Design and Usability Evaluation of an Android-Based Point of Sale Application Using Goal-Directed Design

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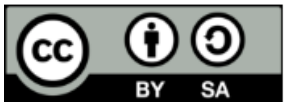
Abstract—The implementation of Point of Sale (POS) systems in culinary micro, small, and medium enterprises (MSMEs) faces a significant challenge due to the low usability levels of existing applications, which hinders technology adoption in daily operations. This study aims to design and implement an Android-based POS application using a Goal-Directed Design (GDD) approach to enhance usability and system effectiveness. The case study was conducted at a typical culinary MSME in Cirebon, specifically the Empal Gentong Mang Sumedi Restaurant. The research method followed the stages of Goal-Directed Design, which included identifying personas, formulating user goals, designing usage scenarios, and implementing the application using the Flutter framework. System evaluation was carried out through functionality testing and usability testing, utilizing the System Usability Scale (SUS) with 20 respondents. Data were gathered through observation, interviews, and questionnaires. The results indicated that the developed POS application achieved an average SUS score of 77.25, which falls within the "Good" and "Acceptable" usability categories. The relatively homogeneous distribution of scores, along with the 95% Confidence Interval values that exceeded the usability threshold, indicates a consistent perception among users regarding the system's ease of use. These findings suggest that implementing Goal-Directed Design significantly improves the interface quality and user experience of Android-based POS applications for culinary MSMEs.

Keywords—Android Application, Goal-Directed Design, Point of Sale, System Usability Scale, MSMEs

Article info: Date Submitted: 2026-04-28 | Date Revised: 2026-04-30 | Date Accepted: 2026-05-04



I. INTRODUCTION

Digital transformation in the micro, small, and medium enterprise (MSME) sector is a strategic issue in the development of modern information systems. MSMEs play a significant role in the national economy, but in practice they still face limitations in utilizing information technology to support core business processes [1], [8]. One critical aspect that is still widely carried out conventionally is the management of sales transactions and daily financial records, especially in small and medium-scale culinary MSMEs [7], [16]. The Point of Sale (POS) system is an important component in supporting business operational activities because it functions as a center for recording transactions, managing menus, and providing sales data needed for managerial decision-making [8], [12]. However, many traditional restaurants in Indonesia still rely on manual recording or simple, non-integrated systems [7]. This condition creates the risk of recording errors, delays in data recapitulation,

DOI: https://doi.org/ 10.37396/jsc.v9i1.660

and low accuracy of financial reports, which impacts the low effectiveness of data-based decision-making [1]. This condition indicates a gap between the operational needs of MSMEs and the technology solutions used. Without adequate POS system support, business owners experience limitations in conducting data -driven decision-making on business performance , which ultimately results in low business efficiency and competitiveness.

The development of mobile devices, especially Android-based smartphones, opens up new opportunities in developing more flexible and affordable POS systems for MSMEs [5], [9]. Mobile-based POS applications enable fast and portable transaction processing with lower implementation costs than conventional desktop systems [16] and ease of adoption for small businesses. The use of the Flutter framework supports the development of applications with high performance and consistent interfaces across platforms [5]. In the context of POS applications, the use of Flutter enables the development of responsive and easily maintained systems. However, the success of POS system implementation is not only determined by technical and functional aspects, but also by the level of user acceptance [10], [14]. Failure of system adoption in MSMEs is often caused by unintuitive interfaces and designs that are not aligned with user needs [1], [6]. Therefore, the Human–Computer Interaction (HCI) aspect needs to be a primary concern in POS application development.

Goal-Directed Design (GDD) is an interactive system design approach that places user goals as the primary basis for design decision-making [1], [6]. This approach emphasizes the development of personas, usage scenarios, and interaction frameworks that align with user needs [2], [3]. In contrast to feature- or technology-oriented design approaches, GDD focuses on how the system can help users achieve their goals effectively and efficiently. In the context of POS applications for culinary MSMEs, this approach is relevant because system users generally do not have a technical background and require an interface that is simple, quick to understand, and minimizes errors. Several studies have shown that the implementation of GDD can improve usability and user satisfaction in mobile applications and MSME information systems [4], [6], [17], [18]. However, the application of GDD in POS system development, especially for culinary MSMEs in Indonesia, is still relatively limited and has not been widely studied empirically with measurable usability evaluations. Although research on Android-based POS has been conducted extensively [7], [8], most have not systematically integrated the GDD approach and have not conducted usability evaluations using standard instruments such as the System Usability Scale (SUS) [12], [20]. Therefore, this study aims to integrate GDD and measurable usability evaluations in the development of Android-based POS applications.

