

## Android-Based Information System for Monitoring and Evaluation of Industrial Internship Activities

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### ABSTRACT

Industrial work practice (Prakerin) is a compulsory program for vocational high school students as part of work-based learning in Indonesia. At SMKN 2 Temanggung, the monitoring and evaluation process remains paper-based, creating significant challenges: teachers and industry supervisors cannot track student progress in real-time, separated data systems cause administrative inefficiency, and physical documentation is vulnerable to loss. This study developed an Android-based information system using Rapid Application Development (RAD) methodology to address these problems through digital integration and real-time monitoring. The system was implemented with dual interfaces: a web-based admin dashboard and mobile applications for students, teachers, and industry partners. Black box testing of 58 test scenarios across four user roles achieved 100% success rate, validating all functional requirements including QR code-based attendance, digital logbook, performance assessment, and report management. The system's key contribution lies in its integrated platform that unifies previously fragmented processes, enabling remote supervision and eliminating paper-based workflows. Implementation results demonstrated that the system successfully facilitates structured documentation, real-time communication, and comprehensive monitoring throughout the internship cycle, effectively resolving the limitations of conventional management approaches at SMKN 2 Temanggung.

**Keywords:** *Android Application, Industrial Work Practice, Information System, Integrated Evaluation, Real-time Monitoring*

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## INTRODUCTION

Field Work Practice (PKL) or Industrial Work Practice (Prakerin) serves as an integral component of the vocational education system in Indonesia, designed to prepare vocational high school (SMK) students for workforce entry. The Regulation of the Minister of Education and Culture No. 50 of 2020 defines PKL as a learning activity for SMK/MAK students conducted through work practice in the industrial sector for a specified period, aligned with curriculum requirements and industry demands. This program operationalizes the concept of Dual System Education (PSG), which systematically and synchronously integrates school-

based education programs with workplace skill acquisition programs in the Business and Industrial World (DUDI) (Suryanto & Widodo, 2021).

Despite its strategic role in vocational education, the Prakerin program continues to face numerous challenges, particularly concerning management and monitoring aspects. Research indicates that PKL implementation in several SMKs remains ineffective due to manual execution, resulting in inefficient management processes (Pratama & Sari, 2022). Similar issues manifest at SMK Negeri 2 Malang, where manual PKL management generates problems related to limited student information access and inefficient data handling (Wicaksono & Hartini, 2023). Conventional Prakerin management encounters several critical challenges. Manual administrative systems contribute to inefficiency in managing student activity data and documentation. The monitoring process relies heavily on physical supervisor visits, demanding substantial time and financial resources (Rahman & Putri, 2022). Additionally, difficulties arise in achieving real-time coordination and communication among schools, students, and industry mentors (Hidayat & Safitri, 2023). Furthermore, inadequate monitoring systems at institutions such as SMK Negeri 1 Sintuk Toboh Gadang frequently result in student dishonesty regarding attendance and daily activity logbook completion (Ananda & Kurniawan, 2022).

However, existing literature reveals critical gaps in addressing these challenges comprehensively. First, while previous studies acknowledge the inefficiency of manual systems (Pratama & Sari, 2022; Wicaksono & Hartini, 2023), they primarily focus on isolated problems rather than analyzing the systemic interconnections between data fragmentation, monitoring limitations, and stakeholder coordination failures. Second, although Rahman & Putri (2022) identify the cost burden of physical supervision, no studies quantify the actual resource wastage or propose integrated digital solutions that simultaneously address monitoring, documentation, and communication gaps. Third, research on student dishonesty in attendance reporting (Ananda & Kurniawan, 2022) lacks technological intervention frameworks that could prevent such issues through automated verification systems.

The advancement of information and communication technology, particularly mobile technology, presents significant potential for addressing these challenges. Android-based mobile applications have demonstrated effectiveness across various educational domains owing to their high accessibility and user-friendliness (Setiawan & Maharani, 2023). Previous research has established that implementing Android applications for Prakerin information systems provides faster, more convenient, and efficient internship management solutions (Kusuma & Nuraini, 2022). Mobile technology utilization aligns with the Education 4.0 concept, which integrates digital technology into learning processes to enhance educational effectiveness and efficiency (Sari & Wijaya, 2023). Despite the promising potential of mobile-based solutions, existing implementations reveal several critical limitations. Kusuma & Nuraini's (2022) Android-based PKL system focused primarily on monitoring efficiency but did not integrate multi-stakeholder evaluation mechanisms or real-time communication features essential for comprehensive internship management. Setiawan & Maharani (2023) demonstrated mobile technology's educational effectiveness,

yet their study lacked empirical validation in vocational education contexts where industry-school coordination presents unique challenges. Furthermore, while Education 4.0 principles advocate digital integration (Sari & Wijaya, 2023), the literature provides limited guidance on implementing unified platforms that seamlessly connect web-based administrative interfaces with mobile applications for field-based users, a critical requirement for Prakerin management involving geographically distributed stakeholders. A notable inconsistency emerges in the literature regarding optimal technology architecture for Prakerin systems. Some researchers advocate standalone mobile applications (Kusuma & Nuraini, 2022), while others suggest web-based centralized systems. However, no study has systematically compared integrated dual-interface architectures (web + mobile) against single-platform approaches, leaving unclear which design better balances administrative control with field accessibility, a fundamental gap this research addresses.

