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Web-Based Procurement System for Mobile Phone Stock at Tsuraya Cell Using Blackbox Testing

Eza Rafli Vernica Saputra[1]*, Abdi Pandu Kusuma[2], Rizki Dwi Romadhona[3]

Informatics Engineering, University of Islam Balitar, Indonesia

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***Correspondence Address:**
ezaptr172@gmail.com

Abstract: This study aims to design a web-based system to support mobile phone stock procurement at Tsuraya Cell by integrating stock demand forecasting. The system was developed using the Weighted Moving Average method, which estimates demand based on sales data from the previous three months. System development followed the Waterfall methodology, consisting of analysis, design, implementation, testing, and maintenance stages. The main features include stock management, transaction recording, demand forecasting, and a summary dashboard to support business operations. The forecasting results show an average accuracy rate of 71.84%, with the highest accuracy achieved for products with stable sales, reaching up to 100%, while products lacking historical sales data were less effectively predicted. Functional testing using the Blackbox method achieved a success rate of 88.24%. These results indicate that the Weighted Moving Average method is suitable for estimating stock needs when sufficient historical data are available. Based on the findings, it can be concluded that the developed system functions effectively, supports stock planning, enhances decision-making accuracy, and contributes to improving the efficiency of mobile phone inventory management at Tsuraya Cell.

INTRODUCTION

In the current era of rapid digital development, driven continuously by technological changes and innovations, inventory management plays a crucial role in ensuring operational continuity and business sustainability. Tsuraya Cell, a company engaged in mobile phone sales, faces significant challenges in managing its inventory efficiently. Issues such as overstock, which leads to excessive storage costs, and understock, which causes customer dissatisfaction due to product unavailability, remain critical (Suhendra et al., 2021). The manual or semi-manual stock management processes at Tsuraya Cell have proven ineffective in adapting to market demand fluctuations, highlighting the need for a more integrated and modern solution.

Historical sales data serve as an important source of information for predicting future stock requirements. The Weighted Moving Average (WMA)

method was chosen because it gives greater weight to recent sales data, producing more accurate predictions aligned with market trends (Fitri Purwaningtias et al., 2023). Implementing this method allows Tsuraya Cell to respond more quickly to changes in demand while reducing the risk of inventory accumulation. In addition, adopting web-based technology provides real-time access to inventory and sales data, further supporting precise decision-making in procurement planning.

An important feature of the system is the integration of safety stock calculation, which functions as a reserve to anticipate sudden increases in demand. With a service level of 85%, the system ensures product availability without significantly increasing operational costs (Dewi & Daryanto, 2024). This approach improves operational efficiency by aligning stock levels with demand trends. Similar studies support the effectiveness of the WMA method; for instance, Erdianita et al. (2023) applied WMA in forecasting coolant stock requirements and successfully enhanced efficiency. These findings indicate that WMA can be applied across industries to achieve inventory optimization.

To ensure system reliability, software testing is a crucial stage. Black-box testing is employed to validate whether the system functions work as expected without assessing the internal structure (Achmad & Yulfitri, 2020). This process ensures that each feature operates as intended and meets user requirements. The novelty of this research lies in integrating WMA forecasting, safety stock calculation, and black-box testing within a single web-based procurement system. This integration not only improves inventory management practices but also contributes to the development of information systems science, particularly in decision support systems for small and medium-sized enterprises (SMEs).

The state of the art of this study indicates that most previous research focused on inventory control or demand forecasting separately, whereas this study combines predictive analytics, safety stock strategy, and functional testing into one practical framework. This integration has a significant impact on bridging the gap between academic research and industrial practice while enhancing business competitiveness in a dynamic mobile phone market.

Based on this context, this study aims to design and implement a web-based mobile phone stock procurement system using the WMA method, combined with safety stock calculation and validated through black-box testing. Therefore, the research problem can be formulated as follows: how can a web-based stock procurement system be designed and implemented at Tsuraya Cell using the Weighted Moving Average method to forecast stock needs, integrate safety stock to maintain product availability, and ensure system reliability and functionality through black-box testing?

RESEARCH METHODS

This study aims to design and develop a web-based mobile phone stock procurement system at Tsuraya Cell using the Weighted Moving Average (WMA) method to predict stock requirements. The research subjects are Tsuraya Cell, including the owner and store staff. The tools used include hardware (a laptop with Intel Core i5 processor, 8 GB RAM, 256 GB storage) and software (PHP, MySQL, Visual Studio Code, Laragon, Bootstrap, Google Chrome).