The contribution of this research is: (1) practical, namely producing a mobile-based POS solution that is applicable and appropriate to the needs of culinary MSMEs and (2) academic, namely enriching studies in the field of software engineering and HCI by presenting Goal-Directed Design integration and measurable usability evaluation on POS systems.

II. RESEARCH METHODS

A. Types and Approaches of Research

This research is an applied software engineering research (Applied Software Engineering Research) which aims to produce an artifact in the form of an Android-based Point of Sale (POS) application. The research approach used is User-Centered Design (UCD), with Goal-Directed Design (GDD) as the main framework for designing the interface and system interaction flow [11], [15] as shown in Figure 1. This approach was chosen because the main problem faced is not only the absence of a POS system, but also the incompatibility of the system with the needs and goals of users in the operational environment of culinary MSMEs. Therefore, this research not only emphasizes the

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technical implementation aspects, but also the quality of the user experience (Usability and User Acceptance) as indicators of system success.

B. Research Objects and Subjects

The object of this research is an Android-based Point of Sale application developed using the Flutter framework . The application is designed to support sales transaction processes, menu management, and sales reporting in culinary MSMEs. The research subjects are system users at the Empal Gentong Mang Sumedi Restaurant, Cirebon, consisting of: (1) Business owners, as decision makers and users of sales reports, and (2) Cashiers (operational employees), as the main users of the system in daily transaction activities. A total of 20 respondents were involved in the system evaluation stage consisting of culinary MSME actors selected based on their direct involvement in using the POS application.

C. Research Stages

This research was carried out through several main stages arranged systematically, as shown in Figure 1. The research stages include: (1) Identification of problems and user needs; (2) Implementation of Goal-Directed Design ; (3) Implementation of Flutter-based POS applications; (4) System evaluation and usability testing .

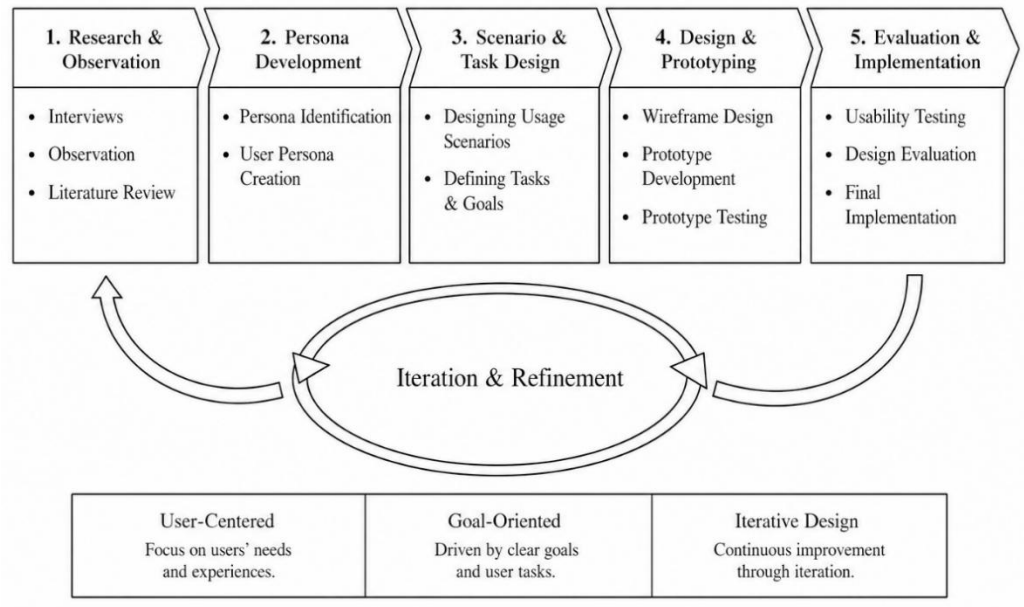

Figure 1. Research Methodology with GDD Method

D. Implementation of Goal-Directed Design

Goal-Directed Design is used as the main approach in designing the interface and interaction flow of the POS application as shown in Figure 2.