Regarding system development, the Rapid Application Development (RAD) method has proven effective for constructing applications within relatively short timeframes without compromising quality (Fitriana & Hakim, 2022). RAD offers adaptability to evolving user requirements and enables iterative prototype development (Nugraha & Dewi, 2023). This methodology proves particularly suitable for mobile application development, which necessitates rapid user feedback and continuous adjustments (Permana & Safitri, 2022). However, critical gaps persist in RAD application for complex multi-user educational systems. While Fitriana & Hakim (2022) validate RAD's speed advantage in academic information systems, their study focused on single-institution contexts without multi-stakeholder coordination complexities inherent in Prakerin programs. Nugraha & Dewi (2023) emphasize RAD's iterative prototyping benefits but do not address how this methodology handles simultaneous development of complementary web and mobile interfaces with synchronized functionality, a challenge absent from their single-platform focus. Additionally, Permana & Safitri's (2022) systematic literature review on RAD for mobile development lacks empirical evidence on how user feedback integration scales when stakeholders have conflicting requirements, as typically occurs among schools, students, and industry partners in Prakerin contexts.

The literature review reveals three fundamental research gaps that this study addresses. First, the integration gap: no existing research presents a comprehensive system that simultaneously integrates attendance tracking, activity documentation, performance evaluation, and multi-party communication into a single unified platform accessible through complementary web and mobile interfaces. Second, the validation gap: while previous studies propose digital Prakerin solutions, they lack systematic validation through comprehensive testing across all user roles (students, teachers, industry supervisors, administrators), leaving uncertain whether such systems function reliably in real-world vocational education environments. Third, the methodological gap: current literature does not demonstrate how RAD methodology can be effectively adapted for developing dual-interface systems (web + mobile) that serve stakeholders with divergent technical capabilities and usage contexts, particularly in resource-constrained vocational education settings. This study contributes to addressing these gaps by designing and implementing an

integrated Android-based Prakerin information system with web admin support at SMKN 2 Temanggung, using RAD methodology adapted for dual-interface development, and validating the system through comprehensive black box testing across all stakeholder roles. The research specifically investigates whether a unified digital platform can overcome the documented limitations of manual Prakerin management while maintaining usability across diverse user groups and operational contexts. Therefore, this study aims to design and develop an Android application using Kotlin as a Prakerin information system at SMKN 2 Temanggung by applying the RAD method to improve the efficiency and effectiveness of Prakerin program management, with specific focus on validating whether integrated digital platforms can successfully replace fragmented manual processes in vocational education internship contexts.

## **METHOD**

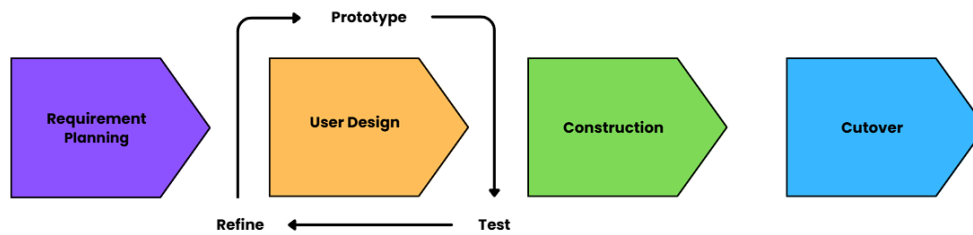
This section discusses Rapid Application Development, research flow, data collection procedures, and the data obtained.

### **1. Rapid Application Development**

Rapid Application Development (RAD) represents a software development methodology that emphasizes accelerated application development through iterative and continuous prototyping. This approach enables developers to construct functional systems within relatively short timeframes by actively involving users throughout every development stage (Fitriana & Hakim, 2022). The methodology proves particularly suitable for projects with constrained timelines while maintaining system quality standards.

RAD exhibits several key characteristics that distinguish it from traditional development methodologies. The approach employs an incremental strategy enabling staged system development, initially prioritizing the most critical components (Nugraha & Dewi, 2023). Additionally, RAD emphasizes active user participation in each development phase to ensure alignment between the developed system and actual user requirements. The methodology also utilizes tools and techniques supporting rapid development, including Computer-Aided Software Engineering (CASE) tools, fourth-generation programming languages, and reusable components (Permana & Safitri, 2022).

The RAD lifecycle comprises four interrelated phases, as illustrated in Figure 1. The Requirements Planning phase involves identifying and analyzing system requirements through intensive discussions with users and stakeholders. During the User Design phase, users engage in designing system interfaces and functionalities through workshops and prototyping sessions. The Construction phase focuses on implementing the system based on approved designs using rapid development tools. Finally, the Cutover phase encompasses system testing, user training, and system deployment into the production environment (Handayani & Irawan, 2023).



**Figure 1.** *Rapid Application Development*

Figure 1 illustrates the iterative workflow of RAD, where the prototype, test, and refine processes can be repeated multiple times between the User Design and Construction phases until optimal results are achieved. This iterative approach enables developers to implement continuous improvements based on user feedback, ensuring that the resulting system better addresses user requirements (Nugraha & Dewi, 2023).

During the Requirement Planning phase, system requirements are identified through intensive discussions with stakeholders including supervising teachers, students, and industry mentors to obtain a comprehensive overview of the system to be developed. This collaborative approach ensures that all stakeholder perspectives are incorporated into the initial system conceptualization (Handayani & Irawan, 2023).

The User Design phase engages users in designing the system interface and workflow. Interface prototypes are created using design tools such as Figma, which are subsequently tested and evaluated collaboratively with users to ensure design alignment with their requirements. This participatory design process enhances user acceptance and system usability (Kusuma & Nuraini, 2022).

