

# A Web-based Point of Sales for Automotive Component Industry using Rapid Application Development model

Melvin<sup>1</sup>, Jansen Wiratama\*<sup>2</sup>, Rudi Sutomo<sup>3</sup>, Samuel Ady Sanjaya<sup>4</sup>

Universitas Multimedia Nusantara

e-mail: <sup>1</sup>melvin@student.umn.ac.id, <sup>2</sup>jansen.wiratama@umn.ac.id, <sup>3</sup>rudi.sutomo@umn.ac.id,

<sup>4</sup>samuel.ady@umn.ac.id

\*Corresponding Author

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## Abstract

*This research aims to increase efficiency in Micro, Small, and Medium Enterprises (MSMEs) in the automotive components industry, focusing on CV Bengkel Megamakmur. CV Bengkel Megamakmur is one of MSMEs engaged in Indonesia's car spare parts industry. In their ongoing business process, CV Bengkel Megamakmur need some help in inventory management, stock of goods, and less integrated sales transaction recording. The main problem identified was the discrepancy between the number of products sold and sales transaction reports. A web-based Point of Sale (POS) application was implemented, which allows the integration of inventory data and sales transactions. This research applied Rapid Application Development (RAD) that suitable for projects with limited resources and short work schedules. This research resulted a web-based POS application that can optimize business processes for managing inventory by monitoring stock and recording sales transactions in an integrated manner. This application has been tested using System Usability Scale (SUS) method and obtained an average score of 86.6, included in the "very good" category. The test results showed that this application has good functionality and can optimize MSME business processes in the automotive components industry.*

**Keywords:** Automotive Component, Point of Sale, Rapid Application Development, System Usability Scale, Web-based

## Abstrak

*Penelitian ini bertujuan untuk meningkatkan efisiensi dalam Usaha Mikro, Kecil, dan Menengah (UMKM) industri komponen otomotif, dengan fokus pada CV Bengkel Megamakmur. Bengkel ini adalah salah satu UMKM yang bergerak dalam industri spareparts mobil di Indonesia. Pada proses bisnis yang berjalan, UMKM ini menghadapi sejumlah kendala dalam hal manajemen inventory, stok barang, dan pencatatan transaksi penjualan yang kurang terintegrasi. Masalah utama yang diidentifikasi adalah ketidaksesuaian antara jumlah produk yang terjual dengan laporan transaksi penjualan. Untuk mengatasi masalah ini, dilakukan sebuah aplikasi Point of Sale (POS) berbasis web yang memungkinkan integrasi data inventory dan transaksi penjualan. Metode yang digunakan dalam penelitian ini adalah Rapid Application Development (RAD), yang cocok untuk proyek dengan sumber daya terbatas dan jadwal kerja yang singkat. Hasil penelitian ini adalah sebuah aplikasi Point of Sale yang dapat mengoptimalkan proses bisnis untuk mengelola inventaris dengan, memantau stok barang, dan mencatat transaksi penjualan secara terintegrasi. Aplikasi ini telah diuji menggunakan metode System Usability Scale (SUS) dan memperoleh skor rata-rata sebesar 86,6, yang termasuk dalam kategori "sangat baik." Ini menunjukkan bahwa aplikasi ini memiliki fungsionalitas yang baik dan dapat mengoptimalkan proses bisnis UMKM di industri komponen otomotif.*

**Kata kunci:** *Automotive Component, Point of Sale, Rapid Application Development, System Usability Scale, Web-based Application*

## 1. INTRODUCTION

Implementing information technology in a business activity can support business processes, especially if the company handles many transactions, such as businesses in the trade or services sector. Accurate and comprehensive calculations of transaction results and amounts and storage media that can store these data safely and quickly, such as computer media, are necessary for a company [1]. Business actors who still rely on conventional data processing models, such as using stationery and paper, will require a long time and have the potential for the risk of human error due to errors made by humans in handling the data, which can result in loss of data, errors in calculations and other losses [2].

