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Development of a Responsive Mobile Web-Based Guest Book Application Utilizing QR Code Technology

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Abstract: The advancement of information technology has driven digital transformation across various sectors, including systems for recording guest data. Conventional guest books using paper media offer ease of use and low cost, but they face several limitations such as data loss risks and inefficiency in data processing. Previous studies have shown that integrating digital technologies, such as web-based applications and QR code utilization, can enhance efficiency and accuracy in guest registration. However, most of these systems are desktop-based and do not yet support user mobility. This study aims to develop a responsive mobile web-based digital guest book application utilizing QR code technology as a more efficient, faster, and safer visitor recording solution. The development method used is the waterfall model, encompassing requirement analysis to implementation and testing. Test results indicate that the application performs optimally across mobile devices and significantly speeds up contactless guest registration. This application is expected to serve as a modern alternative to manual guest book systems and improve operational efficiency in various institutions.

Keywords: Digital guest book, mobile web, QR Code, information system, efficiency

1 Introduction

The rapid development of information and communication technology (ICT) has led to digitalisation in various aspects of life, including systems for recording guest data in government institutions, companies, and educational organisations [1], [2]. Conventional guest book systems that use paper media still offer some advantages, such as ease of implementation, no need for electronic devices, and relatively low initial costs. Additionally, these systems are simple in nature, making them easy for all user levels to understand without requiring special training [1].

However, manual guest book systems have limitations, such as slow data recording processes, the risk of data loss or damage, and inefficiency in data retrieval and visit reporting [2], [3]. In today's digital era, there is a growing demand for systems that are fast, accurate, and accessible in real-time. Many previous studies have proposed web-based digital guest book systems as a solution [3]. For example, a study by [3] and [4] developed a web-based guest book application with an integrated database that improved the speed of data recording and facilitated the summarisation of visits in digital reports, while [5] and [6] demonstrated that structured web-based visitor management systems enhance administrative accountability and visitor tracking.

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Another study by [7] implemented scanning technology in a web-based presence system, demonstrating that automated code scanning significantly accelerates identity verification compared to manual input methods and helps reduce queues during peak hours. Similarly, QR code-based check-in mechanisms have been shown to streamline user interactions and improve service speed [8]. However, the system was limited to desktop devices and did not meet the mobility needs of users in the field [3], [5].

While web-based systems improve the efficiency of data entry and reporting, they are typically tied to desktop or fixed-location devices, limiting user mobility and flexibility. This is especially problematic in organisations where guest registration needs to occur in multiple locations or on the go. Similarly, desktop systems with QR code technology offer a contactless and faster experience but lack the portability required for remote guest check-in.

In contrast, mobile web-based guest book systems combine the strengths of both previous approaches by providing fast and accurate registration through QR codes while also allowing flexible access via mobile devices [9], [10]. This makes them particularly well-suited for modern institutions that prioritise speed, mobility, and real-time data management.

The system developed in this study is a responsive mobile web-based digital guest book that utilises QR code scanning for guest check-ins. It enables real-time data recording and access across multiple device types (especially smartphones) and supports contactless interactions. The system is designed to be lightweight, user-friendly, and adaptable to various institutional environments such as offices, schools, or public service areas.

In response to these limitations, the development of a mobile web-based guest book system has become a relevant solution. It allows users to access the application via various devices, including smartphones, in a flexible and responsive manner. Integrating QR code technology into a web-mobile application not only increases the efficiency of data recording but also supports the implementation of contactless protocols, which are highly needed in post-pandemic environments or high-traffic workplaces that demand rapid service delivery [8], [9], [11].

By adopting technologies from previous studies and integrating them into a more flexible platform, this study aims to develop a responsive mobile web-based digital guest book application utilising QR code technology [3], [12]. This application is expected to become an innovative solution capable of replacing manual systems, accelerating data recording, improving data accuracy, and supporting operational efficiency in various institutions.

2 Literature Reviews

A Digital Guest Book Information System

A digital guest book system is an advancement from traditional paper-based guest registration methods. It aims to enhance the efficiency, accuracy, and security of visitor data management by leveraging information technology [3], [4]. In practice, this system utilises a digital interface to record visitor identity, time of visit, and purpose, which are automatically stored in a centralised database [5], [6]. Compared to manual methods, digital systems offer advantages such as fast data retrieval, automated reporting, and seamless integration with administrative workflows [1], [2].

