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Design and Implementation of a Web-Based Inventory Management with Offline Capability: A Case Study at PT.XYZ

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Abstract- Traditional inventory management systems encounter substantial difficulties in production settings with restricted IT infrastructure and stringent reliability demands. This study proposes the creation of a web-based inventory management system employing the LAMP (Linux, Apache, MySQL, PHP) stack to resolve machine spare parts stock management challenges that often lead to production downtime owing to limited internet connection in industrial environments. The system is additionally enhanced via the XAMPP framework. The tool facilitates stock data administration, documentation of arriving and outgoing items, tracking of item requisitions, and automated alerts for minimum stock levels or stock depletion, all without necessitating internet connectivity. Field installation results illustrate the system's ability to oversee inventory in real-time offline, produce automated reports (PDF and Excel). System testing employed White Box Testing (WBT) to validate functionality and performance, demonstrating an average response time of under 1 second per data enter and effortless report output to PDF/Excel formats for subsequent analysis. The test showed that the WBT achieved a 100% success rate, confirming that all functions operated as anticipated, and the data can be updated promptly, and providing a dependable inventory management solution for industrial settings with restricted internet connectivity. This research enhances realistic and adaptive inventory systems designed for manufacturing sectors.

Keywords: Inventory Management, Extreme Programming, White Box testing, Web Application, Spare Parts

I. INTRODUCTION

Inventory management is an essential activity that contributes to the success of manufacturing and distribution enterprises. The efficacy of inventory management systems is directly assessed by a company's performance in delivering superior customer service, minimising inventory investment, maximising throughput, and reducing expenses [1], [2].

Efficient inventory management is essential for the seamless functioning of production operations in the manufacturing sector, particularly firms that manufacture aluminium cans. In this industry, the management of machine spare parts inventory presents a considerable problem for machine and electrical specialists, chiefly due to the dependence on manual processes that are frequently imprecise and labour-intensive [3]. The lack of spare parts when required can cause production interruptions, leading to financial losses and diminished productivity. The remote locations of numerous industrial sites worsen this problems, as inconsistent internet availability diminishes the efficacy of cloud-based or online inventory management solutions.

Prior studies have shown that Warehouse Management Systems (WMS) can improve inventory management efficiency via automation and real-time oversight. The necessity for a stable internet connection continues to be a significant barrier to the implementation of WMS in industrial settings with inadequate network infrastructure. Therefore, an alternative solution is required that functions offline while offering additional capabilities such as data collection, inventory management, and precise reporting.

This research examines the creation and execution of a web-based inventory management program designed for the manufacturing sector, specifically addressing the difficulties associated with restricted internet connectivity. The research investigates the design and creation of a system that functions offline, guaranteeing continuous inventory management in remote or network-limited settings. It analyses how such a system may effectively oversee inventory, namely machine replacement parts, to enhance stock control procedures and reduce production interruptions. Additionally, the study evaluates the

system's capacity to generate precise and flexible inventory reports in PDF and Excel formats, hence improving decision-making and managerial supervision.

II. METHODS

A. Inventory Management System

Inventory management has been a primary emphasis of operational research for several decades, especially in the manufacturing industry. A research by [4] demonstrates that Warehouse Management Systems (WMS) may improve inventory management efficiency by optimizing order processing, inventory verification, and transportation protocols, leading to improvements in the timeliness and reliability of goods delivery through thorough assessment. Alternative methodologies such as Just In Time (JIT) [5], [6], [7] and ABC analysis [8] have proven efficient in minimising storage costs while maintaining appropriate inventory levels. This method can be implemented in areas with robust and dependable internet infrastructure. Nonetheless, in certain regions with inadequate technological circumstances, this method is suboptimal and therefore less appropriate for enterprises situated in remote areas.

Web-based technologies like PHP and MySQL are extensively utilized in the creation of inventory management systems. This results from other supporting features, such as user-friendliness, scalability, and proficient database integration capabilities. This approach has a limitation: it requires internet connectivity. This can be achieved by configuring XAMPP, Apache, MySQL, and PHP as local servers to facilitate offline application functionality. This technology allows users to view and handle data offline, a benefit that has been inadequately addressed in previous studies.

