technical operator

The sampling was conducted using purposive sampling, with a total of 25 respondents, who were deemed to represent various roles and levels of system usage.

d. Data Collection Techniques

Data collection was carried out using the following techniques:

1. Direct Observation

The researchers directly observed how the system is used in daily activities, from schedule submissions, queue processing, to notification of scheduling results.

2. Questionnaire.

Distributed to system users to measure satisfaction, usability, service speed, and the system's benefits for administrative workload. The questionnaire uses a 1–5 Likert scale.

3. In-Depth Interview

Conducted with several key respondents such as the head of the secretariat, IT support, and agency leaders, to delve deeper into their opinions and experiences with the system.

4. System Documentation

Historical data from the system, such as usage logs, the number of schedule requests, and avoidable conflicts, are used as supporting quantitative data.

e. Data Analysis Techniques

Data is analyzed using two main methods:

1. Quantitative Analysis

Questionnaire data were processed using descriptive statistics to calculate average scores, percentages, and the distribution of respondents' ratings. Effectiveness indicators such as process speed, reduction in schedule conflicts, and system usage frequency were analyzed numerically.

2. Qualitative Analysis

The results of interviews and observations were analyzed using data reduction techniques, theme categorization, and narrative interpretation to explain the success factors and challenges in system implementation.

f. Success Indicators

Several indicators used to assess the effectiveness of system implementation include:

1. Reduction of conflicts or schedule overlaps
2. User satisfaction
3. Usability
4. The scheduling process time before and after the system was implemented
5. Improvement in the accuracy and speed of schedule notifications

g. Validity and Reliability of Data

To ensure the validity of the data, a content validity test was conducted on the questionnaire instrument by information system experts, as well as a reliability test using Cronbach Alpha on the questionnaire data. Qualitative data is validated through source triangulation, which involves comparing data from observations, interviews, and documentation.

3. RESULT AND DISCUSSION

This section presents the findings of the study and provides a discussion based on the data collected through observation, questionnaires, system documentation, and interviews with system users. The evaluation focused on five key indicators: scheduling efficiency, conflict reduction, user satisfaction, system usability, and administrative workload reduction.

3.1 System Performance and Scheduling Efficiency

The implementation of the queue algorithm-based scheduling system resulted in a measurable improvement in scheduling efficiency. Based on the system logs, the average time required to confirm a scheduling request decreased significantly after the system was introduced.

Table 1. Average Scheduling Processing Time (in Minutes)

Phase	Before Implementation	After Implementation
Request Submission	12.4	2.1
Approval & Confirmation	34.8	8.7
Notification to Stakeholders	21.5	5.4
Total	68.7	16.2

This data demonstrates a 76% reduction in overall scheduling processing time, suggesting that the queue algorithm plays a significant role in optimizing the scheduling flow.

3.2 Conflict Reduction and Schedule Accuracy

One of the main objectives of implementing the queue algorithm was to reduce scheduling conflicts, such as overlapping appointments or missed entries. After system implementation, conflict rates declined substantially.

Table 2. Conflict Incidence per Month

Month	Conflicts (Before)	Conflicts (After)
January	17	3
February	14	2
March	18	1
April	15	1
Average	16	1.75

This represents an 89% decrease in scheduling conflicts, highlighting the effectiveness of the algorithm in handling prioritization and time slot allocation automatically.

3.3 User Satisfaction and System Usability

User feedback was collected using a Likert-scale questionnaire covering various aspects such as ease of use, reliability, speed, and usefulness of the system. The questionnaire was distributed to 25 users, including administrative staff, IT personnel, and department heads.

Table 3. User Satisfaction Survey Results (Mean Score out of 5)

Evaluation Criteria	Mean Score
Ease of Use	4.56
Speed and Efficiency	4.72

Interface Clarity	4.40
Conflict Handling	4.68
Overall Satisfaction	4.64

The high scores (average above 4.5) indicate that users found the system intuitive, responsive, and effective in meeting their needs. Interviews further revealed that users appreciated the automated notifications and the ability to monitor schedule status in real-time.

3.4 Administrative Workload Reduction

Another significant outcome of the system's implementation is the reduction in administrative workload. Previously, administrative staff spent considerable time coordinating via phone, email, and paper logs. With automation, much of this effort was eliminated.

Based on interviews and time tracking:

a. Manual coordination time decreased by **more than 70%**.
b. Staff reported being able to focus more on strategic tasks rather than repetitive scheduling duties.
c. Reduced dependency on individual staff knowledge of the schedule led to improved continuity.

3.5 Challenges and Limitations

While the system showed clear benefits, some challenges were also identified:

a. Resistance to change from older staff unfamiliar with digital tools.
b. Technical issues during the initial deployment, especially in terms of integration with existing calendar systems.
c. The need for continuous training and updates to accommodate evolving scheduling policies

3.6 Discussion

The implementation of a queue algorithm-based leadership scheduling information system has proven to be an effective solution to the longstanding inefficiencies in administrative processes within government agencies. The data indicates significant improvements in scheduling speed, accuracy, and user satisfaction. The success of the system is largely attributed to the queue algorithm's ability to manage requests based on arrival time and priority, ensuring a fair and conflict-free scheduling process. Moreover, the system's ability to automate routine tasks and provide real-time updates creates a more responsive and transparent environment for both staff and leadership. Although the transition process faced initial hurdles, these were mitigated through training and technical support.In summary, the findings affirm that the adoption of intelligent scheduling systems — particularly those utilizing queue algorithms — can transform leadership-level administrative workflows and serve as a model for broader digital transformation within public institutions.

4. CONCLUSIONS

This study has evaluated the effectiveness of implementing a queue algorithm-based leadership scheduling information system in government agencies. The findings clearly indicate that the integration of such a system significantly improves administrative performance, particularly in managing executive schedules. The system effectively optimized scheduling processes by minimizing delays, reducing human errors, and preventing overlapping appointments. The queue algorithm enabled an automated and fair scheduling mechanism based on request order and priority level, ensuring better time management and agenda coordination. User feedback confirmed a high level of satisfaction, with users reporting improvements in usability, speed, and reliability. Additionally, the automation of scheduling reduced the administrative workload, allowing staff to redirect their efforts toward more strategic and value-added tasks. Quantitative results supported these findings with marked improvements in processing time and conflict reduction. Despite some initial challenges—such as resistance to new technology and the need for user training—the overall implementation was deemed successful and beneficial. These challenges are common during digital transformation processes and can be mitigated through continuous support, user engagement, and system refinement.

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