In carrying out business activities, business actors need a data processing system that can handle data processing activities such as processing goods data and transaction data. Business activities that operate in the field of mechanic or workshop services are one of the business activities that also require technological assistance to run the business and business optimally. These activities can include service transactions, administrative handling, and data collection on goods coming in and out of the warehouse after the sale or purchase of goods [3]. CV Megamakmur is one of the MSMEs that sells automotive products and accessories installation services. The business processes that run in this workshop are still conventional, namely the use of stationery and report books, so there is the potential for risk of losing data and transaction reports that do not relate to data on goods in the warehouse. Online sales are crucial for modern businesses, offering a way to reach a broader audience and boost revenue. It provides a convenient shopping experience for customers who can browse and buy from anywhere. Businesses benefit from collecting and analyzing customer data, allowing them to personalize marketing and build strong relationships. Online sales are cost-effective, with lower overheads compared to traditional stores. In today's digital age, having a strong online presence is not just beneficial but necessary for businesses to stay competitive and adapt to changing consumer habits [4].

Several previous studies related to business process problems have explained the role of using a computerized system to overcome these problems. The application of computer-based systems can be sales transaction and reporting systems, cashier systems, decision support systems, and worker recruitment systems. Implementing an ERP system with a sales module in a company can process sales data more efficiently and effectively [5]. Implementing Point of Sales (POS) in the MSME food stall industry has also optimized the sales transaction process [6]. Not only MSMEs in the service sector but MSMEs that sell cake products [7], livestock and egg production companies improve their business process by utilizing the POS [8].

Regarding information systems scope, the POS has a smaller area than a regular information system. Previous research has increased performance in managing employee data in the HR Department by utilizing information systems [9]. The application of information systems has also proven effective in managing sales reports at paint production companies in managing sales data [10].

Based on the literature review from previous research, the obstacles at the Megamakmur Workshop can be overcome with a computerized system such as POS to facilitate workshop data processing, as has been done in previous studies. One solution that can be done is to design a POS with features that can help handle sales transaction activities, reduce inaccuracies or loss of sales data, and manage goods in the warehouse by utilizing technology via electronic media [11]. Transforming from a conventional model to a POS can help optimize business processes at CV Megamakmur Workshop in managing inventory and sales. The designed POS can manage sales transactions and other related business operations [12]. POS is the final point in the sales process, where customers pay for the products or services purchased [13].

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## 2. METHODOLOGY

The decision to opt for Rapid Application Development (RAD) as Software Development Life Cycle (SDLC) was driven by factors aligned with the project's needs. RAD was chosen due to its emphasis on rapid prototyping, iterative development, and user feedback, making it particularly advantageous when time is a critical factor. The project may have a tight deadline or require quick delivery, and RAD's ability to produce functional prototypes allows for faster development cycles. The number of teams involved in the project may also play a role in choosing RAD. If the project requires collaboration between multiple teams or stakeholders, RAD's incremental and collaborative approach facilitates parallel development, ensuring a more streamlined and cooperative workflow. In essence, the decision to choose RAD as the SDLC is likely based on a combination of time constraints, software complexity, the need for iterative development, and the involvement of multiple teams, all of which align with RAD's strengths in delivering quick, flexible, and collaborative software development [14]. Due to the short time for system development with a short cycle and the lack of need to wait long to find out the outcomes of the system being built, this model was chosen since it is adequate for the needs of this research [15]. RAD model is one of SDLC models, and this model has been compared with other models, such as Prototyping, Spiral, and Waterfall. The comparison results show that the RAD model is considered the most suitable system development model for this research. RAD is shown in Figure 1. RAD phases in figure 1 shows requirement planning, user design, construction and cutover.

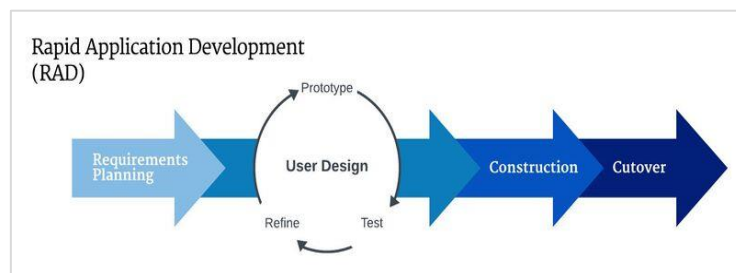


Figure 1. Rapid Application Development Phases.