The Extreme Programming (XP) have shown efficacy in software development by providing systems that promptly address user needs via quick iterations and ongoing testing. System testing is a vital aspect for ensuring dependability, and the White Box Testing approach has been used for this study since it enables testers to analyse all logical paths inside the source code, confirming that each function operates according to its requirements.

This research combines XAMPP technology, the XP methodology, and White Box Testing to provide a novel and reliable inventory management system. Despite the development of various web-based inventory systems, few prioritise offline functionality in industrial environments with limited internet. This study fills that gap by offering an application that functions successfully offline, while integrating efficient notification and reporting capabilities.

B. XAMPP Open Software

XAMPP represents its fundamental components: X (cross-platform), A (Apache), M (MySQL/MariaDB), P (PHP), and P (Perl). XAMPP operates as a standalone server, enabling local editing, design, and software development. The latest iteration of XAMPP facilitates local database administration with phpMyAdmin without requiring an internet connection and allows for offline upgrades. XAMPP serves as open-source software that operates as a local server, enabling users to develop and test web applications on personal computers without requiring an online server [9].

C. Extreme Programming (XP)

Extreme Programming (XP) is an agile software development methodology applicable to application development. XP guarantees client happiness, superior software quality, and effective project management. It is a dynamic model that underscores ongoing dialogue and the incorporation of novel features and concepts [10].

Extreme Programming (XP) is a software development design that prioritizes cooperation, adaptability, and efficiency via an iterative process. As shown in Figure.1, it consists of four essential phases: (1) **Planning**: encompasses problem identification, user needs assessment, and scheduling; (2) **Design**: wherein the team formulates system designs and diagrams to resolve recognized problems and needs; (3) **Coding:** involving the creation of adaptable, maintainable code to actualize the design; (4) **Testing:** involves evaluating the code to verify its functionality, with modifications implemented as necessary.

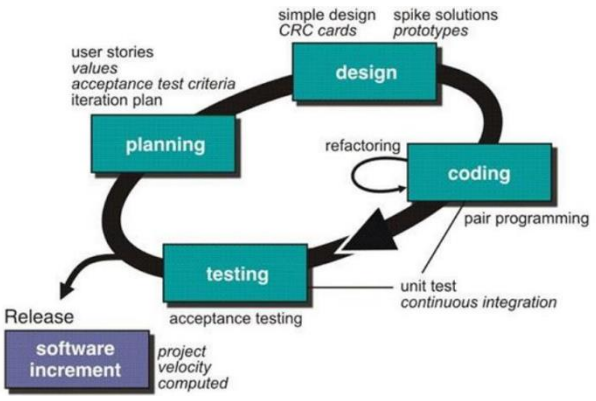

Figure.1 Phases in extreme programming [11]

XP improves software quality and adaptability to evolving user requirements by advocating for approaches like continuous automated testing for early problem identification and favoring effective, straightforward solutions over excessive complexity. This engineering method enhances software quality and addresses uncertain client demands [12].

The XP methodology is employed in this study as it effectively addresses all customer-requested changes and facilitates rapid adjustments in software development [13]. This stage offers the benefit of including brief stages and the repetition of various components based on the project's primary purpose [14], [15].

D. White Box Testing (WBT)

Testing is the process of exercising a program with the explicit goal of detecting errors prior to delivery to the end user [16]. Most organizations recognize the significance of testing in the software development life cycle to identify and eliminate errors. Studies indicate that Software Testing utilizes approximately 40%-50% of total resources, 30% of total effort and 50%-60% of the total cost of software development [17], [18], [19], [20]. The duration necessary for software testing underscores the critical importance of evaluating software prior to its delivery or use by the end-user [21].

White Box Testing (WBT) is an essential method in Extreme Programming (XP) to guarantee code coverage and stability. This testing method involves examining the details of design by utilizing the control structure of procedural program design to partition testing into multiple test cases [22]. This testing performed to ascertain the internal functioning of software and ensure that its internal operations conform to the specifications established through the control structure of a designed technique.