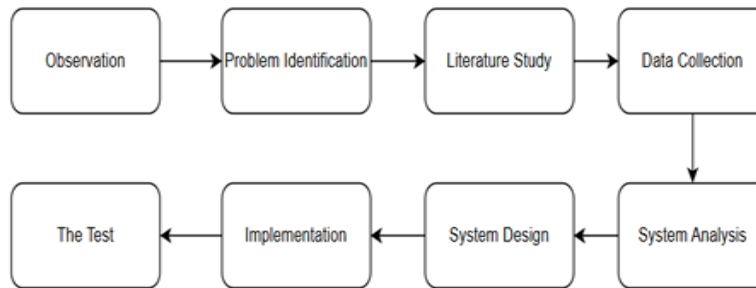
The Construction phase represents the implementation stage where approved system designs are transformed into functional applications. This process encompasses writing program code using Kotlin for the Android application, integrating the database with Firebase, and developing the interface using XML-based layouts. The utilization of modern development tools and frameworks accelerates the construction process while maintaining code quality (Purnomo & Lestari, 2023).

The final stage, Cutover, includes comprehensive testing and system deployment. The system undergoes black box testing to verify that all functionalities operate according to specifications, followed by user training and full implementation in the operational environment. This systematic deployment approach minimizes implementation risks and ensures smooth transition to production use (Fitriana & Hakim, 2022).

The application of the RAD method in developing the Android-based Prakerin information system provides an effective development approach, as each phase maintains clear focus, involves users directly, and permits continuous iteration. Consequently, the developed system demonstrates greater adaptability to real-world requirements and significantly enhances the efficiency of monitoring and evaluating industrial work practices

## 2. Research Flow

The research flow in this study is shown in Figure 2. This research methodology adopts a systematic approach consisting of eight main stages to develop an Android-based industrial work practice information system.



**Figure 2.** Research Flow

- 1) Observation, which involves direct observation of the object or environment being studied. Direct observation at SMKN 2 Temanggung is useful for obtaining necessary information through recording and direct monitoring of the research object that can be utilized as research data.
- 2) Problem Identification, where the issue found at SMKN 2 Temanggung is the low efficiency in data processing and the slow data collection process in the monitoring and evaluation system of industrial work practice.
- 3) Literature Study, which is a method to obtain materials related to the research. This method is used to review journals and books about industrial work practice information systems or mobile-based monitoring systems.
- 4) Data Collection, carried out to obtain information required to achieve research objectives. This stage involves interviews, and the collection of both secondary and primary data.
- 5) System Analysis, which includes identifying and defining the system requirements needed. These requirements consist of functional needs such as login features and main menu features, as well as non-functional needs such as software and hardware specifications.
- 6) System Design, which refers to designing or planning the desired system based on the previous analysis results. It includes architectural design, user interface design, and system design diagrams such as use case and activity diagrams.
- 7) Implementation, the stage where the planned and designed system is realized and applied. This process involves software development, hardware configuration, and system testing.
- 8) Testing, conducted using the black box method, which tests software functionality to ensure that each function in the application runs properly without considering the execution flow of the program.

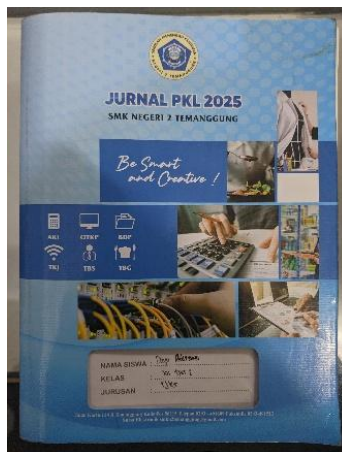
### 3. Data Collection Procedure

In a study, the data collection method is a crucial element of the research; therefore, this stage must be carried out carefully and in accordance with proper protocols to avoid errors.

- 1) Observation was conducted through direct field visits to identify the current system of industrial internship management at SMKN 2 Temanggung, including documentation processes, monitoring mechanisms, and administrative workflows.
- 2) Interview was carried out with the Principal of SMKN 2 Temanggung to gather in-depth information about the implementation of the internship program, administrative challenges, student monitoring mechanisms, and system requirements needed to support industrial work practice activities.
- 3) Literature Study involved reviewing scientific publications, journals, and books related to industrial work practice application systems and Android-based mobile monitoring and evaluation systems to establish the theoretical foundation for the research.

### 4. Data Obtained

The data obtained in this study are necessary to support the development of an Android-based industrial work practice information system for monitoring and evaluating student activities at SMKN 2 Temanggung. The data were collected through direct observation in business and industrial environments, as well as structured interviews with industry supervisors.



*Figure 3. The 2025 Industrial Work Practice (Internship) Journal of SMK Negeri 2 Temanggung*

As shown in Figure 3, the 2025 Industrial Work Practice (Internship) Journal of SMK Negeri 2 Temanggung serves as the main document used to record student activities during their industrial work practice. This journal functions as a reference for documenting students' daily activities and as an information source for the school to conduct monitoring.

**LEMBAR PENILAIAN  
DARI DUNIA USAHA/ DUNIA INDUSTRI**

Nama: \_\_\_\_\_  
 Kelas: \_\_\_\_\_  
 Jurusan: \_\_\_\_\_

Aspek Non-Teknis / Soft Skill

No.	Aspek / Praktek	Nilai	Urutan
1.			
2.			
3.			
4.			
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6.			