The study employs a Research and Development (R&D) design using the Waterfall model, covering the stages of needs analysis, system design, implementation, testing, and maintenance. The variables measured include stock prediction accuracy, system functionality, and stock management effectiveness. Data collection techniques involve direct observation of stock management processes, interviews with the owner and staff, and literature review from books, journals, and scientific articles related to stock forecasting and web-based systems.

Data analysis is performed through qualitative evaluation of operational processes and stock prediction calculations using the WMA method. System functionality is tested using Black-box Testing to validate features such as login, dashboard, stock management, stock prediction, and account settings. The developed system is then evaluated based on prediction accuracy and operational suitability to support more effective decision-making in mobile phone procurement.

RESULTS AND DISCUSSION

The design results of the Web-Based Mobile Phone Stock Procurement System at Tsuraya Cell are realized in the form of a web-based system that facilitates the management of mobile phone stock in the store, ranging from recording, monitoring, to efficient and structured stock procurement. All features are presented in a user-friendly interface, making it easy for store admins to operate the system.

1. Admin Dashboard Pages

a) Login Page

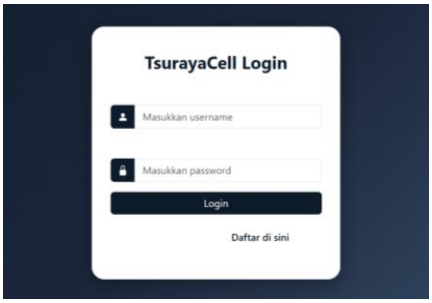


Figure 1. login page

Displays the login form with fields for Username, Password, and a dark blue Login button. A registration link is provided for new users.

b) Register Page

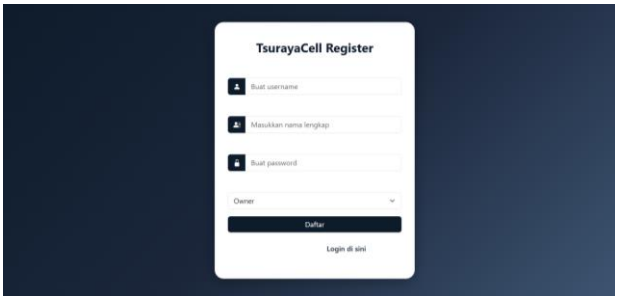


Figure 2. register page

Shows the registration page with input fields for username, full name, password, and role selection (Owner/Admin).

c) Owner Dashboard Page

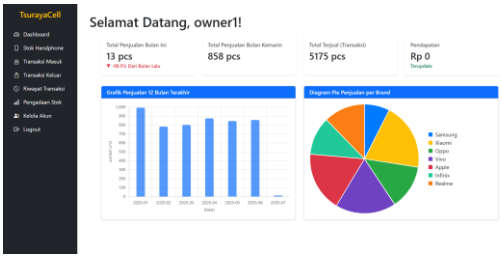


Figure 3. owner dashboard page

Presents a summary of sales performance in numbers and charts. The navigation menu on the left includes Dashboard, Mobile Stock, Incoming/Outgoing Transactions, Transaction History, Stock Procurement, Account Management, and Logout. Bar and pie charts facilitate the analysis of sales trends, complemented by system notifications.

d) Admin Dashboard Page

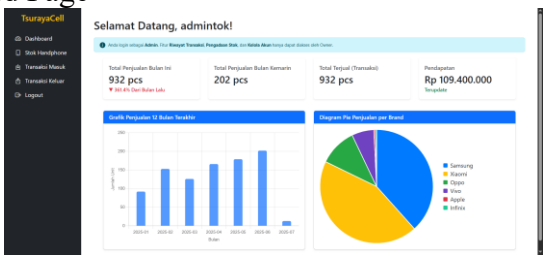


Figure 4. admin dashboard page

Shows the admin dashboard with limited access according to the user role, including notifications regarding restricted feature access.

e) Mobile Stock Page

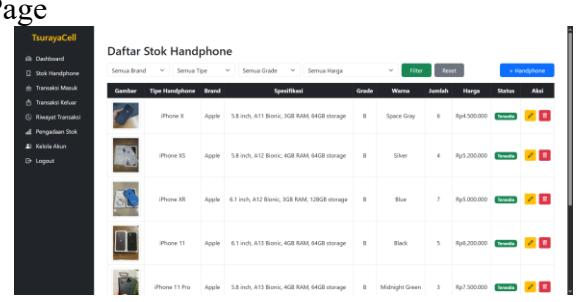


Figure 5. mobile stock page

Displays the list of mobile phone stock, allowing admins to view, add, search, filter, edit, and delete stock data. Input fields for filtering, a stock table, and Edit/Delete action buttons are provided.