1. Phase 1: Requirements Planning  
At this phase, interviews with the owner of CV Bengkel Megamakmur were conducted to observe problems. This phase is required for the next phase, user design. The requirements for user design are determined to avoid miscommunication with users.
2. Phase 2: User Design  
User Design is the stage when a design or design of the application is created so that the system design runs according to plan and follows predetermined needs, which are expected to be able to overcome the problems found in the first stage. In this research, a design was designed using Unified Modeling Language (UML) tools, using use case, activity, and class diagrams [16].
3. Phase 3: Construction  
Construction stage is the stage when starting the application design that has been planned previously. This research designed a Web-based POS, which will begin to be compiled using the PHP for the back-end development and the MYSQL for the Database Management System (RDBMS) [17].
4. Final Phase: Cutover  
This Cutover is the final phase of this RAD Model. This phase will conduct the functionality of the web-based POS designed from the previous phase. This application was tested to reduce the risk of errors or defects in the application by the user using a System Usability Scale (SUS). The testing will focus on testing the software's functionality [18]. The utilization of System Usability Scale (SUS) is used as a measuring tool because it's straightforward, easy

to use, and effectively assesses the usability of a system or product. Compared to other tools, SUS is user-friendly, doesn't require specialized knowledge, and provides a standardized metric for easy comparisons. It offers a holistic view of usability, considering learnability, efficiency, and user satisfaction. SUS's widespread use in both academia and industry provides benchmark data for organizations to compare their usability performance. Its simplicity makes it a cost-effective choice for evaluating and improving system usability [19].

### 3. RESULT AND DISCUSSION

In the initial phase of RAD model, requirement planning is carried out through interviews with the owners of CV Bengkel Megamakmur. These interviews were carried out on the Bengkel Megamakmur with the owner and two admin staff in June 2023. During these interviews, an in-depth exploration of the needs and challenges faced by Bengkel Megamakmur in their inventory management and transaction report processes is conducted. The insights gathered from these interviews are then carefully observed and analyzed, forming the foundation for the next phase in the RAD model: user design. The requirements planning analysis shown in Table 1 has five issues that most concurred in the business process. The five issues the derived into recommendations to overcome by utilizing the POS. In the user design phase, the focus shifts towards translating the gathered requirements into practical solutions.

Table 1. Requirements Planning Analysis.

No	Issues	Recommendation
1	The data is not organized well, potentially human error	Organized the data stored in a database management system using a POS
2	The cost of service and transaction is calculated manually, and there is potential miscalculation	Automation cost calculation through the POS minimizes human error or miscalculation
3	It required a long time to process the transaction or find inventory data	Real-time processing
4	Access to transaction data is taken sometimes because it is stored physically.	Ease of access to transaction data
5	Stock management needs to count manually and requires a long time to conduct	Efficient stock management

Designing an POS starts from the initial stage: forming or developing the POS to be built. In this designed research, the application modeling process was carried out using the Unified Modeling Language, often known as UML. In UML modeling, three diagrams are used to visualize the system to be built: use cases, activity diagrams and class diagrams.

#### 3.1. Use Case Diagram

The resulted use case diagram can be shown in figure 2. Based on figure 2, there are Admin as an actor who has responsibility to manage customers data, mana supplier data, manage product data, and manage transaction data. Admin actor interacts with various use cases to manage different aspects of the system. Two common relationships used in use case diagrams are include and extend.

1. Manage Customer Data and Manage Supplier Data. These standalone use case represents the admin's ability to manage customer information. No "include" or "extend" relationships are specified for this use case.
2. Manage Product Data. This use case includes multiple extended use cases. The admin can manage various aspects of product data, including:
  - Manage Product Category Data: The admin can add, update, or delete product categories. This is an "extend" relationship because it adds functionality without making it mandatory for the base use case.