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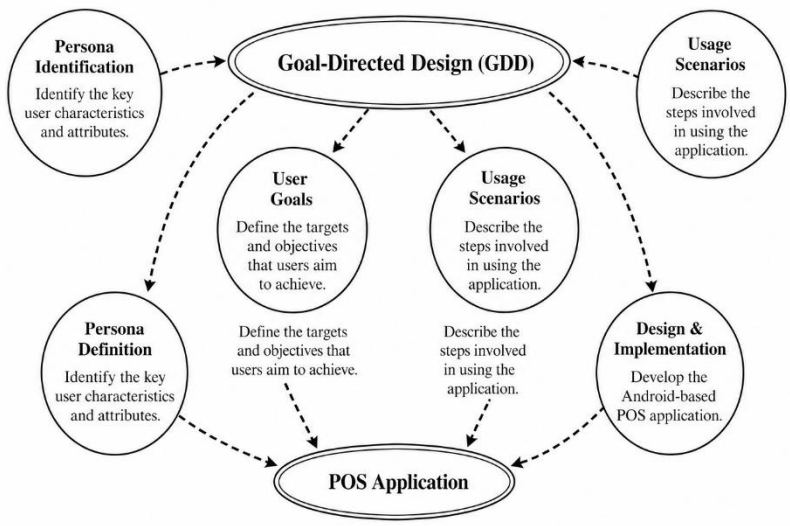


Figure 2. GDD flow in POS application

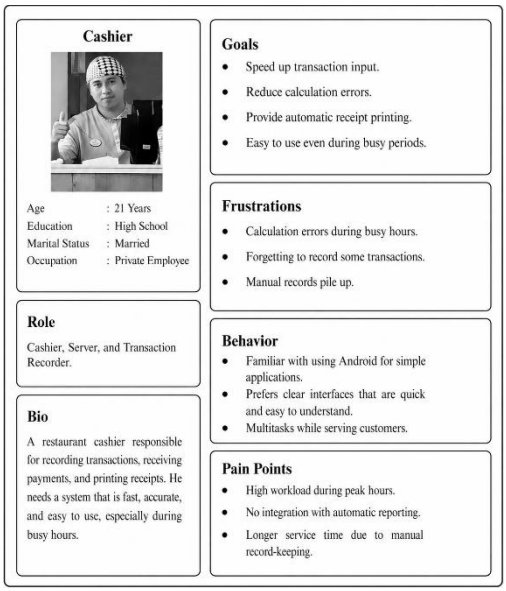
The application of GDD in this research consists of the following stages:

1. Research and Data Collection

Observations and interviews were conducted to understand the user's work context and identify system requirements [2], [3]. This approach aligns with persona-based interaction design practices in the HCI literature [13]. The initial stage was conducted to gain a deep understanding of the user's work context, needs, and problems. Data collection techniques used included: (1) Direct observation, to observe the transaction flow and manual sales recording process; and (2) Semi-structured interviews to explore user needs, complaints, and expectations regarding the POS system. The results of this stage indicate that users require a system that speeds up the transaction process, minimizes recording errors, and provides easy-to-understand sales reports.

2. Modeling : Personas and Scenarios

The development of personas and usage scenarios is carried out to model the characteristics and goals of users [11], [15], which has been proven to improve the quality of interface design [17], [18]. Based on observation and interview data, user modeling is carried out in the form of personas. Personas are designed to represent the characteristics, goals, and limitations of the main users of the system.



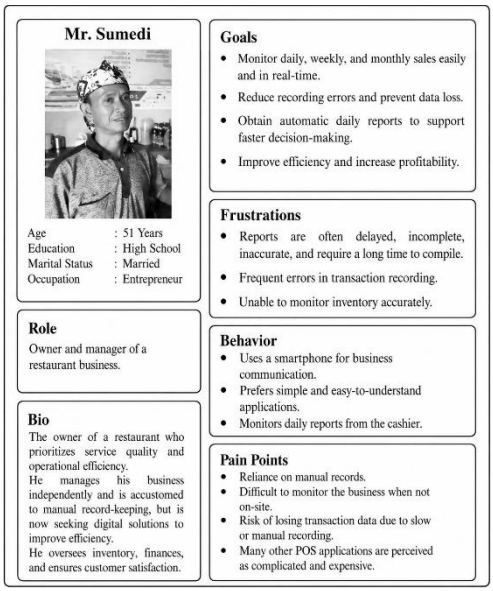


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Figure 3. User Persona Cashier and Owner

Two main personas were generated in this research: (1) The cashier persona, which focuses on the speed and ease of transactions, and (2) The business owner persona, which focuses on access to sales reports and business control. Next, usage scenarios were developed that describe how users interact with the system to achieve their goals. These scenarios serve as the basis for determining the functional requirements and interaction design of the application.