B QR Code Technology

A QR code (quick response code) is a type of two-dimensional barcode capable of storing large amounts of data and can be quickly scanned using digital device cameras such as smartphones [7], [9]. According to [8] and [9], QR codes offer benefits in terms of fast access, high data capacity, and contactless usability, making them widely adopted in modern information systems, including for attendance

tracking, e-ticketing, and visitor authentication purposes [10], [11]. In the context of a guest book system, QR codes are used to accelerate the registration process by directing users to a digital form or system through a simple scan, eliminating the need for manual data entry [3], [6].

C Responsive Web-Mobile Applications

Responsive web-mobile applications are web-based systems designed to adapt their display and functionality across various screen sizes, including desktops, tablets, and smartphones [12], [13]. Responsive design ensures that users can access the application optimally on any device without needing to install additional native software, thereby lowering adoption barriers and enhancing cross-device usability [13]. Front-end frameworks such as Bootstrap or Tailwind CSS, combined with back-end frameworks such as Laravel, are commonly used in responsive web interface development [4], [12], [13]. In digital guest book development, a responsive approach enables flexibility for users, particularly for reception staff or visitors using mobile devices on-site.

D Related Studies

Several previous studies have explored the development of guest book and attendance systems using modern web and scanning technologies. Studies by [7] and [10] investigated the implementation of QR and barcode scanning in web-based attendance systems and showed substantial improvements in registration speed and data accuracy. Meanwhile, [3], [4], and [5] developed web-based guest book and visitor management applications with database integration that facilitated automatic reporting of visitor data, and [6] incorporated digital QR visitor passes for residential and institutional access control. However, many earlier systems were primarily optimised for desktop terminals or lacked an integrated mobile-responsive interface combined with real-time complaint and feedback management. These studies also did not fully address cross-device user experience in high-mobility service environments. This research seeks to address that gap by providing a flexible, responsive mobile web solution integrated with QR code scanning.

3 Methods of System Development

The system development method used in this study is the Waterfall method. The Waterfall method is a structured approach to software development that follows a sequential and systematic process, where each phase must be completed before proceeding to the next stage [5], [14]. In this study, the Waterfall method was chosen because the system requirements are well-defined and the scope of development does not change dynamically, making it suitable for a disciplined engineering workflow [14]. The cycle of the Waterfall method is illustrated in Figure 1

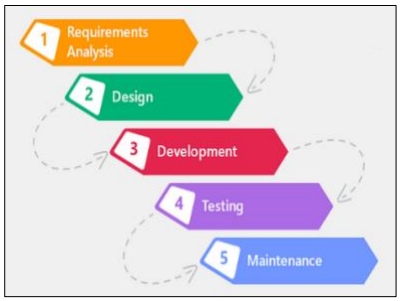

Figure 1. Waterfall Method Cycle

A Requirements Analysis

The requirements analysis phase is a crucial process in system development aimed at identifying and defining both functional and non-functional requirements that the system must meet to satisfy user

expectations. As explained by [15], systematic analysis of both functional specifications and non-functional quality attributes (such as usability, security, and performance) throughout the software development lifecycle is essential to ensure operational reliability.

In this study, the developed system is a responsive web-mobile guestbook application integrated with QR code technology [3], [12]. The main goal of developing this system is to streamline digital guest registration and the collection of customer complaints or suggestions through a QR code scanning mechanism [3], [16]. Incorporating a structured digital complaint module allows institutions to capture service feedback systematically and accelerate follow-up actions [16]. This system is intended to replace the traditional paper-based guestbook, which has been deemed inefficient, prone to data loss, and time-consuming in terms of data entry.

Based on the results of the system requirements analysis, two main types of requirements have been identified: functional requirements and non-functional requirements [15]. Functional requirements outline the features or services that the system must offer to achieve its primary objectives, while non-functional requirements pertain to the quality criteria that must be met for the system to operate effectively and efficiently. The identification of requirements was carried out through direct interviews and observation of guest service processes and complaints. The details of the functional requirements are presented in Table 1, and the details of the non-functional requirements are presented in Table 2.

