

## School inventory management using android based qr code

Siti Sufaidah<sup>1</sup>, Miftahul Ulum<sup>2</sup>

<sup>1</sup>informatics engineering, Universitas KH. A. Wahab Hasbullah

<sup>2</sup>Email: miftaulum159@gmail.com

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### ABSTRACT

*Inventory management of school facilities is an essential part of asset management to ensure the availability, condition, and effective use of items. However, manual inventory recording often leads to data inaccuracies, difficulties in tracking, and consumes a significant amount of time and effort. Therefore, this study aims to design and develop a mobile application based on Android to assist the inventory management process of school facilities more efficiently and accurately by utilizing QR Code technology. The application is developed using Java/Kotlin programming language and Android Studio framework, with SQLite used for local data storage and PHP-MySQL for data synchronization to the server when connected to the internet. The main features include inventory data input, QR Code generation and printing, QR Code scanning for item tracking, item condition updates, and damaged or repair-needed item reporting. The system is also equipped with user authentication to ensure that only administrators have access to the data. The testing results show that the application runs well on Android devices and is capable of managing inventory data more quickly and accurately compared to manual methods. The integration of QR Codes facilitates instant item identification through scanning, thereby accelerating the recording and checking processes. Thus, this application is expected to be a practical and efficient solution for inventory management in school environments.*

**Keywords:** *Inventory Management, Mobile Application, Android, QR Code, School Facilities*

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### INTRODUCTION

Inventory management is an essential process in schools to ensure the availability, proper condition, and efficient use of facilities such as desks, chairs, computers, projectors, bookshelves, and teaching aids. Traditionally, many schools still rely on manual methods such as recording in books or spreadsheets. This approach is prone to errors, data loss, difficulties in tracking, and inefficiencies in updating information. Studies by Randy (2020) and other researchers highlight that manual inventory systems often fail to meet the demands of real-time monitoring and effective asset utilization, especially in educational institutions that manage a large number of items.

A similar issue occurs in Yayasan TK Islam Al Husna, an early childhood education institution in Jombang, which manages more than 300 inventory items, including student desks and chairs, educational media, electronic devices, and office supplies. The institution still records its inventory manually in books and Excel files stored on a local computer. This condition reflects a gap between the increasing complexity of inventory needs and the traditional management methods that are no longer sufficient.

With the rapid development of digital technologies, the adoption of mobile-based systems has become a necessity to improve the efficiency and accuracy of inventory management. Recent studies suggest that the use of QR Code technology provides significant advantages in asset identification and tracking due to its ability to store unique and easily retrievable information (e.g., item name, acquisition date, condition, and maintenance history). However, most existing studies focus on inventory systems in general industries or higher education institutions, with limited research applied to early childhood educational settings. This gap indicates the novelty of the present study.

Therefore, this research proposes the design and development of an Android-based mobile application integrated with QR Code technology for inventory management in school facilities. The system is supported by a local SQLite database and synchronized with a PHP-MySQL backend through the CodeIgniter 4 framework when connected to the internet. Compared to previous works, this study contributes by offering a lightweight, mobile, and practical solution tailored to the needs of small-scale

educational institutions, which often lack advanced digital infrastructure.

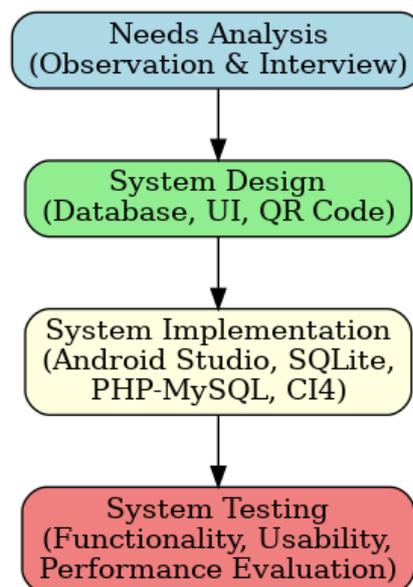
In line with prior research, this study supports the argument that digital transformation in inventory management enhances transparency, accuracy, and efficiency. At the same time, it introduces innovation by applying mobile-QR Code integration specifically in early childhood education contexts. The main objective of this research is to design and implement an application that enables efficient data input, updating, and tracking of school inventory, both offline and online, while ensuring data synchronization and security through administrator authentication.

## **METHOD**

This study applied a research and development (R&D) approach using a mixed quantitative-qualitative method. The research subjects consisted of more than 300 inventory items at TK Islam Al Husna, Jombang, including desks, chairs, electronic devices, and teaching aids, with respondents involving one school administrator and two supporting staff members.