Aspek Non Teknik / Skill

No.	Aspek / Praktek	Nilai	Urutan
1.	Teori		
2.	Aspek Kerja		
3.	Kejuruan		
4.	Kejuruan		
5.	Kejuruan		

Penyusun: 2012/2013  
 Revisi: 2014/2015

**Figure 4.** Business/Industry Assessment Sheet

In addition, the assessment instrument is also an essential component of this research. As shown in Figure 4, the Business/Industry Assessment Sheet is used to evaluate students' performance. This instrument includes two main aspects: technical/skill aspects and non-technical/attitude aspects. In the identity section, the assessment sheet contains information such as the student's name, class, and major, which facilitates the identification process. The assessment is conducted by the industry supervisor through direct observation, and the results are presented in numerical scores and letter grades.

## FINDING AND DISCUSSION

This section presents the development results of the web-based and mobile application for industrial internship management at SMKN 2 Temanggung. Following the RAD methodology, the system was developed through four phases: requirements planning, user design, construction, and cutover. The implementation provides an integrated platform accessible via web interface for administrators and mobile application for students, teachers, and industry partners. The results are presented in three main aspects: system requirements analysis, logical design, and user interface implementation.

### 1. System Requirements Analysis

#### 1.1 Functional Requirements

The functional requirements analysis describes the processes that can be performed by the system and the information that must be available and produced by the system.

- 1) Login Feature: Displays an authentication form used to access the system, available for admin, students, industry supervisors (DUDI), and teacher supervisors.
- 2) Reset Password Feature: Displays a password reset form via email, accessible to students, DUDI, and teacher supervisors.
- 3) Dashboard Home Feature: Displays a summary of information and recent activities, accessible to all users according to their roles.

- 4) Account Management Feature: Displays user information tables and access management, accessible to the admin.
- 5) Announcement Creation Feature: Displays a form for creating and managing announcements, accessible to the admin.
- 6) Logbook Feature: Displays an input form and history of daily internship activities, accessible to students.
- 7) Attendance Feature: Displays QR Code scanning and attendance history, accessible to students.
- 8) Report Upload Feature: Displays a form for uploading final internship reports in PDF format, accessible to students.
- 9) Profile Feature: Displays personal and academic information, accessible to students.
- 10) QR Code Generation Feature: Displays a QR Code generator for student attendance purposes, accessible to DUDI.
- 11) Grade Input Feature: Displays a form for assessing students' technical and non-technical performance, accessible to DUDI.
- 12) Supervised Students Feature: Displays a list of supervised students with a search function, accessible to teacher supervisors.
- 13) Report Review Feature: Displays the review of final internship reports with options for approval or revision, accessible to teacher supervisors.
- 14) Group Chat Feature: Displays group communication between students, DUDI, and teacher supervisors in one conversation room, accessible to all users within the supervision group.

## 1.2 Non-Functional Requirements

### A. Software requirements for development :

- 1) Android Studio – Used as the main Integrated Development Environment (IDE) for building Android-based mobile applications.
- 2) Visual Studio Code – Used as an additional code editor for web admin interface development and project file management.
- 3) Firebase – Serves as the backend service for authentication, real-time data storage, and database management.
- 4) ZXing Library – Supports QR Code scanning functionality within the application, particularly for attendance processes.
- 5) Git – Functions as a version control system to manage source code changes and facilitate collaboration during development.

### B. Hardware requirements for admin :

- 1) Processor: AMD Ryzen 7 4800H
- 2) Operating System: Windows 10/11
- 3) Memory: 16 GB
- 4) Storage: 512 GB SSD

### C. Hardware requirements for mobile users :

- 1) OS: Minimum Android 6.0
- 2) Memory: Minimum 4 GB
- 3) Storage: Minimum 64 GB
- 4) Camera sensor for QR Code scanning
- 5) GPS for location tracking

## 2. Logic Design

### 2.1 Model Architecture

From the architectural model shown in Figure 5, the website and mobile application share interconnected data. In this architecture, the system is designed to use both web and mobile applications, where both platforms are linked through an API that serves as a bridge to the Firebase database. The administrator accesses the system through the web admin interface for management purposes, while students, teachers, and industry mentors use the mobile application. All data interactions between the web platform and the mobile application are processed through a centralized API, ensuring data consistency and security. Firebase serves as the main database that stores all system information, including user data, logbook entries, attendance records, and evaluation reports.