f) Add Mobile Page

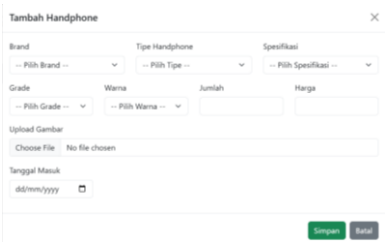


Figure 6. add mobile page

Shows the form for adding new mobile phone data in a pop-up modal, including fields for brand, type, specifications, grade, color, quantity, price, entry date, and image upload. Action buttons for Save and Cancel are available.

g) Edit Mobile Stock Page

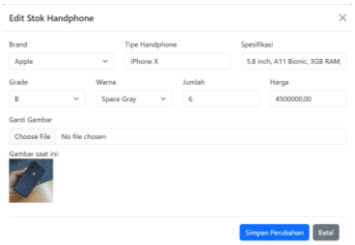


Figure 7. Edit Mobile Stock Page

Displays the form for editing mobile stock. Admins can modify brand, type, specifications, grade, color, quantity, price, and replace the image. Action buttons for Save Changes and Cancel are provided.

h) Incoming Transaction Page

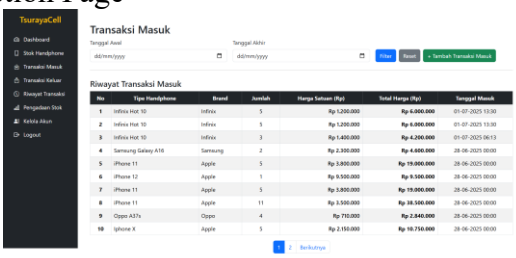


Figure 8. incoming transaction page

Displays a list of incoming stock, including type, brand, unit quantity, and entry date, along with a button to add a new transaction.

i) Outgoing Transaction Page

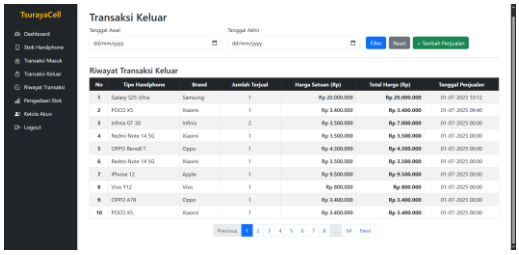


Figure 9. outgoing transaction page

Shows the sales history with date filters and details including phone name, brand, quantity sold, total price, and a button to add a new transaction.

j) Transaction History Page

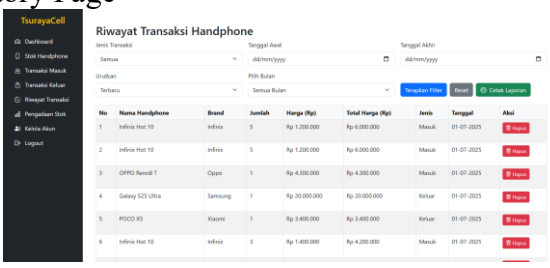


Figure 10. transaction history page

Shows a combined view of incoming and outgoing transactions. Users can filter, select transaction types, and generate PDF reports. The table includes phone name, brand, quantity, price, total, transaction type, date, and action buttons.

k) Mobile Stock Procurement Page

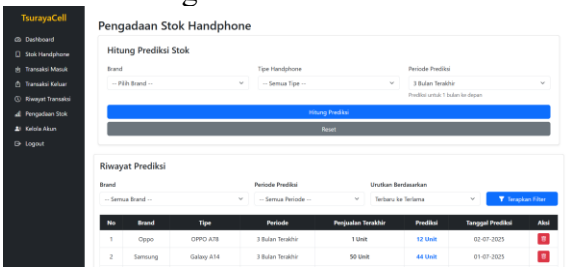


Figure 11. mobile stock procurement page

Shows the stock prediction feature based on the last three months of sales. Users select brand, type, and prediction period, then view estimated stock needs and prediction history.