The research procedure was conducted in four stages: (1) needs analysis through observation and interviews, (2) system design including database structure, user interface, and QR Code integration, (3) application implementation using Android Studio (Java/Kotlin), SQLite, and PHP-MySQL with the CodeIgniter 4 framework, and (4) system testing to evaluate functionality, usability, and performance.

Research instruments included interview guides, observation sheets, the developed mobile application, and QR Code scanners integrated into Android devices. Data were collected through observations, interviews, black-box testing, and performance tests. Data analysis was carried out descriptively for qualitative findings, while system evaluation focused on functional accuracy, response time, and user feedback.

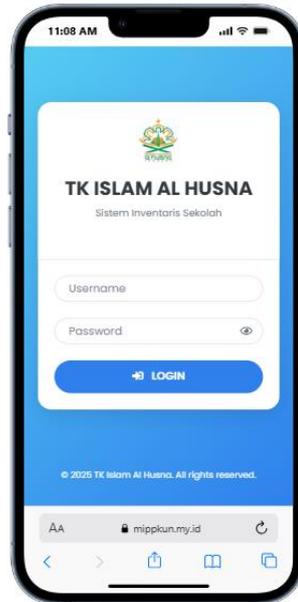


**Figure 1. Flowchart of Research Methodology (R&D Approach)**

## **RESULT AND DISCUSSION**

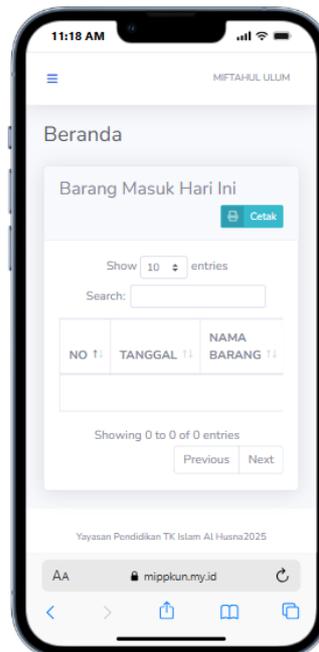
### **a.) Result**

The mobile inventory management application was successfully developed and implemented on Android devices. The main features included inventory data entry, QR Code generation and printing, QR Code scanning for item tracking, inventory updates, and reporting of damaged items. The system was also equipped with administrator authentication and server synchronization through the CodeIgniter 4 framework.



**Figure 2. Login Display**

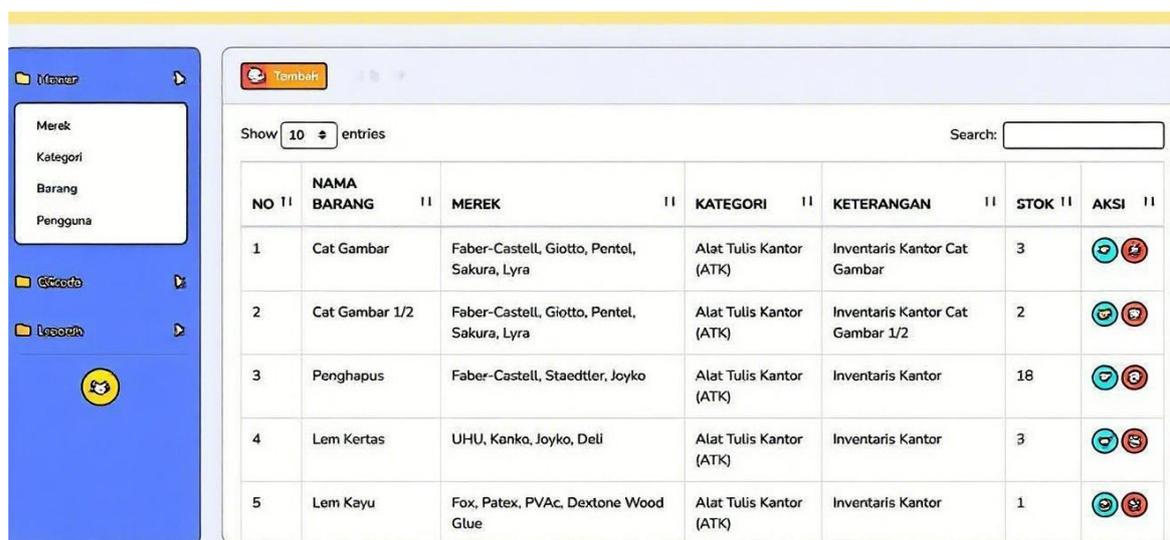
This login screen serves as the main gateway to access the school inventory system, ensuring that only users with authorized accounts (admin) can log in.