3. Requirement Definition

Functional and non-functional requirements are formulated based on user objectives to avoid feature creep [6], [11]. This stage aims to translate user objectives into system requirements. The resulting requirements are classified into: (1) Functional requirements, such as transaction recording, menu management, and sales report generation, and (2) Non-functional requirements, such as ease of use, system response speed, and interface consistency. The GDD approach ensures that each system requirement has a direct relationship to user objectives, thus avoiding the addition of irrelevant features (feature creep).

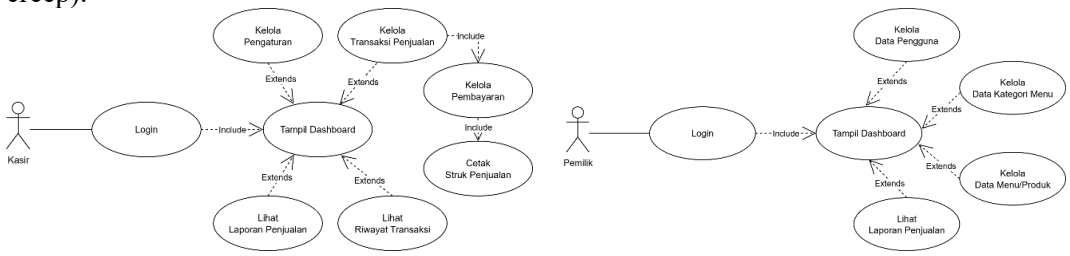

Figure 4. Use Case Diagram

4. Framework Definition and Refinement

The design of the navigation structure and interaction flow was carried out iteratively by considering the principles of usability and mobile design patterns [13], [14]. At this stage, the application interaction framework was designed , including: (1) navigation structure; (2) transaction flow, and (3) main interface layout. The initial prototype was developed and refined iteratively based on user feedback. This process aims to ensure that the interface design is intuitive and supports the user's natural workflow.

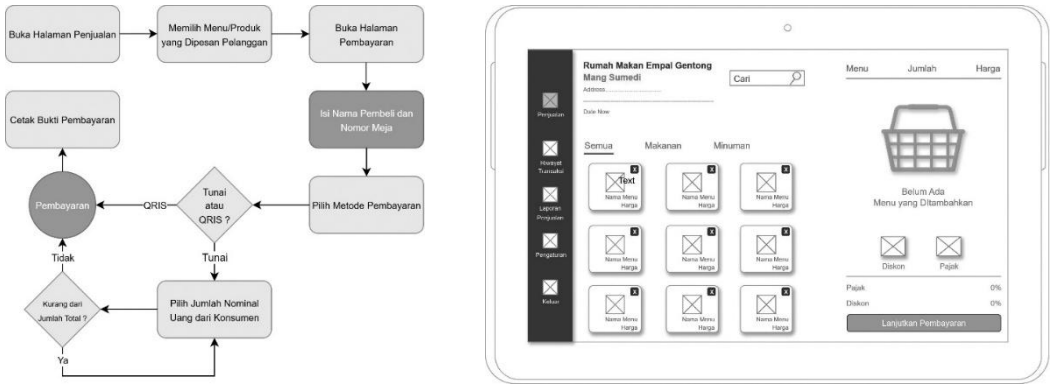

Figure 5. Transaction Flow and Main Interface Layout

5. System Implementation

The POS application is implemented using the Flutter framework with the Dart programming language . Flutter was chosen because it supports cross- platform application development [5] with high performance and interface consistency.

a. System Architecture

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The system architecture is designed using a client–server approach , with the main components: (1) Mobile application as the client , and (2) Database as the transaction data storage server . This architecture enables centralized data management and supports further system development.