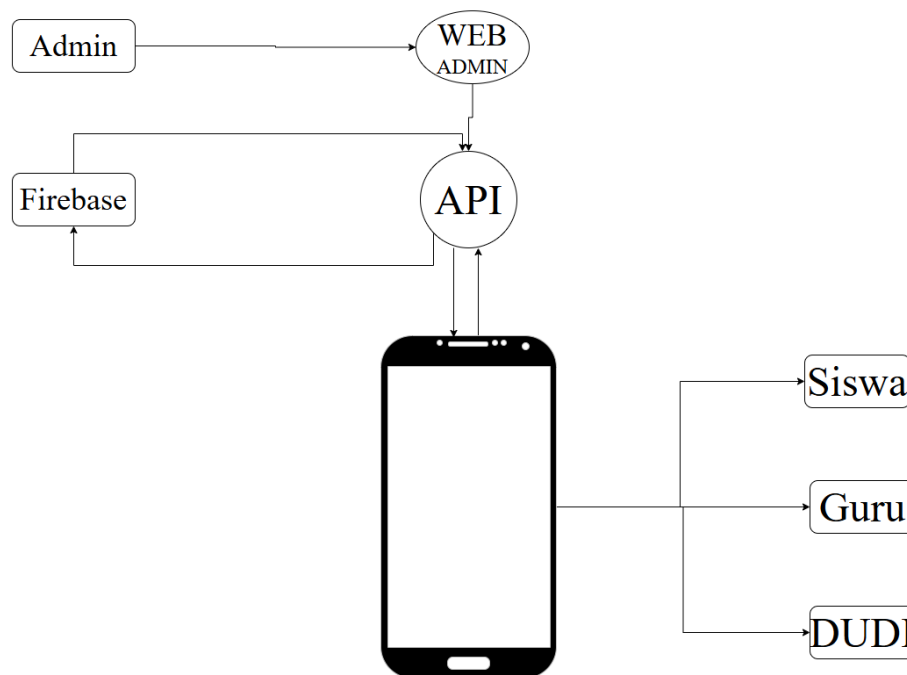


Figure 5. Model Architecture

### 2.2 Use Case Diagram

The use case diagram is utilized in this study to explain the functional requirements of the Prakerin information system. Actors and scenarios are identified

to construct the system architecture. The use case diagram, created using design software, provides a comprehensive view of system utilization from an external user's perspective (Wijaya & Kusuma, 2023). This diagram illustrates anticipated system behavior during implementation. Figure 6 demonstrates that four actors interact with the Prakerin information system, representing the primary stakeholders involved in the internship management process.

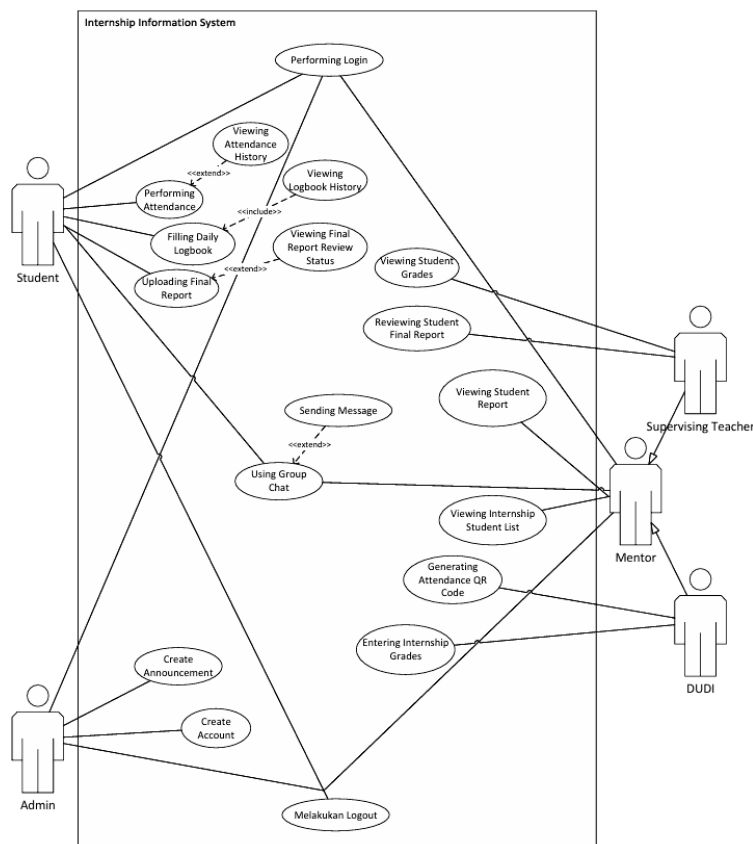


Figure 6. Use case diagram

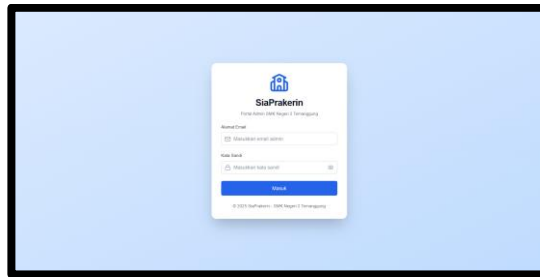
### 3. User Interface

In this phase, the designed system is implemented using programming. Below are the interface displays for the web-based and mobile applications.

#### 3.1 Web Admin School Interface

##### 1) Login Page

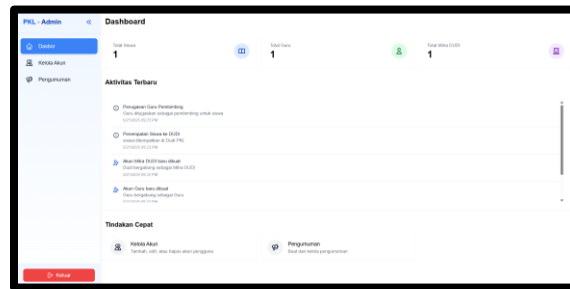
The admin login page displays a form for email and password that must be filled in to access the dashboard. After a successful login, the admin is directed to the dashboard to manage user accounts and announcements. The admin login page interface can be seen in Figure 7.



**Figure 7.** Login page (admin)

## 2) Dashboard Page

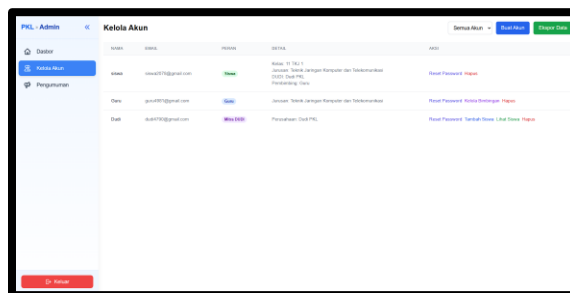
Figure 8 shows the Admin Dashboard page. This page presents a data summary, including the total number of registered students, teachers, and industry partners (DUDI). It also features a Recent Activity section to display logs of important activities, as well as a Quick Actions feature at the bottom for accessing User Management and Announcements.