**Figure 3. homepage view**

The homepage displays a summary and the latest information regarding items newly added to inventory.

- 1) The Al-Husna Islamic Kindergarten logo is displayed in the upper left corner, along with the words "Al-Husna Islamic Kindergarten Inventory."
- 2) Below it are several charts, including the homepage, master, QR code, and report, each with a different function.
- 3) On the right is a print button that prints today's incoming items, including the number, date, item name, brand, category, description, quantity, and search input.
- 4) On the right is a print button that prints today's incoming items, including the number, date, item name, brand, category, description, quantity, and search input.



**Figure 4. Item Page**

The item page displays a summary and the latest information regarding items newly added to inventory.

- 1) There are add data and search features for the item section.
- 2) The table displays the item number, name, category, description, stock, and action buttons for deleting and editing the item table.

**b.) Functional Testing**

Black-box testing was conducted on all core features, including login, item input, QR Code generation, QR Code scanning, and report generation.

**Table 1** Blackbox Testing Table, Summarizes the results of functional testing.

No	Feature	Test Scenario	Expected Output	Result
q1	Login	Correct username & password	Access granted to dashboard	Success
22	Login	Wrong password	Error message displayed	Success
33	Add Item	Input item data	Data saved and QR Code generated	Success
44	Generate QR Code	Add valid item	QR Code generated and printable	Success
55	Scan Item	Scan QR Code	Item data displayed	Success
66	Update Stock	Change stock data	Stock updated in database	Success
77	Report	Select report period	Report displayed and printable	Success
88	Data Sync	Device online	Data synchronized with server	Success

All tested features worked as expected, indicating that the application meets functional requirements.

**c.) Performance Testing**

Performance evaluation focused on response time for scanning QR Codes and synchronizing data. On average, QR Code scanning was completed in **1.2 seconds**, while manual item search took approximately **7–10 seconds**. Data synchronization with the server required **3–5 seconds** depending on internet connectivity. This shows a significant improvement compared to manual methods.

**d.) Security Testing**

System security was evaluated by testing incorrect login attempts, unauthorized API access, and

SQL injection simulations. The application successfully rejected invalid login credentials, denied unauthorized API access, and protected the database against SQL injection. This indicates that the system provides a basic level of security suitable for school environments.

#### e.) Discussion

The results demonstrate that the developed mobile inventory management system significantly improves the efficiency and accuracy of asset management in schools. Compared to manual inventory recording, which is prone to errors and time-consuming, the proposed application enables instant identification of items using QR Code scanning, thereby accelerating inventory tracking and reporting.

These findings align with previous studies such as Faisal & Putri (2022), who implemented QR Code-based inventory systems using Firebase, and Rachman & Susanto (2020), who developed an Android-based inventory system for high schools. However, those studies primarily targeted large-scale institutions and different technical infrastructures. In contrast, this research provides a lightweight solution specifically tailored for early childhood education institutions (kindergarten level), which are often neglected in digital transformation initiatives.

Another novelty of this research lies in the integration of local SQLite storage with CodeIgniter 4 server synchronization, allowing the system to function both offline and online. This hybrid approach ensures that users can record inventory data even without internet access, with automatic synchronization when the device reconnects. Such flexibility is crucial in schools with limited connectivity.

The security evaluation also shows that the system adequately protects against common vulnerabilities such as invalid logins and SQL injection. While this study only supports a single administrator user, it demonstrates the feasibility of applying QR Code-based inventory systems in small-scale educational settings.

The implications of this research are twofold: (1) it offers a practical and affordable digital solution for schools with limited IT resources, and (2) it contributes to the broader adoption of mobile-based inventory systems in education. Future research can expand the system to support multi-user access, role-based authorization, and enhanced data encryption to strengthen security.

## Result

The development of the Android-based inventory management application at TK Islam Al Husna produced a system capable of recording, updating, and tracking school facilities using QR Code technology. The results are presented in three main aspects: functionality, efficiency, and user evaluation.

#### a.) System Functionality

The application was tested through several scenarios including login, item registration, QR Code generation and scanning, stock updates, and report generation. All tested features worked correctly, showing that the system met its design objectives. A condensed summary of functional testing is presented below:

**Table 2. Summary of Functional Tests**

Category	Functions Verified	Status
Authentication	Login, logout, invalid login attempts	Success
Data Handling	Item input, stock update, item condition update	Success
QR Code	Generate, print, and scan item QR Codes	Success
Reporting	Damage reporting and inventory reports	Success
Connectivity	Offline storage and online synchronization	Success

#### b.) System Efficiency

The system performance was evaluated by comparing manual recording and the developed application. On average, manual data recording required between **7–10 seconds** per item, while QR Code scanning reduced the process to **1–2 seconds**. This demonstrates a substantial reduction in time required for item identification and tracking.