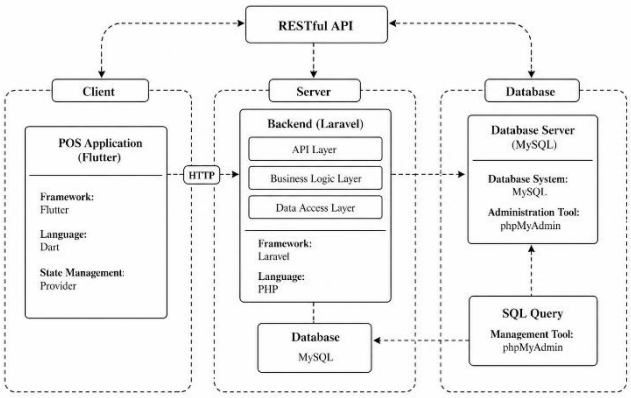

Figure 6. Flutter-Based POS System Architecture

b. Application Module

The POS application developed consists of several main modules, namely: (1) User dashboard module ; (2) Menu management module; (3) Sales transaction module; and (4) Sales report module. Each module is designed according to user needs that have been identified at the GDD stage.

E. System Evaluation Method

Usability evaluation was conducted using the System Usability Scale (SUS) because it is a reliable standard instrument and is widely used in interactive system research [20]. Interpretation of SUS scores refers to the interpretation categories of Bangor et al. [19], where scores above 68 are categorized as acceptable usability (above the average threshold of 68). System evaluation was conducted to assess the functional quality and usability of the POS application. The evaluation methods used include: (1) Functional Testing, functional testing is conducted to ensure that all system features run according to the established requirements, testing is conducted using a black-box testing approach and (2) Usability Testing , usability testing was conducted on 20 respondents using a combination of methods: (1) Observation of system usage; (2) Post-use interviews; and (3) System Usability Scale (SUS), chosen because it is a standard instrument that has been widely used to measure system usability quantitatively and allows for objective comparison of results. The SUS value is calculated using a standard formula and interpreted based on the usability level category .

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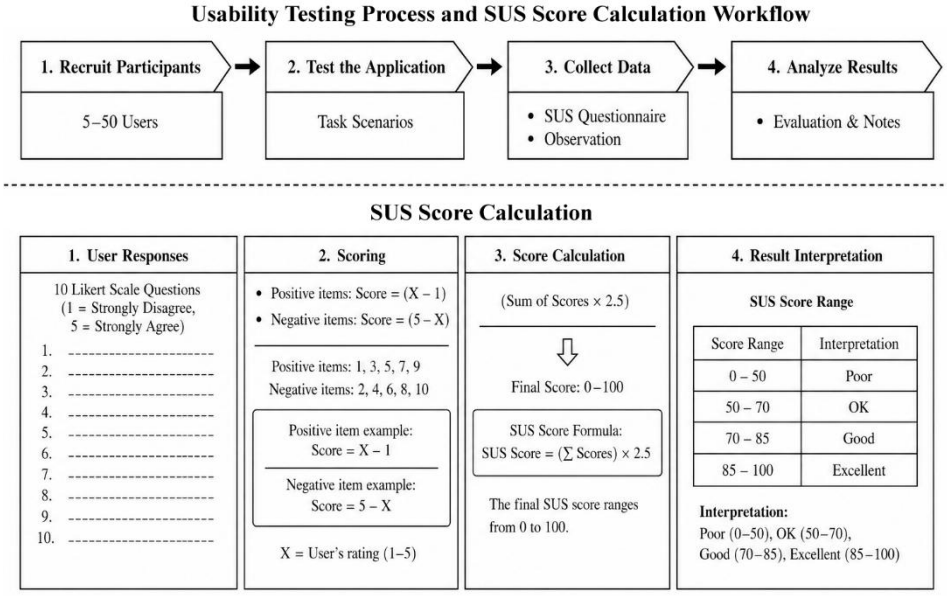

Figure 7. Usability Testing Process Scheme and SUS Score Calculation

F. Data Analysis Techniques

Qualitative data from observations and interviews were analyzed using a descriptive-analytical approach to identify problem patterns and user needs. Quantitative data from the SUS were analyzed by calculating average scores and interpreting them based on a predetermined usability scale . This analytical approach allows for a comprehensive system evaluation, both in terms of user experience and overall system quality.