**Figure 8.** Dashboard page (admin)

## 3) Manage Account Page

Figure 9 shows the User Management page, which the admin uses to manage student, teacher, and industry partner (DUDI) accounts. This page displays detailed account information and provides actions such as password reset, account deletion, and role-specific features—for example, managing mentorship for teachers or adding students to a DUDI account. The admin can also create new accounts and export existing account data.



**Figure 9.** Manage account page (admin)

### 3.2 Mobile Student Interface

#### 1) Mobile Login Page

As shown in Figure 10, the mobile application login interface supports three user roles: student, teacher, and industry partner (DUDI). Users select their role from a dropdown before entering their email and password to access the system. This feature ensures role-based authentication, allowing proper control over data access.

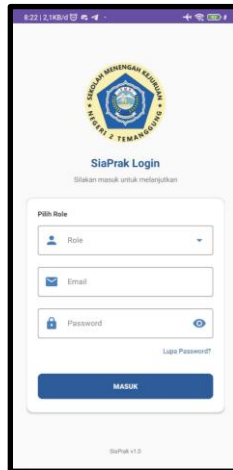


Figure 10. Mobile login page

#### 2) Home Page

After a successful login, students are directed to the home page, as shown in Figure 11. This page displays the student's identity, field of expertise, and Prakerin location. It also shows the Prakerin status, including the start and end dates, total number of days, and progress achieved. At the bottom, students can view their technical and non-technical scores, as well as a button to display detailed scores.

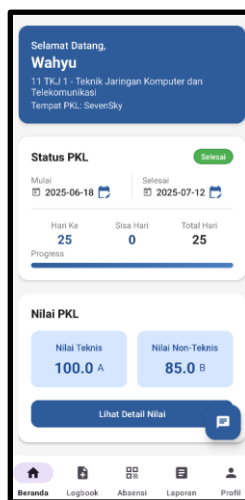


Figure 11. Home page (student)

### 3) Attendance Page

Figure 12 shows the Student Attendance page, which is used to record attendance during Prakerin. Its main feature is the Scan QR Code button for marking attendance. The page also displays the most recent attendance information, including the date, time, and location, as well as an Attendance Statistics section that presents the cumulative number of present and absent days, facilitating real-time monitoring.

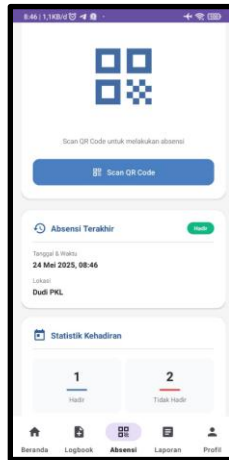


Figure 12. Attendance page (student)

### 3.3 Mobile DUDI Interface

#### 1) Create Attendance QR Code page

Figure 13 shows the implementation of the Generate Attendance QR Code page. This page allows users to create a QR code that students use for the attendance process. Displayed information includes the DUDI name, GPS status, and location coordinates. After pressing the Generate QR Code button, the system generates a QR code that students can scan to record their attendance.

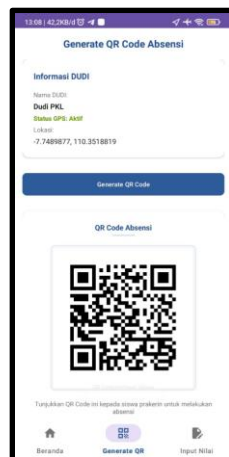


Figure 13. Create attendance QR code page (DUDI)

## 2) Student Score Input page

Figure 14 shows the Student Score Input page. Through this page, DUDI can search for student data by name to display information such as ID and class. DUDI can then enter technical and non-technical scores, with the technical scores section providing options to add specific materials along with their corresponding scores.

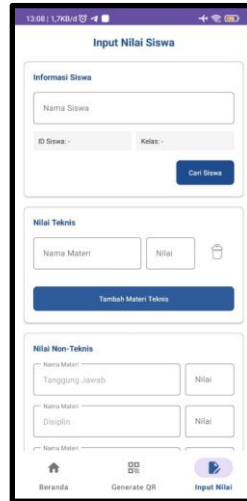


Figure 14. Student score input page (DUDI)

## 3.4 Mobile Teacher Supervisor Interface

### 1) Mentorend Student List page

Figure 15 shows the Mentored Students page, which allows teachers to view the list of PKL students along with their identities and placement statuses. This page makes it easier for teachers to monitor their mentored students directly through the system. If a student is clicked, the system displays detailed information on that student's scores and attendance.

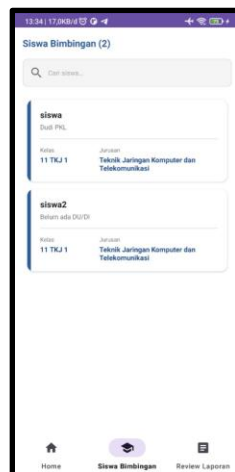


Figure 15. Mentored students list page (Teacher)

## 2) Report Review page

After selecting a report entry, the user is directed to the Final Report Review Detail page, which displays complete information such as the report title, submission date, status, and a download link for the document. The page also provides text input fields and page number entries to record specific revisions. Two main action buttons, “Requires Revision” and “Approve Report,” allow the teacher to determine the student’s final report status. The interface of this page can be seen in Figure 16.