E. Baseline study

The fishbone diagram classifies the fundamental reasons of ineffective spare parts management in the aluminum can manufacturing sector into four principal categories: Material, Method, Measurement, and Man. Each category has been developed to represent particular aspects influencing the issue inside the company's operating framework. Within the Material category, "Obsolete or Incompatible Spare Parts" arises when components become outdated due to machinery enhancements or erroneous ordering, leading to waste and production interruptions.

The Method category highlights "Insufficient Real-Time Transaction Recording for Spare Parts," as manual or delayed documentation in connectivity-restricted environments results in erroneous inventory data. In Measurement, "Unpredictable Lead Times for Spare Parts Procurement" affects production because to inconsistent supplier delivery timetables. Finally, Man emphasizes "Human Errors in Spare Parts Data Entry and Management," including technicians entering inaccurate part codes or amounts, which contributes to stock disparities. This thorough analysis guides the development of an offline web-based system to tackle these difficulties, improve operational efficiency, and reduce stock discrepancies and procurement delays.

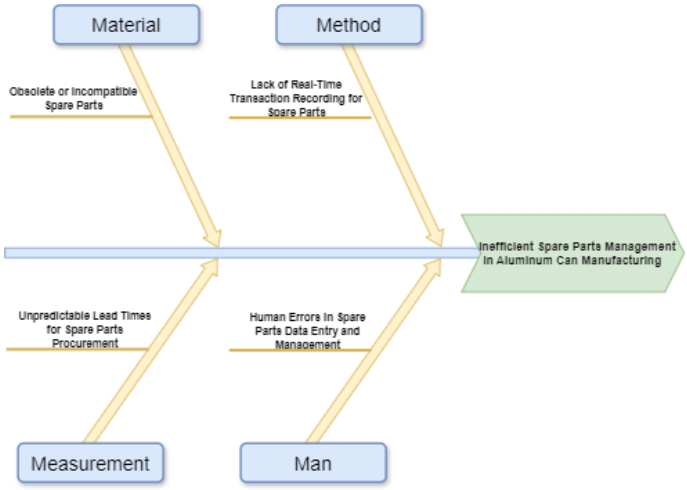

Figure.2 Research Root Cause Diagram

F. Iterative Software Model

This model includes planning, gathering requirements, producing a design, executing the design, checking the implementation, and obtaining client review.

1. Requirement and Specification

This research investigates the development and execution of a web-based inventory management system tailored for the manufacturing industry, notably targeting the challenges posed by restricted internet access. The system development strategy and schedule required four calendar months. The activity started with the identification of requirements via interviews with several stakeholders directly engaged in this system, including the administration, purchasing team, and engineering team. Three functional needs have been identified: the administrator responsible for recording order transactions, purchasing or buying functionalities, and engineering-related capabilities. Furthermore, other non-functional needs have been identified. The criteria include system performance, user interface usability, dependability, and security.

2. Design

The interaction between users and applications in the inventory management system is described by block diagram, as shown in Figure.3. There are three users with distinct authorisations: admin, engineering, and purchasing. This figure has several use cases, of which six serve as examples of test cases: User Access Management, Request Stock Inventory, Stock of Goods, Incoming Stock, Outgoing Stock, and Export Data.

The administrator is tasked with overseeing user accounts, entering, modifying, and monitoring data related to inventory, including incoming and departing products, as well as processing request stock inventory and generating reports on inventory transactions.