Table 1: Functional Requirements of the System

No	Requirement Name	Description
1	QR Code Scanning	The system provides static or dynamic QR codes placed in strategic areas (such as reception desks, waiting rooms, or service counters) and accessible to users via mobile devices.
2	Guestbook Form Interface	After scanning the QR code, users are directed to a responsive web interface that displays a digital form for entering visit information.
3	Guestbook Form Fields	The form includes several fields such as full name, affiliated institution/organisation, contact number, purpose of visit, and visit time, which is recorded automatically.
4	Complaint and Suggestion Form	The system provides an additional feature in the form of a complaint and suggestion form, which includes fields for the subject, message content, identity (optional), and service rating (optional).
5	Data Storage	The data entered by users is automatically stored in a centralised database for reporting and analysis purposes.

Table 2: Non-Functional Requirements of the System

No	Requirement Name	Description
1	Responsiveness	The system interface is designed to adapt optimally to various screen sizes, including smartphones, tablets, and desktops.
2	High Accessibility	The system can be accessed directly through a web browser without the need to install any additional applications.
3	Data Security	User input will be validated, and administrative access is protected through authorisation and authentication mechanisms to ensure data integrity and confidentiality.
4	Time Efficiency	The form is designed to be completed by users in less than two minutes.
5	Real-Time Processing	Each submitted data entry is immediately processed and stored in real-time, making it instantly available for reporting or further processing.

B System Design

System design is a critical phase in the software development lifecycle that aims to transform functional requirement specifications into a technical blueprint that can be implemented. In this phase, the system's structure, process flows, and key components involved in the application are modelled using Unified

Modeling Language (UML) to ensure that all system functions operate in accordance with user needs and development objectives [17], [18].

In this study, the system designed is a responsive mobile web-based digital guestbook application that utilises QR code technology to support efficient and rapid visitor data entry and customer complaint submission. To support a comprehensive system design, three types of UML modelling diagrams are used: a use case diagram, an activity diagram, and a class diagram [17], [18].

The use case diagram is used to illustrate the interactions between users (guests/visitors and administrators) and the system [17]. This diagram visualises the main functionalities such as QR code scanning, guestbook data entry, complaint submission, and data management by the administrator. There are two actors involved in this use case diagram. The first actor is the administrator, who has the ability to manage guestbook data, customer complaint information, and report data. The second actor is the guest, who can register, fill in the guestbook information, and submit complaints. The use case diagram is shown in Figure 2.

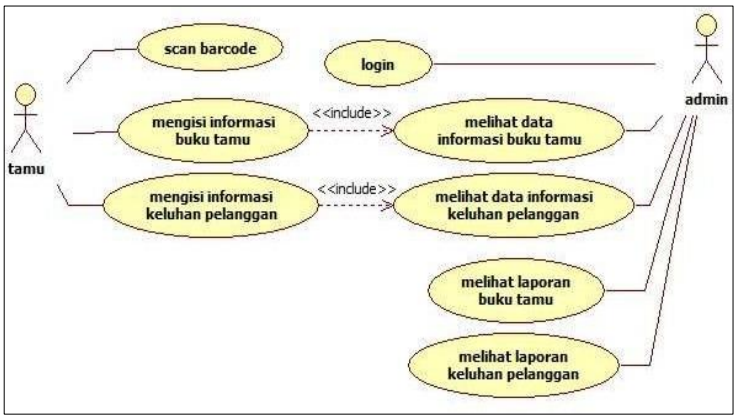

Figure 2. Use Case Diagram of the Mobile Web-Based Digital Guestbook Application

The activity diagram represents the flow of activities within the system, starting with the user scanning the QR code and filling out the digital form to the data being stored in the database [17], [18]. This diagram helps identify the sequence of processes and potential bottlenecks in the system's workflow. The system's activity diagram for the administrator illustrates in detail the workflow or processes performed by the admin in carrying out their responsibilities in managing guest data, including activities such as data entry, monitoring, and reporting. The administrator's activity diagram is shown in Figure 3.