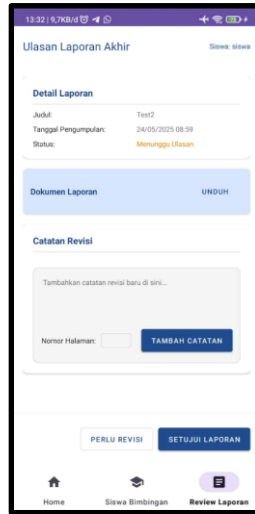


Figure 16. Report review page (Teacher)

## DISCUSSION

This section interprets the implementation results and testing outcomes within the context of existing literature, critically examining how the developed system addresses documented challenges in Prakerin management and contributes to the broader field of vocational education technology. The successful implementation of the dual-interface architecture (web admin + mobile application) represents a significant advancement over previous single-platform approaches documented in the literature. While Kusuma & Nuraini (2022) demonstrated that Android-based PKL systems could improve monitoring efficiency, their implementation focused solely on student-side functionality without integrating administrative control mechanisms. This study's architecture addresses this limitation by providing complementary interfaces: the web dashboard enables administrators to manage accounts and announcements centrally (Figures 7 through 9), while mobile interfaces allow field-based stakeholders, students, teachers, and industry supervisors, to interact with the system in operational contexts (Figures 10 through 16). This architectural decision directly responds to coordination challenges identified by Hidayat & Safitri (2023), who noted difficulties in real-time communication among schools, students, and industry mentors. The implemented group chat feature within supervision groups facilitates direct communication channels previously unavailable in manual systems, effectively eliminating the

communication delays Rahman & Putri (2022) attributed to physical supervision dependency. Unlike previous studies that proposed isolated digital solutions, this research demonstrates that integrated platforms connecting multiple stakeholders through role-specific interfaces can overcome systemic coordination failures inherent in geographically distributed Prakerin programs.

The QR code-based attendance system (Figures 12 and 13) addresses a critical gap identified by Ananda & Kurniawan (2022), who documented student dishonesty in manual attendance reporting at SMK Negeri 1 Sintuk Toboh Gadang. By requiring students to scan dynamically generated QR codes with GPS verification, the system implements automated verification mechanisms absent from previous digital Prakerin solutions. This approach contrasts with conventional digital attendance systems that rely solely on user-reported data without location validation. The real-time attendance tracking capability directly confronts the monitoring limitations documented by Rahman & Putri (2022), who identified physical supervision visits as time and resource intensive. While their study acknowledged these constraints, it did not propose technological solutions that could eliminate supervision visit requirements. This research demonstrates that GPS-enabled QR attendance combined with digital logbooks (Figure 11) enables continuous remote monitoring, potentially reducing or eliminating the need for routine physical supervision while maintaining oversight quality. This finding extends Setiawan & Maharani's (2023) work on mobile application effectiveness in education by providing empirical evidence that such systems can successfully replace physical presence requirements in vocational education contexts. However, the system's reliance on GPS and camera sensors (as specified in hardware requirements) introduces potential access barriers for students with older devices, a limitation not addressed in the current implementation. This represents an important consideration for future research, as equitable technology access remains crucial in vocational education settings serving diverse socioeconomic populations.

The digital assessment system allowing industry supervisors to input both technical and non-technical scores (Figure 14) addresses data fragmentation issues identified across multiple studies (Pratama & Sari, 2022; Wicaksono & Hartini, 2023). Unlike manual systems where assessment sheets, attendance records, and activity logs existed as separate paper documents vulnerable to loss (as documented in Figures 3 and 4), the implemented system centralizes all evaluation components in a unified database accessible through Firebase. This integration offers a significant advantage over previous digital solutions. Kusuma & Nuraini's (2022) Android PKL system focused primarily on activity monitoring without integrating comprehensive assessment mechanisms. By contrast, this study's approach enables holistic evaluation by connecting daily logbooks, attendance patterns, technical competencies, and attitudinal assessments in a single platform, providing supervisors and administrators with comprehensive student performance data previously unavailable in fragmented manual systems. The report review functionality (Figure 16) further demonstrates integration benefits by allowing supervising teachers to access, download, and evaluate final reports digitally with structured revision tracking. This feature addresses documentation management challenges implicit in Wicaksono & Hartini's (2023) findings

about limited information access in manual PKL systems at SMK Negeri 2 Malang. The ability to provide specific page-level feedback directly through the system represents a novel contribution not documented in existing Prakerin management literature.

The successful system validation through 100% black box testing success rate (Table 1) across 58 test scenarios and four user roles provides empirical support for RAD methodology's effectiveness in complex educational system development. This finding extends Fitriana & Hakim's (2022) work, which validated RAD for academic information systems but did not address multi-stakeholder educational contexts requiring simultaneous web and mobile interface development. The iterative prototyping approach enabled by RAD proved particularly valuable for accommodating diverse stakeholder requirements. Through multiple design, test, and refine cycles in the User Design phase, the system incorporated feedback from administrators, teachers, students, and industry supervisors, stakeholder groups with significantly different technical capabilities and operational needs. This contrasts with traditional waterfall methodologies, which would require complete requirements specification before development begins, potentially missing critical usability issues only discoverable through iterative testing with actual users. However, the study's application of RAD also revealed methodological challenges not adequately addressed in Nugraha & Dewi's (2023) review of RAD effectiveness for mobile education applications. Coordinating simultaneous development of web and mobile interfaces required careful API design to ensure data consistency across platforms, a complexity not present in single-platform RAD projects documented in existing literature. This suggests that while RAD remains suitable for dual-interface development, additional architectural planning phases may be necessary to prevent integration issues that could emerge during the Construction phase.