In addition, synchronization between the local SQLite database and the server via CodeIgniter 4 took approximately **3–5 seconds**, depending on internet conditions.

c.) User Evaluation

Qualitative feedback was collected through short interviews with the school administrator. The findings highlight three benefits perceived by users:

- The application reduced errors in recording compared to Excel or paper-based methods.
- QR Code scanning provided a faster way to locate and check inventory items.
- Reporting became easier since summaries could be generated directly from the system.

These results indicate that the proposed system is both technically reliable and practically useful for managing school inventory in small educational institutions.

## **Discussion**

The findings of this study indicate that the development of a mobile-based inventory management system using QR Code technology significantly improves the efficiency, accuracy, and transparency of school asset management. The implementation at TK Islam Al Husna demonstrates that a lightweight Android application can address the limitations of manual recording, which often leads to inaccuracies, data loss, and time inefficiency.

Compared to previous studies, the results show both alignment and innovation. Rachman and Susanto (2020) developed an Android-based inventory system for secondary schools, while Faisal and Putri (2022) utilized Firebase for QR Code-based inventory tracking in higher education institutions. These studies confirm that QR Code technology is effective for item identification and data management. However, their systems targeted larger institutions and required more advanced infrastructures. In contrast, the present study contributes novelty by focusing on early childhood education settings, which typically operate with limited IT resources, and by combining offline SQLite storage with online synchronization through CodeIgniter 4, ensuring operational flexibility in environments with unstable connectivity.

The findings also reinforce established theories of information systems efficiency, particularly Davis's Technology Acceptance Model (TAM), which emphasizes perceived usefulness and ease of use as primary determinants of adoption. The school staff's feedback confirms that the system is not only technically reliable but also practically beneficial, aligning with TAM's assumptions. Moreover, the reduction in processing time from 7–10 seconds manually to 1–2 seconds with QR scanning provides empirical evidence of increased system efficiency, consistent with earlier works on mobile system optimization.

This study further contributes to the ongoing discourse in educational technology by demonstrating that small-scale institutions can benefit from digital transformation. While previous models often overlooked kindergartens and early childhood education centers, this research highlights their potential adoption of low-cost, efficient solutions. Thus, the results can be integrated into broader theories of ICT adoption in education, particularly in resource-constrained environments.

The implications of this study are twofold. First, it provides a practical framework for other schools seeking to digitize inventory management without significant infrastructure investment. Second, it opens opportunities for theoretical refinement by expanding ICT adoption models to include small-scale institutions. Future work may explore system scalability, multi-user access, and enhanced data security through encryption, which could strengthen both the theoretical and practical contributions of this research.

## **CONCLUSIONS (font size 12pt)**

This study concludes that the development of a mobile-based inventory management system utilizing QR Code technology has proven effective in enhancing the efficiency, accuracy, and transparency of school asset management. Implemented in TK Islam Al Husna, the system successfully addressed the limitations of manual inventory processes by enabling rapid item identification, streamlined reporting, and reliable data synchronization between offline and online environments.

The results demonstrate that QR Code integration significantly reduces the time required for inventory tracking, improves data accuracy, and strengthens accountability in school resource management. These findings are consistent with theoretical frameworks of technology adoption, particularly the Technology Acceptance Model, and highlight the applicability of mobile-based solutions for small-scale educational institutions that often lack sophisticated IT infrastructure.

In addition to validating the research objectives, this study offers a contribution by introducing a lightweight, hybrid (offline-online) inventory management model for early childhood education settings, an area rarely explored in previous research. The novelty lies not only in the technological integration but also in its contextual adaptation to schools with limited connectivity and resources.

Nevertheless, the study has several limitations. The system is currently restricted to a single administrator user and limited to the Android platform. Furthermore, the security features are still basic and do not incorporate advanced encryption or role-based access. These limitations, however, present opportunities for future research. Potential directions include expanding the system to support multi-user access, integrating stronger data security protocols, adapting the system for iOS or cross-platform use, and applying the solution to larger educational institutions to test scalability.

In conclusion, the system developed in this study provides a practical, efficient, and affordable solution for digitalizing school inventory management, while also opening new avenues for further exploration and innovation in the field of educational information systems.

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