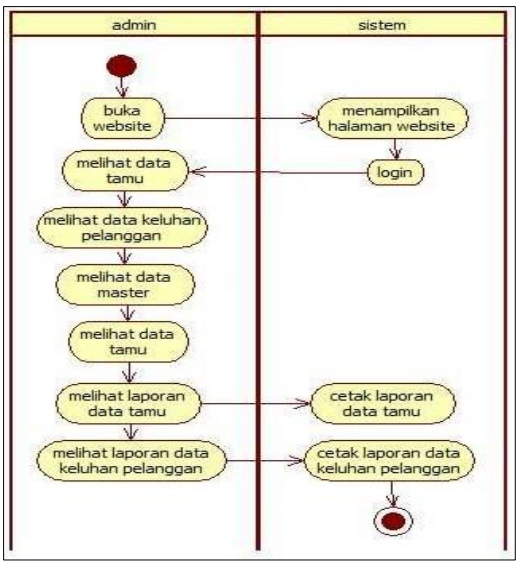

Figure 3. Administrator's Activity Diagram of the Mobile Web-Based Digital Guestbook Application

The system's activity diagram for guests provides a detailed representation of the steps a guest must follow, starting from scanning the QR code to completing registration and filling out the forms for visit purposes and customer complaints. The guest activity diagram is shown in Figure 4.

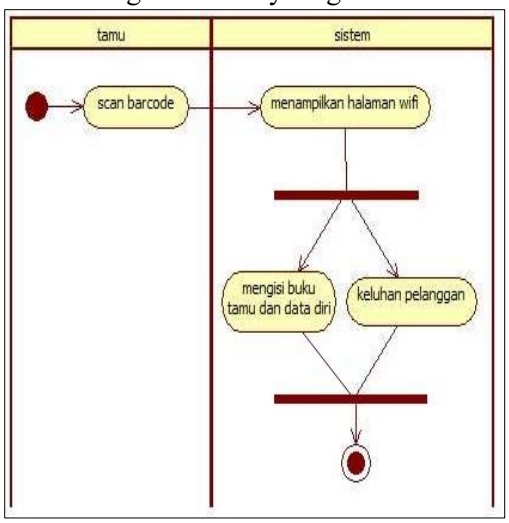

Figure 4. Guest Activity Diagram of the Mobile Web-Based Digital Guestbook Application

The class diagram illustrates the static structure of the system by representing the main classes along with their attributes and relationships, such as the Guest, Complaint, Admin, and QR Code classes [18]. This model serves as the foundation for relational database design and object-oriented system implementation. The class diagram is shown in Figure 5.

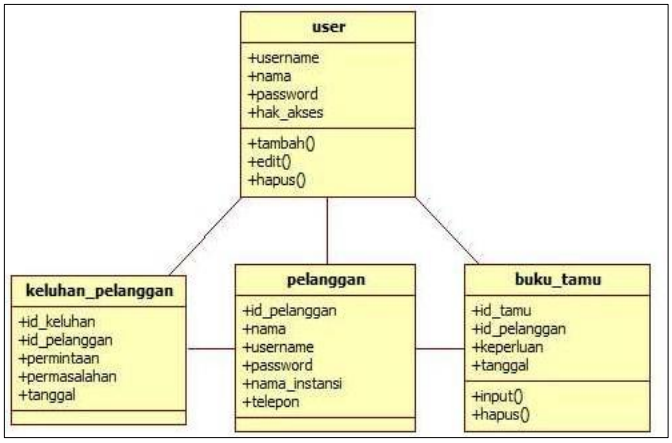

Figure 5. Guest Class Diagram of the Mobile Web-Based Digital Guestbook Application

C Implementation

According to [14], implementation is the process of translating the technical design into source code, which includes the development of the user interface, system logic, database management, and comprehensive integration of application components.

The application developed in this study is a responsive mobile web-based digital guestbook, featuring core functionalities such as visitor data entry and customer complaint submission through QR code scanning [3], [16]. The system is designed to be accessible from various devices, particularly smartphones, without requiring additional installation, thereby supporting user mobility and efficiency [12], [13]. The primary objective of this application is to replace the inefficient paper-based manual system and to minimise physical contact during the guest registration process [8], [9].