The system's implementation demonstrates measurable improvements over manual processes documented at SMKN 2 Temanggung. Where paper-based journals (Figure 3) required physical collection and manual review, digital logbooks enable immediate supervisor access to student activities. Where assessment sheets (Figure 4) existed as standalone documents requiring physical storage and retrieval, integrated grade management allows instant access to comprehensive evaluation data. These improvements directly address inefficiency concerns raised by Pratama & Sari (2022) regarding manual PKL execution. The elimination of physical documentation needs represents a particularly significant advancement. Manual systems documented at SMKN 2 Temanggung faced inherent vulnerabilities: paper journals could be lost or damaged, assessment sheets might be misplaced, and attendance records required secure physical storage. By contrast, Firebase-based cloud storage ensures data persistence and accessibility regardless of physical location, effectively eliminating documentation loss risks that plague manual systems. Furthermore, the system's data export functionality enables administrators to generate comprehensive reports for institutional evaluation and quality assurance purposes, capabilities fundamentally unavailable in manual systems where data aggregation required labor-intensive manual compilation. This feature aligns with Education 4.0 principles emphasized by Sari & Wijaya (2023), demonstrating how digital

integration enhances not only operational efficiency but also institutional capacity for data-driven decision-making.

While the 100% black box testing success rate validates functional requirements, this testing approach has inherent limitations not addressed in the current study. Black box testing examines input-output behavior without analyzing internal code quality, meaning potential performance issues, security vulnerabilities, or code maintainability concerns remain unvalidated. Future research should incorporate white box testing, security audits, and usability evaluations to comprehensively assess system quality beyond functional correctness. Additionally, the study lacks post-implementation longitudinal evaluation measuring actual usage patterns, user satisfaction, and long-term system impact on Prakerin management efficiency. While the system demonstrates technical functionality, empirical evidence of sustained adoption and measurable efficiency improvements in real-world operations would strengthen claims about practical effectiveness. This represents a common gap in educational technology research, where implementation studies rarely include extended field evaluations documenting actual impact on educational processes and outcomes. The research context, limited to SMKN 2 Temanggung, also constrains generalizability. Different vocational schools may face distinct challenges requiring system adaptations. Comparative studies implementing the system across multiple institutions with varying resources, student populations, and industry partnerships would provide valuable insights into scalability and adaptability requirements for broader adoption.

This research contributes to vocational education technology literature by demonstrating that integrated digital platforms can successfully overcome systemic limitations of manual Prakerin management when designed with multi-stakeholder requirements and role-based access in mind. Unlike previous studies that addressed isolated aspects of PKL management, this work presents a holistic solution connecting monitoring, documentation, assessment, and communication in a unified system validated across all stakeholder roles. The study also extends RAD methodology application by providing empirical evidence that iterative development approaches can successfully accommodate complex dual-interface architectures serving stakeholders with diverse technical capabilities. This methodological contribution addresses gaps in existing RAD literature, which predominantly focuses on single-platform development contexts. Practically, the implemented system offers a replicable model for other vocational institutions facing similar Prakerin management challenges. The open architecture using widely accessible technologies (Android, Kotlin, Firebase) and standard development tools facilitates adaptation and deployment in resource-constrained educational settings, potentially supporting broader digital transformation initiatives in Indonesian vocational education.

## **CONCLUSION**

SMKN 2 Temanggung's annual internship program faces challenges from manual paper-based processes, resulting in inefficient administration, difficult monitoring, poor

documentation, slow coordination, and subjective evaluation. Physical supervision visits are time-consuming while manual activity logs are prone to loss or damage.

Black Box testing validated system functionality by examining input-output behavior without analyzing internal processes. As shown in Table 1, all 58 test scenarios executed successfully across four user roles, confirming the system meets functional requirements.

**Table 1. Black box testing results summary**

User Role	Total Tests	Success Rate	Key Function Tested
Admin	19	100%	Login, dashboard, account management, announcements, data export
Student	14	100%	Login, dashboard, logbook, QR attendance, report upload, group chat
DUDI	14	100%	Login, student list, QR generation, grade input
Teacher	11	100%	Login, student supervision, report review, document download
Total	58	100%	All functional requirements validated successfully

System implementation includes web admin interface for login (Figure 7), dashboard (Figure 8), and account management (Figure 9), plus mobile interfaces for students with login (Figure 10), home dashboard (Figure 11), and QR attendance (Figure 12), DUDI with QR generation (Figure 13) and grade input (Figure 14), and teachers with student list (Figure 15) and report review (Figure 16). The testing results in Table 1 demonstrate 100% success rate, confirming the system achieves its objective of providing integrated internship management for all stakeholders.

Based on the conducted research, the Android-based internship information system with admin dashboard support, developed using RAD methodology and validated through Black Box testing, operates according to functional requirements. The system provides key features including account management, QR code-based attendance, daily logbook, student assessment, group chat, and final report management. The implementation of web admin and mobile interfaces for students, DUDI, and supervising teachers effectively supports each stakeholder's role in internship execution. This system enables structured and well-documented administration, monitoring, and communication processes, successfully addressing the problems previously encountered in the manual system. The testing results in Table 1 demonstrate 100% success rate, confirming the system achieves its objective of providing integrated internship management for all stakeholders.

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