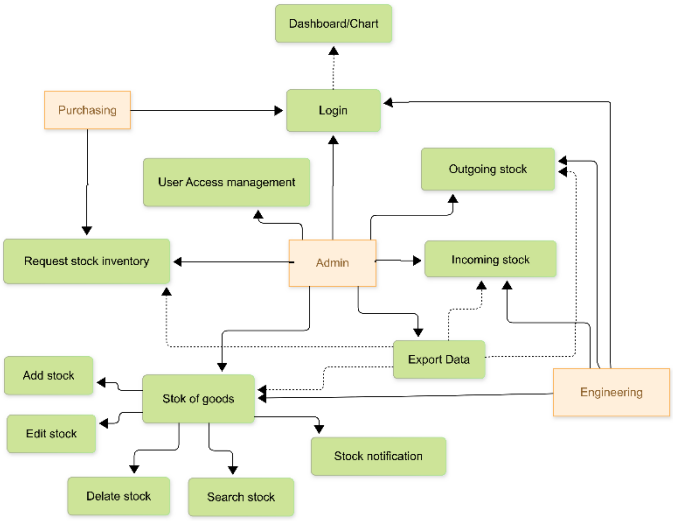

Figure.3 Research Block Diagram

The engineering actor is tasked with assessing the need for items, as well as entering and updating data on inventory levels, arriving shipments, exiting shipments, and requisitions for goods. The purchasing is tasked for receiving and updating the status of goods requests, identifying suppliers, generating purchase orders (PO) with top management approval, and overseeing the inventory of incoming and departing products. This use case diagram serves as the foundation for system design, guaranteeing that all user interactions and system functionalities are well delineated and aligned with operational requirements.

3. System Implementation

The design and evaluation flowchart of the system described in this research are shown in the Figure.4. This standard application is developed using the Extreme Programming (XP) style, which prioritises extensive user participation, flexibility to evolving requirements, and ongoing testing to guarantee software quality. The used technologies include XAMPP as a local server with Apache and MySQL capabilities for offline functionality, PHP for business logic and data manipulation, MySQL as a relational database management system, and HTML, CSS, and JavaScript for a responsive user interface.

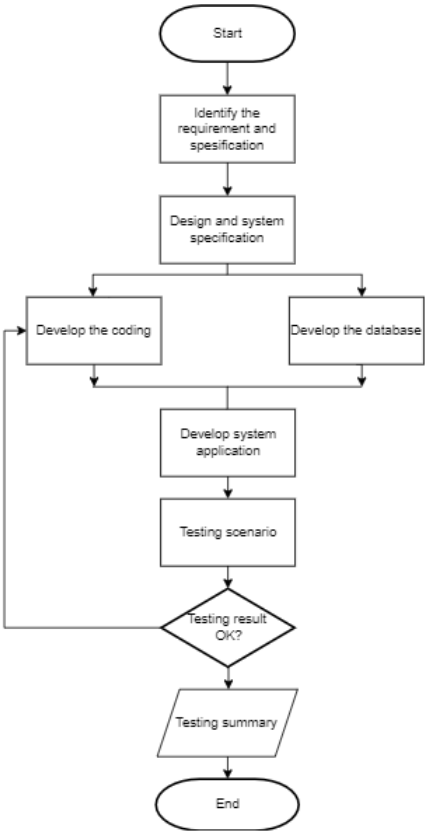

Figure.4 Research Flow Chart

4. Testing and Validation

White Box Testing (WTB) is the most suitable testing methodology for this reseach since it comprehensively evaluates all characteristics of the program, including logic streams and situations that may elude standard functional testing. Employing WTB guarantees that all functionalities inside the products stock application are comprehensively evaluated and operate correctly. This research included testing many features, including the login function, admin administration feature, goods stock feature, incoming goods feature, and goods request feature.

III. RESULT AND DISCUSSIONS

A. Final Result

This inventory application provides many features aimed at enhancing effective inventory management. The Dashboard feature displays two graphs consist of incoming and exiting goods, which illustrating the number of items over the last 15 days.

Figure.5 The dashboard page view

The x-axis represents item names, while the y-axis indicates quantity, with filtering options available by day, month, or year as seen in Figure.5. This system includes the cabinet layout function offers a visual representation of the storage locations of items organised by item code, to enhance item retrieval in the inventory, as seen in Figure.6.

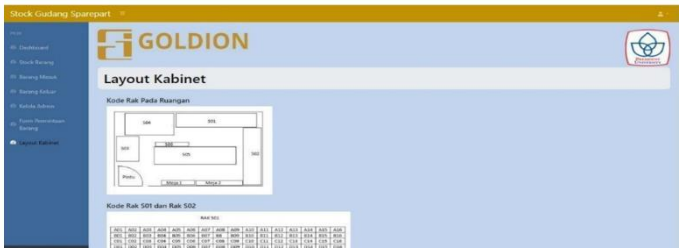

Figure.6 The cabinet layout view

The inventory shown consists of a table including item code, brand, item name, type, and stock levels. The inventory of items is shown in Figure.7. A search function is available to locate items by their codes, facilitating the retrieval process. Furthermore, the program has an item addition feature, an item modification feature for adjusting inventory levels, a feature for item deletion, and an export functionality to convert tables from the application into PDF, CSV, Word formats, printed, and the system offers automated warnings when inventory is depleted.