1. QR Code Scanning Feature:
   Users can scan a QR code available at specific locations to be directly redirected to a digital form, providing quick access for visitors to enter the system via smartphone scanning [3], [9]. Once scanned, users are immediately directed to the guestbook or complaint form page. The use of QR codes simplifies the data collection process, reduces physical contact, and supports service efficiency and digitalization [8], [10]. The QR code form menu interface is shown in Figure 6.
2. Home Interface:
   The home interface presents two main action options: the guestbook section and the guest complaint section, which can be accessed by users. The home interface is shown in Figure 7.
3. Guestbook Form:
   This form captures personal information, originating institution, purpose of visit, and visit time. The digital guestbook serves to automatically record visitor identity and visit objectives [3], [4]. Users fill in their name, institution, and purpose of visit, after which the data is immediately stored in the system. This form facilitates data collection, accelerates the check-in process, and supports the digitalisation of services at PT. KAI. The guestbook form interface is shown in Figure 8.



Figure 6. QR Code Form Menu Interface



Figure 7. Home Interface



Figure 8. Guestbook Form

4. Complaint Form:
   Customers can submit feedback, suggestions, or complaints related to the services received [16]. This digital complaint form is used to record grievances, unmet requests, and service-related issues. Users are only required to fill in their name, organisation, and the content of the complaint. The data is then immediately stored in the system for further action by PT. KAI Palembang. The customer complaint form interface is shown in Figure 9.
5. Guestbook Data Interface:

This interface displays the digital guestbook data, including the visitor's name, organisation, and purpose of visit, as well as the date and time of visit. The data is automatically stored and can be accessed by the administrator for monitoring and reporting purposes. The guestbook data interface is accessible only to the admin. The guestbook data interface is shown in Figure 10.

6. Customer Complaint Data Interface:
   The customer complaint data displays information related to issues or suggestions submitted by users, including name, organisation, content of the complaint, and submission time, in order to support service evaluation and improvement [16]. The customer complaint data interface is shown in Figure 11.



Figure 9. Customer Complaint Form

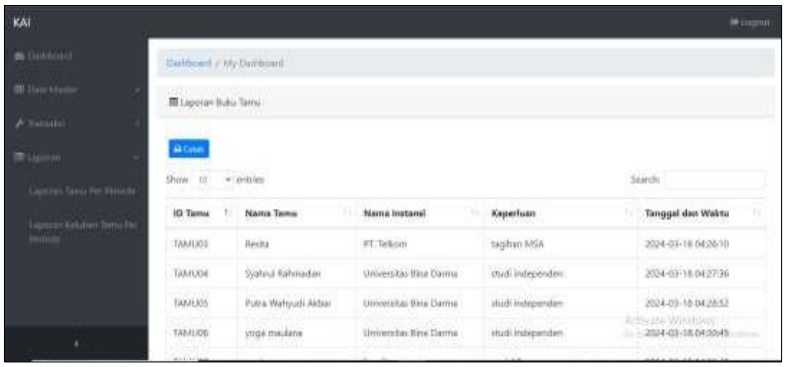

Figure 10. Guestbook Data

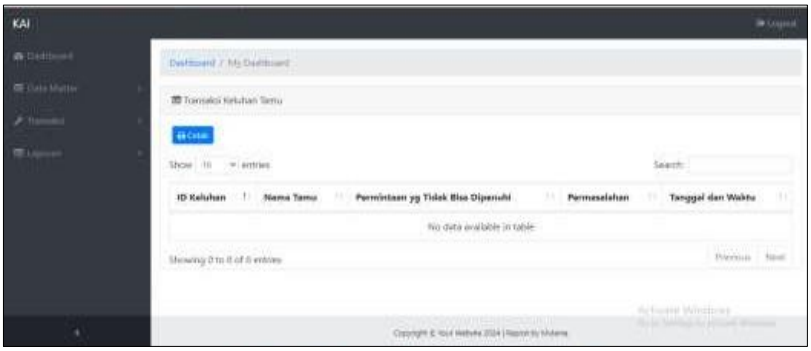

Figure 11. Customer Complaint Data

This application was developed using the PHP programming language with the Laravel framework and responsive front-end styling, which handles core functionalities such as user data processing and validation, session management, and role-based access control to specific pages like the admin panel [4], [12], [13]. The database system uses MySQL, structured with key tables such as guest, complaint, admin, and QR code, all interconnected to maintain data integrity and ensure processing efficiency [4], [5]. The QR code is generated from a URL that links to the guestbook form and can be scanned using a mobile device's camera, directing users straight to the application via their browser [3], [9].