G. System Usability Scale (SUS) Calculation

Usability measurements were conducted using the System Usability Scale (SUS), which consists of 10 statements on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). The SUS score is calculated in several stages as follows:

1. For each odd-numbered item (1, 3, 5, 7, 9), a score is calculated by subtracting 1 from the response value ($S_i = X_i - 1$).
2. For each even-numbered item (2, 4, 6, 8, 10), the score is calculated by subtracting the response value from 5 ($S_i = 5 - X_i$).

The scores obtained from each item produce an adjustment score ranging from 0 to 4. Next, all item scores are added together and multiplied by 2.5 to obtain the final SUS score ranging from 0 to 100, as formulated as follows:

$$SUS = \left(\sum_{i=1}^{10} S_i\right) x\ 2.5 \qquad (1)$$

To obtain the average system usability value , the SUS scores from all respondents are added up and divided by the number of respondents (n):

$$\overline{SUS} = \frac{\sum_{j=1}^{n} SUS_j}{n} \qquad (2)$$

The SUS scores obtained are then interpreted based on standard categories, where a value of 68 is used as the average usability threshold , and values above it indicate a good level of system acceptance (acceptable usability).

III. Results and Discussion

A. Android POS Application Implementation Results

Point of Sale (POS) application developed using the Flutter framework . This application is designed to support restaurant operations end-to-end , from transaction

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recording and menu management to sales reporting. Functionally, the application consists of several main modules:

1. User Dashboard Module

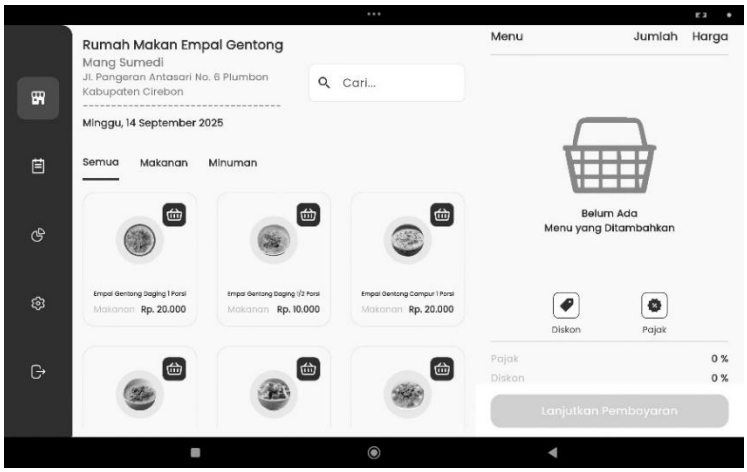

Figure 8. User Dashboard

2. Menu and Pricing Management Module

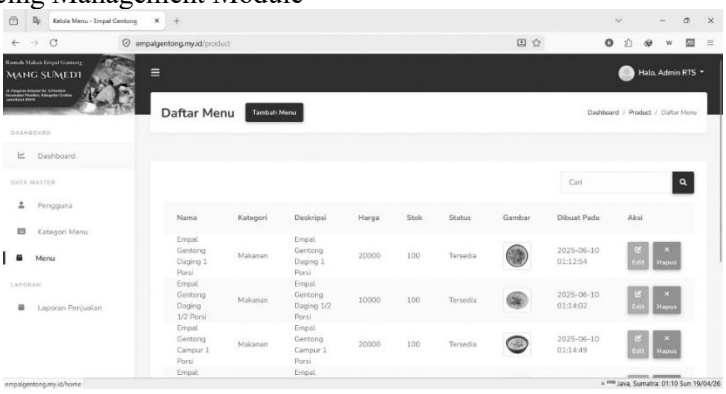

Figure 9. Menu and Price Management Module (Web Base)