l) Account Management Page

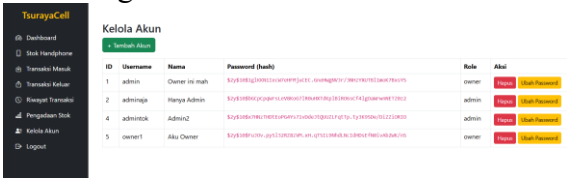


Figure 12. account management page

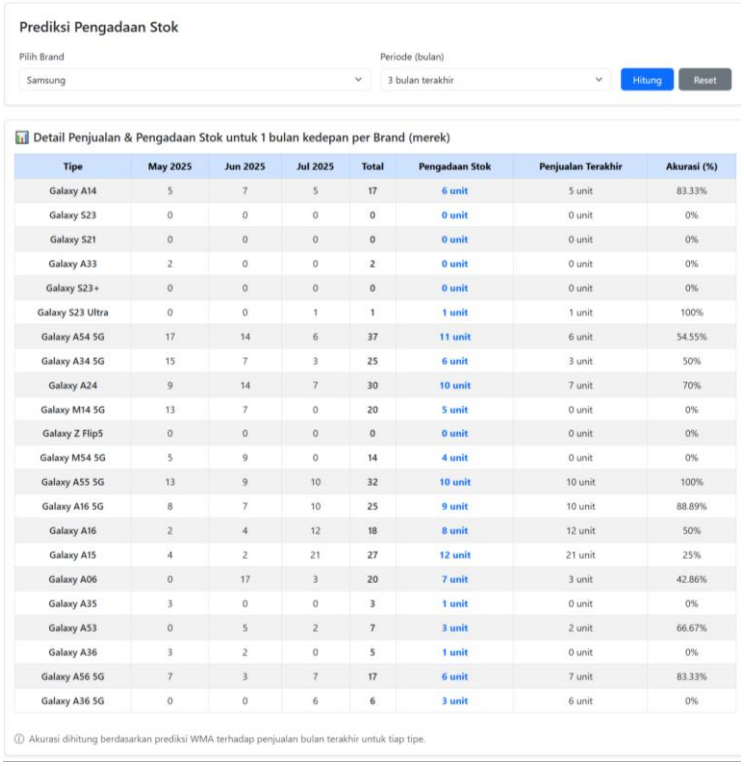
Displays the user account list, including ID, username, name, password (hashed), role, and action buttons for deleting or changing passwords.

2. Implementation of the WMA Method

```php
function hitungWMA(array $penjualan, int $bulan): float {
    $n = count($penjualan);
    $weights = range(1, $n);
    $totalWeight = array_sum($weights);
    $sum = 0;
    for ($i = 0; $i < $n; $i++) {
        $sum += $penjualan[$i] * $weights[$i];
    }
    return $totalWeight > 0 ? $sum / $totalWeight : 0;
}
```

Figure 13. WMA method prediction code

Shows the PHP code for the hitungWMA() function used to calculate mobile stock predictions using the Weighted Moving Average (WMA) method. This function takes an array of historical sales data and the prediction period, then calculates weighted averages to estimate the next stock requirements.



Prediksi Pengadaan Stok

Pilih Brand: Samsung | Periode (bulan): 3 bulan terakhir | Hitung | Reset

Detail Penjualan & Pengadaan Stok untuk 1 bulan kedepan per Brand (merek)

Tipe	May 2025	Jun 2025	Jul 2025	Total	Pengadaan Stok	Penjualan Terakhir	Akurasi (%)
Galaxy A14	5	7	5	17	6 unit	5 unit	83.33%
Galaxy S23	0	0	0	0	0 unit	0 unit	0%
Galaxy S21	0	0	0	0	0 unit	0 unit	0%
Galaxy A33	2	0	0	2	0 unit	0 unit	0%
Galaxy S23+	0	0	0	0	0 unit	0 unit	0%
Galaxy S23 Ultra	0	0	1	1	1 unit	1 unit	100%
Galaxy A54 5G	17	14	6	37	11 unit	6 unit	54.55%
Galaxy A34 5G	15	7	3	25	6 unit	3 unit	50%
Galaxy A24	9	14	7	30	10 unit	7 unit	70%
Galaxy M14 5G	13	7	0	20	5 unit	0 unit	0%
Galaxy Z Flip5	0	0	0	0	0 unit	0 unit	0%
Galaxy M54 5G	5	9	0	14	4 unit	0 unit	0%
Galaxy A55 5G	13	9	10	32	10 unit	10 unit	100%
Galaxy A16 5G	8	7	10	25	9 unit	10 unit	88.89%
Galaxy A16	2	4	12	18	8 unit	12 unit	50%
Galaxy A15	4	2	21	27	12 unit	21 unit	25%
Galaxy A06	0	17	3	20	7 unit	3 unit	42.86%
Galaxy A35	3	0	0	3	1 unit	0 unit	0%
Galaxy A53	0	5	2	7	3 unit	2 unit	66.67%
Galaxy A36	3	2	0	5	1 unit	0 unit	0%
Galaxy A56 5G	7	3	7	17	6 unit	7 unit	83.33%
Galaxy A36 5G	0	0	6	6	3 unit	6 unit	0%

Akurasi dihitung berdasarkan prediksi WMA terhadap penjualan bulan terakhir untuk tiap tipe.