- Manage Brand Product Data: The admin can manage brand-related data like product categories. This is also an "extend" relationship.
  - Manage Incoming Product Data: The admin can handle incoming product information, including details like stock and pricing. This is an "extend" relationship.
  - Manage Outcoming Product Data: The admin can manage data related to the sale or disposal of products. This is also an "extend" relationship.
3. Manage Transaction Data. This use case includes the "Print Transaction Data" use case through an "include" relationship. This means that whenever the admin is managing transaction data, it always includes the sub-use case "Print Transaction Data." In other words, printing transaction data is integral to managing transaction data. "Include" is used when one use case is always part of another use case. In this case, "Print Transaction Data" is always included when managing transaction data. "Extend" is used when additional functionality is optional. Here, the admin can extend "Manage Product Data" by managing product categories, brands, incoming product data, or outcoming product data, depending on their needs.

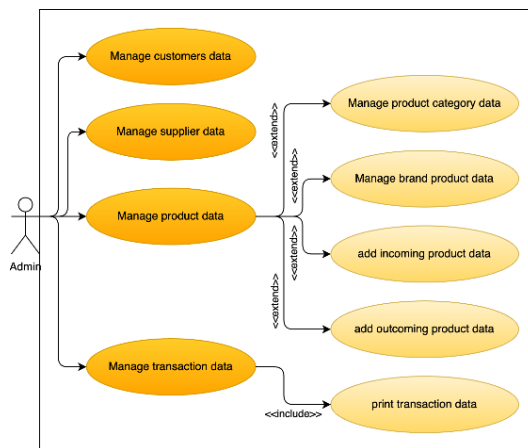


Figure 2. Use Case Diagram of POS Application.

3.2. Activity Diagram

Activity diagram shows interaction between admin and POS Application with each feature derived from the use case diagram. The result of activity diagram shown in figure 3.

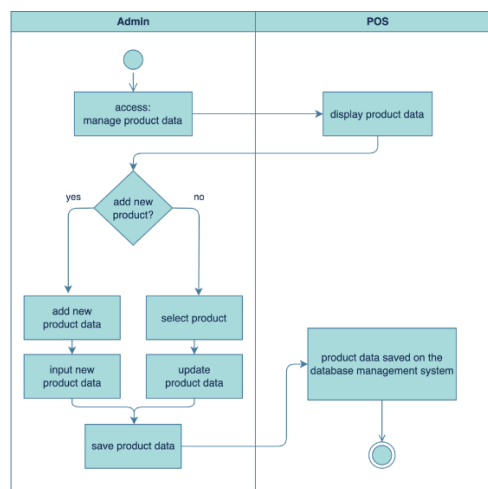


Figure 3. Activity Diagram of of POS Application.

Figure 3 shows the flow when Admin uses the product management feature on POS application. Activity diagrams start with initial nodes and end with final nodes.

### 3.3. Application Dashboard

RAD phases of construction show the results of POS application user interface. This construction phase follows the previous stage, namely, user design. The result of POS dashboard can be shown in figure 4.