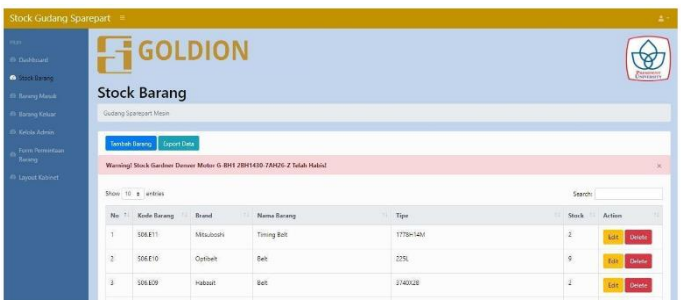

Figure.7 The display of stock page view

The incoming and outgoing goods functionalities document transactions in a table with columns for number, date, item code, brand, name, kind, amount, and description, including capabilities to add, modify, remove, search, and filter by date, along with comparable report export choices. The Inquiry function presents a table that includes the number, date, name, operator, purchase requisition number, item information, quantity, and status, along with options to search, modify status, filter dates, and export reports in many formats. These elements together provide organised, responsive, and operationally suitable inventory management, as shown in Figure.8.

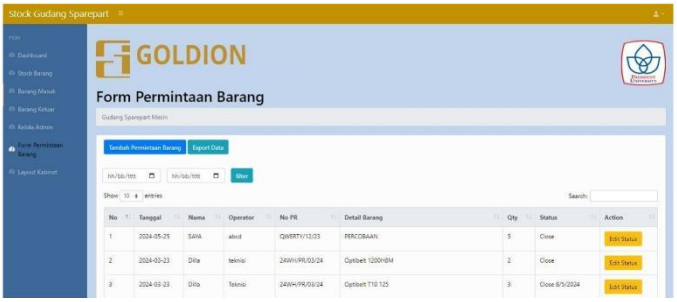

Figure.8 The display of inquiry page view

B. System Testing

Testing is conducted to affirm the effective development of the application design in accordance with the planned characteristics of the desired stock application. The WBT addressed six essential application functionalities:

- Login: validates user credentials.
- User Access Management: manages administrator information.
- Stock of Goods: monitors item stock quantities.
- Incoming Stock: records stock increments.
- Outgoing Stock: documents inventory disbursements.
- Request Stock Inventory: oversees requests for spare components.

All testing are conducted without an internet connection, as seen in Figure.9, which shows the Wi-Fi in the off state. The test results prove that this feature is successful and can be used.

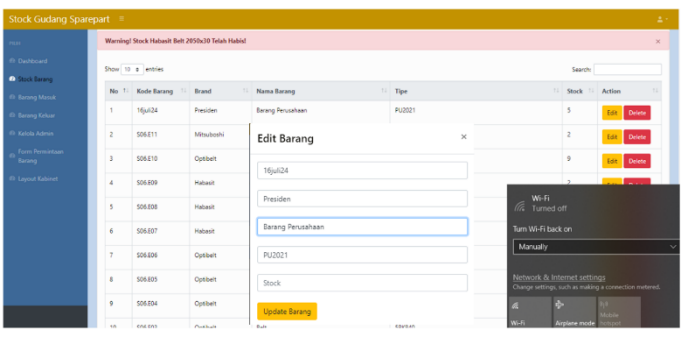

Figure.9 Testing all the feature with offline mode

Test scenarios were developed for each feature, including logical pathways and test cases with both valid and invalid inputs. A synopsis of the scenarios encompasses:

- Authentication: evaluated email and password pairings (valid/invalid) for secure access (e.g., correct email with incorrect password results in access denial).
- User Access Management: assessed CRUD actions (Create, Read, Update, Delete) on administrative data (e.g., adding a new administrator and the data displayed in the table).
- Inventory: evaluated the functionalities of adding, editing, deleting, and searching items, stock depletion notifications, and data export (e.g., stock modification then updated stock documented).
- Incoming Stock: confirmed documentation of incoming goods, date filtration, and data exportation (e.g., inactive the date filter function and all data presented).
- Outgoing Stock: verified documentation of outgoing goods, inventory validation, date filtration, and data export (e.g., surplus stock leading to insufficient stock alerts).
- Request Stock Inventory: evaluated the addition of features, status updates, search functionality, and date filtering (e.g., status modification and the system will be updated).