3. Sales Transaction Module

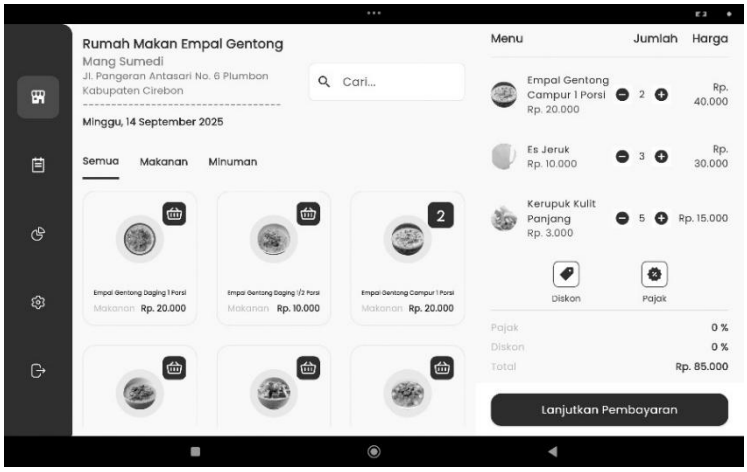

Figure 10. Sales Transaction Module

4. Transaction History and Report Module

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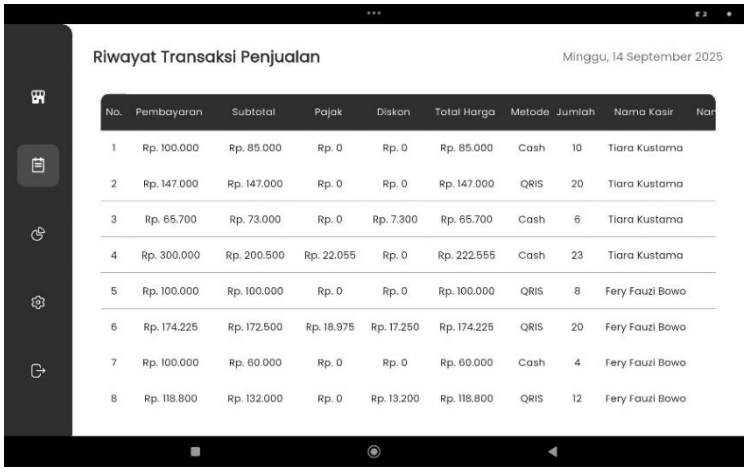

Figure 11. Transaction History Module

Figure 12. Transaction Report Module

The interface was implemented with Goal-Directed Design principles in mind , where each display is designed based on the primary goals of the users (cashiers and business owners), not simply feature completeness. This approach aims to minimize user cognitive load and expedite the completion of primary tasks.

B. System Functionality Evaluation

Functionality testing was conducted using black-box testing methods to ensure that all key application features function according to user requirements. Testing focused on real-world usage scenarios in a restaurant environment.

Table 1. POS Application Functionality Test Results

Tested Features	Testing Scenario	Results
User Login	Enter valid username and password	Succeed
Menu Management	Add, change, delete menu	Succeed
Sales Transaction	Input items and payments	Succeed
Transaction History	Displaying transaction data	Succeed
Sales report	Daily and periodic recaps	Succeed

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Test results showed that all of the system's main functions performed according to requirements specifications. No critical failures were found during the testing process, thus declaring the system suitable for further usability evaluation.

C. Usability Evaluation Results Using the System Usability Scale (SUS)

Usability evaluation was conducted to measure the level of ease of use of the POS application from the end-user perspective. The instrument used was the System Usability Scale (SUS), introduced by Brooke (1996) as a simple, reliable, and widely validated usability measurement tool in various interactive system contexts. The test involved 20 respondents, consisting of cashiers and owners of culinary MSME restaurants who represent actual users in restaurant operational environments with diverse technological experience backgrounds.

1. Descriptive Statistical Analysis

Descriptive statistical analysis was used to provide a quantitative overview of the SUS test results. The data processing results showed that the system obtained an average SUS score of 77.25 with a standard deviation of 5.55. The 95% Confidence Interval (CI) calculation was performed to strengthen the statistical reliability of the test results. 95% CI = (74.65 – 79.85). The entire CI range is above the threshold score of 68, which confirms that the usability level of the POS application is statistically acceptable with a high level of confidence.

Table 2. SUS Test Results

Parameter	Mark
Number of Respondents	20
Minimum Score	67.50
Maximum Score	87.50
Average (Mean)	77.25
Standard Deviation (SD)	5.55
Standard Error (SE)	1.24
95% Confidence Interval (CI)	74.65 – 79.85

This score is significantly above the industry benchmark of 68, which is generally considered the global average for various digital systems (Bangor et al., 2008). The distribution of scores shows a relatively normal distribution with low variation, indicating the consistency of user perceptions of the system's usability quality .

Based on Bangor et al.'s (2008) interpretation, scores in the 70–80 range are categorized as "Good," while scores above 80 approach the "Excellent" category. Thus, a score of 77.25 places the system in the Good (Grade B) category and is at a level of acceptability suitable for operational implementation. These findings indicate that systems designed using the GDD approach are able to meet user expectations in terms of ease of use, efficiency, and learnability .