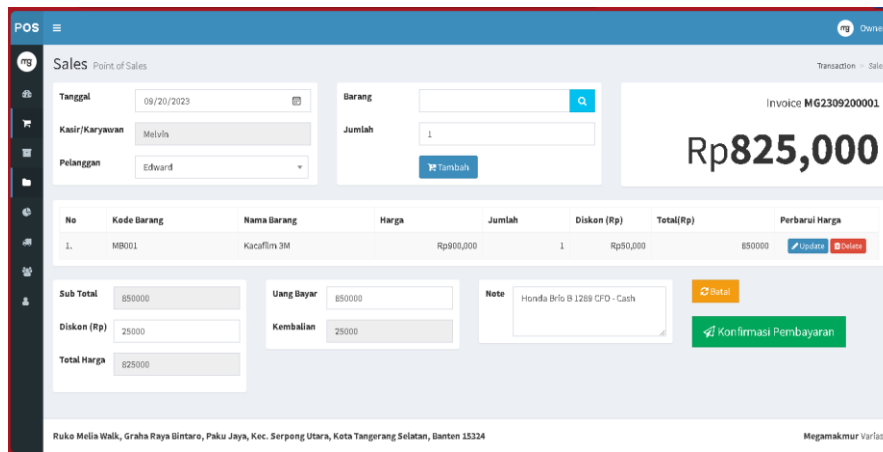


Figure 4. POS Application Dashboard

Figure 4 is web-based Point of Sales Bengkel Megamakmur user interface. The user interface displays information and features of Admin can access as a POS user. Four main features can be accessed from the Menu: Manage customer data, Manage Supplier Data, Manage Product Data (figure 5), and Manage Transaction Data (figure 6). POS Application is also completed with features of detailed information related to the last transaction, such as Transaction date, cashier's name, customer's name, item name, number of items, item price, discount, sub-total, and total price. On the user interface, A yellow button functions to cancel the transaction, and a green button to confirm the transaction and make payment.

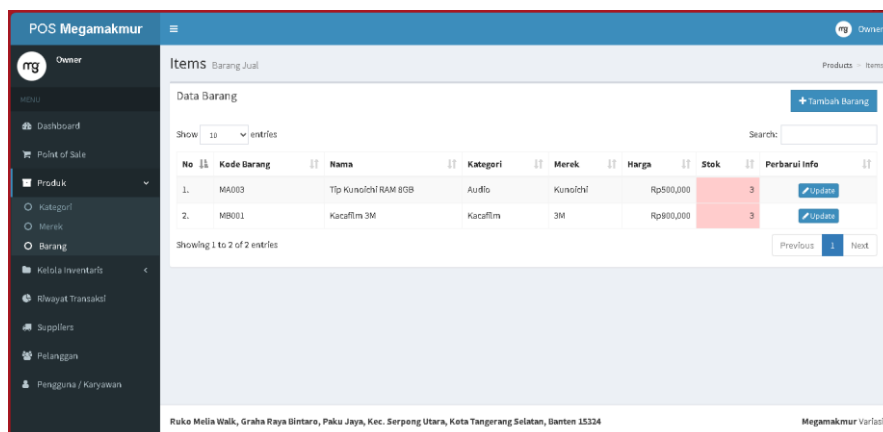


Figure 5. Manage Product user interface of POS Application

Figure 5 displays the user interface related to features that Admins can use to manage product data. Admin can add items and update detailed item information through the Manage Product Data feature. This feature is also equipped with CRUD, namely, Create, Read, Update, and Delete product data.

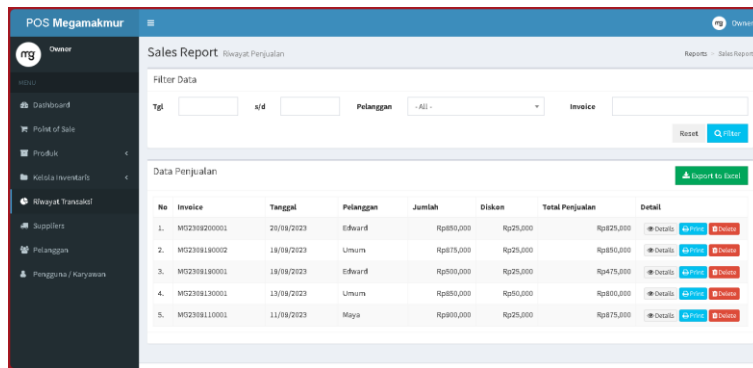
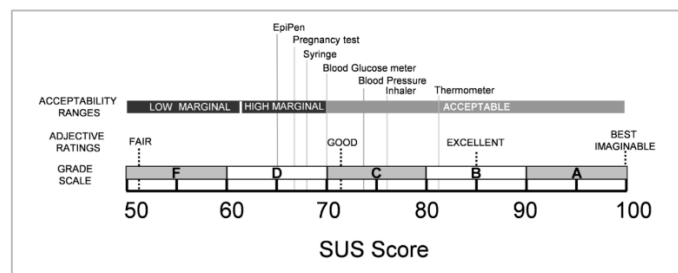


Figure 6. Sales Transaction user interface of POS Application

Figure 6 displays the user interface for goods sales transaction data as a list of items. There is start and end date information and customer name and invoice to filter transaction searches. Apart from being printed using the Print feature, transaction report results can be exported in Microsoft Excel.