Figure 14. Samsung brand stock procurement results

Image 14 presents the stock procurement prediction results for the Samsung brand. The system calculates estimates for 24 mobile phone models. Prediction

accuracy ranges from 25% to 100%, depending on historical sales patterns. The total recommended stock is 111 units.

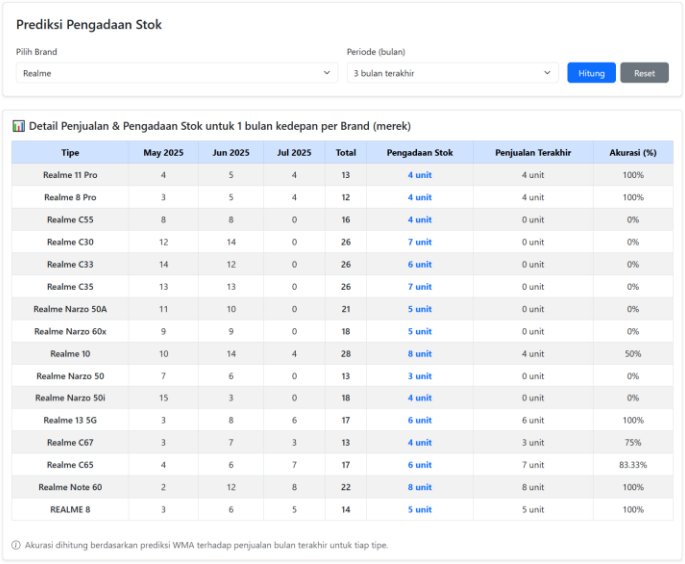


Figure 15. Realme brand stock procurement results

Image 15 displays the stock prediction for the Realme brand. Among 16 mobile phone models, some models achieved 100% accuracy (e.g., Realme 11 Pro), while several models had no sales in the last period, resulting in 0% accuracy. The total recommended procurement for Realme is 88 units.

3. Black Box Testing

The Black Box method is used to test the system's functionality based on specifications, without examining the source code. The focus of the testing is on inputs and outputs, ensuring that each feature operates as expected.

Table 1.

No	Page	Number of Tests	Valid	Invalid
1.	Login/Register	4	4	0
2	Dashboard	4	2	2
3	Phone Stock	6	6	0
4	Incoming Transactions	2	2	0
5	Outgoing Transactions	4	4	0
6	Transaction History	4	4	0
7	Phone Procurement	4	3	1
8	Account Management	6	5	1
Total		34	30	4

Success Percentage Calculation:

$$Success\ Percentage = \frac{valid\ tests}{invalid\ tests}\ x\ 100\%$$

$$Success\ Percentage = \frac{30}{34}\ x\ 100\% = 88{,}24\%$$

Based on the results of the Black Box testing, it can be concluded that the system operates with a success rate of 88.24%. Most functions have worked according to the specifications, especially the core features such as login, stock management, and transactions. However, there are some shortcomings in terms of display responsiveness and page access security, which are recommended to be immediately addressed to improve system quality, particularly in terms of user experience (UX) and security.

CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

Based on the research and discussion, the web-based mobile phone stock procurement system at Tsuraya Cell was successfully developed using the Waterfall method, encompassing requirement analysis, system design, implementation, testing, and maintenance. This structured approach ensures organized development and minimizes implementation errors.

The Weighted Moving Average (WMA) method effectively forecasts stock needs using the last three months of sales data, achieving high accuracy for phone types with consistent sales history, with some types reaching 100% accuracy. However, the method is less effective for types without prior sales data, predicting 0 units in such cases.

Black Box Testing indicated that the system is reliable and functional, achieving a success rate of 88.24%, confirming that core features such as stock management and procurement operate as intended.

B. Recommendations

Based on the research findings, the following suggestions are proposed for future system development:

1. Integrate a financial reporting module to enable comprehensive monitoring of transactions, profit, and cash flow.
2. Add automatic stock notifications to prevent stockouts.
3. Conduct periodic user testing to refine the interface and improve usability.
4. Explore additional prediction methods, such as linear regression or advanced time series, to handle inconsistent sales data, especially for new or less stable phone types.

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