D System Testing (Black Box Testing)

Testing is the final stage in the software development life cycle, aimed at ensuring that the system operates in accordance with the functional requirements and is free from errors that may affect end users [14], [19]. One commonly used testing method is black-box testing, a specification-based software testing approach that focuses on evaluating system functions based on inputs and outputs without examining the internal structure of the program code [19], [20]. As demonstrated in recent web application evaluations [20], black-box testing effectively verifies user workflows, form validation, and administrative modules against defined functional requirements. The test results are presented in Table 3.

Table 3. Functional Testing Results of the Guestbook and Customer Complaint Application

No	Component	Testing Objective	Testing Method	Test Result	Conclusion
1	QR Code Scanning	To ensure the QR code correctly redirects to the digital form	Scanning using a smartphone camera with an active browser	QR code successfully redirected to the guestbook form page without issues	Functioning properly
2	Guestbook and Complaint Forms	To test data input, validation, and storage in the database	Simulated data entry in the form and database verification	Data was successfully stored and accurately displayed in the admin panel	Compliant
3	Admin Panel	To verify admin access for viewing and summarising data	Login as admin and access the guest and complaint report menus	Admin was able to view all submitted visit and complaint data in real-time	Admin panel functions optimally

4 Research Results

The result of this study is a responsive mobile web-based digital guestbook application, designed to facilitate the guest registration process and customer complaint submission through QR code scanning [3], [12], [16]. The application has been successfully developed and tested using the Waterfall development approach [14] and functionally evaluated through black-box testing [20]. The research results can be seen in Table 4.

Table 4. Research Results of the Guestbook and Customer Complaint Application

No	Resulting Aspect	Scientific Description of Research Findings
1	Responsive Mobile Web-Application	The developed application can be optimally accessed on various devices (desktop and smartphone) through a browser without the need for installation, featuring a simple and user-friendly interface.
2	Effectiveness of QR Code Scanning	QR codes placed at strategic points have proven effective in directing users quickly to the digital form, enabling seamless and contactless interaction.
3	Functionality of Guestbook and Complaint Forms	The digital forms enable users to efficiently submit personal information and complaints. The data is automatically stored and can be monitored in real-time by admin.
4	Web-Based Admin Panel	The admin panel facilitates the management of guest and complaint data through an informative dashboard, equipped with search, filter, and report printing features.
5	Success of Black Box Testing	Using the black box testing method, all features were evaluated across various input scenarios. The results demonstrate that the system responded accurately and met all functional requirements.

5 Conclusion

This study has successfully developed a responsive mobile web-based digital guest book application that leverages QR code technology to facilitate fast, accurate, and contactless guest registration and complaint submission. All core features have been proven to function as expected through the application of the Waterfall development approach and Black Box testing. Therefore, the application effectively replaces the manual paper-based system, enhances data recording efficiency, and supports the digitalisation of services in institutions such as PT KAI (Persero) Divre III Palembang.

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Conflict of Interest Statement

The authors declare that there is no conflict of interest regarding the publication of this manuscript. Furthermore, the authors have no financial, personal, or institutional relationships with PT. KAI (Persero) Divre III Palembang or any other organizations that could inappropriately influence or bias the work reported in this paper.

Author Contributions

Imam Solikin contributed to the conceptualization of the study, research methodology design, overall supervision, validation, and critical revision of the manuscript. Mulania conducted the requirements analysis, UML system modeling, back-end and MySQL database development, and prepared the initial draft of the manuscript. Nanda Firmansyah was responsible for responsive front-end interface development, QR code integration, black-box functional testing, and technical documentation. All authors have read and approved the final version of the manuscript.

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