### 3.4. User Testing

In the last phase of RAD implementation, System Usability Scale (SUS) testing was carried out to validate the functional aspects of POS application. This test was carried out so that POS application could be adequately used by CV Bengkel Megamakmur in optimizing its business inventory and transaction processes. The score obtained by SUS should be above 70 or equivalent to Grade C with the adjective Good as shown in Figure 7.



Gambar 7. System Usability Scale (SUS) Adjective Ratings.

Ten questions were asked to three users who will use POS application namely owner, cashier 1, and cashier 2. The questions concerned users' assessment of POS application usage based on its functionality. Based on Figure 7, we show that score 1 indicates strongly disagree, and score 5 indicates strongly agree. The results can be seen in Table 2.

Based on Table 2, the score results given by each user are then added up and calculated according to the rules of the SUS method as follows:

$$X = (\text{Total score from Positive}) - 5$$

$$Y = 25 - (\text{Total score from Negative})$$

$$\text{SUS Score} = (X + Y) * 2.5$$

Based on the calculations obtained, the final SUS value for each user is:

- a) Owner =  $((5+5+5+4+5)-5) + (25 - (2+2+1+1+2)) * 2.5 = 90$  (Excellent)
- b) Admin 1 =  $((4+5+5+3+5)-5) + (25 - (2+2+1+1+2)) * 2.5 = 85$  (Excellent)
- Admin 2 =  $((5 + 5 + 5 + 3 + 5) - 5) + (25 - (2 + 2 + 2 + 1 + 2)) * 2.5 = 85$  (Excellent)

Table 2. Results of SUS testing.

Questions	Users			Total Scores
	Owner	Admin 1	Admin 2	
Question 1	5	4	5	14
Question 2	2	2	2	6
Question 3	2	2	2	6
Question 4	5	5	5	15
Question 5	1	1	2	4
Question 6	5	5	5	15
Question 7	1	1	1	3
Question 8	4	3	3	10
Question 9	2	2	2	6
Question 10	5	5	5	15
Question	24	22	23	69
Positive Accumulated score	8	8	9	25
Negative Accumulated score	5	4	5	14

After calculating it based on the average of the total scores for each user, a score of 86.6 is obtained or equivalent to a grade with the Adjective Excellent. Thus, through this SUS testing, the POS design is suitable for application to the CV Bengkel Megamakmur to help optimize their business processes regarding Inventory and Transaction Management.

#### 4. CONCLUSION

This research developed a web-based Point of Sales using the Rapid Application Development System Design Model. The features of the POS delivered follow the needs of CV Bengkel Megamakmur MSMEs for managing inventory, updating data on goods in the warehouse, and managing sales transactions, including transaction history, printing transaction history, and sales reports. The results of functionality testing on the POS using the System Usability Scale (SUS) method obtained an average score of 86.6 (very good) from the users, proving that the POS is suitable for the MSME Automotive Component Industry

#### 5. FUTURE WORK

For future research, it is recommended to expand beyond System Usability Scale (SUS) and consider incorporating software validation processes, such as software architecture validation. This involves assessing whether a software architecture aligns with its intended requirements and goals, offering a crucial step in the software development process. Various methodologies, including Architectural evaluation methods, Architecture tests and reviews, and Model-based validation, can be explored for software architecture validation. Research could provide an in-depth overview of these methodologies, analyzing and summarizing their strengths and weaknesses. This analysis would serve as a guide for determining the most suitable methodology for specific cases, offering valuable insights for future software development and testing. By integrating software architecture validation into the research scope, potential problems could be identified and addressed early on in the development process, preventing costly and challenging issues later [20].

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