2. SUS Score Distribution

The distribution of SUS scores is shown in Figure 13, which represents the distribution of application usability levels based on user perceptions with the main interpretations:

a. SUS scores are in the range of 67.5 – 87.5.
b. There were no extremely low scores, indicating no system rejection.
c. The distribution tends to be close to normal with a concentration of scores in the 75–80 range.

These findings indicate that the application has a relatively consistent level of usability among users.

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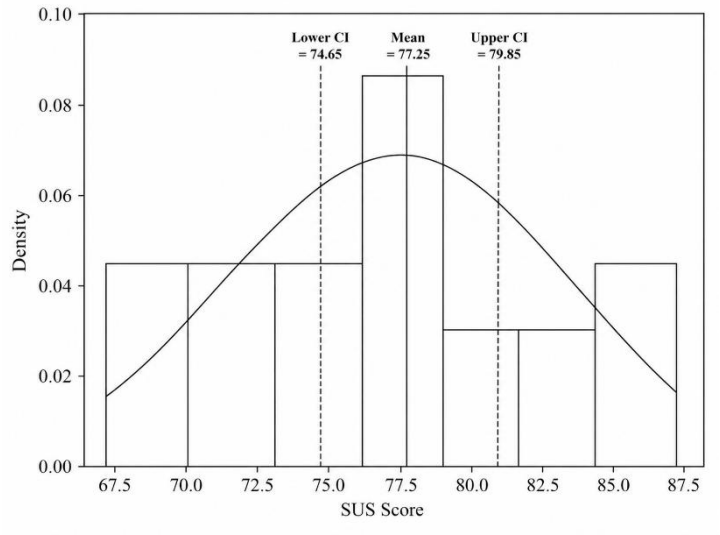

Figure 13. Distribution of SUS Scores

D. Discussion

1. Usability Feasibility of POS Application

Based on the SUS test results, the developed POS application has a usability level in the "Good" category. This indicates that the system is: (1) Easy to learn; (2) Efficient to use; and (3) Acceptable by non-technical users. These results are in line with the SUS interpretation standard which states that a score above 70 reflects a system that is ready for use in a real operational environment.

2. Goal-Directed Design's Contribution to Usability

The implementation of Goal-Directed Design has been shown to contribute significantly to improving application usability . Focusing on the user's primary goals results in: (1) a concise transaction flow; (2) an intuitive navigation structure; and (3) a reduction in usability errors during testing. This approach supports findings in the HCI literature that suggest that user-goal-driven design results in a more effective user experience than feature-oriented design.

3. Implications for the Development of MSME POS Systems

The results of this study indicate that an Android-based POS application designed with a user-centered and goal-oriented approach can be an effective solution for culinary MSMEs. Good usability has the potential to increase technology adoption, operational efficiency, and transaction recording accuracy.

IV. CONCLUSION

The application of Goal-Directed Design in the development of Android POS applications has proven effective in producing a simple, structured system that meets the needs of cashiers and business owners. Flutter -based applications are able to support stable and real-time operations . The usability evaluation shows a SUS score of 77.13 (Good category), with a consistent value above the threshold of 68, so the system is considered feasible and easy to use. This study confirms that the goal-oriented design approach improves interface quality and work efficiency for MSMEs. Further development requires adding strategic features (QRIS, stock management, visual analytics), conducting comparative evaluations and additional HCI methods, and testing on a wider MSME scale with the support of cloud and multi-device architectures . This study presents novelty through the integration of Goal-Directed Design (GDD) in the development of Android-based POS applications for culinary MSMEs, with a persona-based approach to improve usability and user experience. This novelty is reinforced by empirical validation using the

DOI: https://doi.org/ 10.37396/jsc.v9i1.660

System Usability Scale (SUS) which shows the significant influence of usability on technology adoption, as well as implementation using Flutter as a practical and scalable solution.

ACKNOWLEDGEMENT

The authors would like to thank the Ministry of Higher Education, Science, and Technology of the Republic of Indonesia for their support through the Novice Lecturer Research scheme (Contract Number: 8020/LL4/PG/2025). Thanks are also extended to Catur Insan Cendekia University for its academic and administrative support, and to all parties, especially students, colleagues, and culinary MSME owners, who have contributed to this research.

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