The test has demonstrated that the WBT achieved a 100% success rate, validating that all features functioned in accordance with expectations, and the data can be updated without delay. Every evaluated logical pathway and condition fulfilled expectations, confirming the application's dependability for production deployment.

IV. CONCLUSION

The testing and analysis of the stock application developed in this research indicate that the application effectively facilitates item searches throughout all menus, including stock, arriving goods, outgoing goods, and goods requests. This program has automated alerts for stock depletion and the capability to present data according to a specified date filter, achieving a test success rate of 100% and providing real-time data updates without latency. The program facilitates offline functionality, enabling users to add, amend, and remove item data while automatically updating stock numbers. The capability to export reports in PDF and Excel formats for stock, arriving products, departing goods, and goods requests is provided, ensuring a fast and precise procedure.

It is advisable to enhance the application by including a change history function to monitor data alterations, refining the interface for user comfort, and integrating barcode scanning technology to expedite the recording and identification of items. These enhancements are anticipated to augment the efficiency and usefulness of the program in stock management.

V. REFERENCES

[1] E. P. A. Soegoto, "Web Based Online Inventory Information System," in *IOP Conference Series: Materials Science and Engineering (INCITEST)*, 2020.

[2] O. B. Erameh K.B., "Design and Implementation of a Web-Based Inventory Control System Using a Small Medium Enterprise (SME) as a Case Study," *NIPES - Journal of Science and Technology Research*, vol. 3, no. 3, pp. 211 - 219, 2021.

[3] R. A.D.Irham and B.A.Ajayi, "Cloud-Based Inventory System for Effective Management of under and Over-stock Hazards," in *The 8th International Conference on Computer and Communication Engineering (ICCCE)*, Kuala Lumpur. Malaysia, 2021.

[4] K. Shanmugamani and F.B.Mohamad, "The Implementation of Warehouse Management System (WMS) to Improve Warehouse Performance in Business to Business (B2B)," *International Journal of Industrial Management*, vol. 17, no. 4, p. 231 – 239, 2023.

[5] J.Haekal, "Inventory Analysis at the Inspection Services Division using Economic Order Quantity (EOQ) and Just in Time (JIT) Approach," *International Journal of Scientific and Academic Research (IJSAR)*, vol. 3 (6), 2023.

[6] Ruqeishi, I. Al and A.Ullah, "Inventory Management: Methods, Approaches, Benefirs and Challenges," *International Journal of Social Sciences and Management Review*, vol. 7, no. 4, pp. 10-18, 2024.

[7] V.Kumar and S.Moses, "Reducing Inventory Costs in Uncertain Supply Chains: A JIT and Stochastic Lead Time Model," *Kaav International Journal of Science, Engineering & Technology*, vol. 12, no. 1, pp. 31-37, 2025.

[8] R.M.Khazaal, "The Integrative Framework between the Theory of Constraints and the Approach to the Cost of Activity (ABC) to Reduce Costs (An Applied Study),"

International Journal of Economics, Management and Accounting, vol. 1, no. 1, pp. 381-396, 2025.

[9] Gaurang, "Accessing XAMPP MySQL database remotely + locally," 19 May 2012. [Online]. Available: https://gaurangpatel.net/accessing-xampp-mysql-database-remotely-locally.

[10] A.Shrivastava and et.al, "A Systematic Review on Extreme Programming," in *International Virtual Conference on Intelligent Robotics, Mechatronics and Automation Systems 2021 (IRMAS 2021)*, Chennai, India, 2021.

[11] R.I.Borman, A.T.Priandika and A.R.Edison, "Implementasi Metode Pengembangan Sistem Extreme Programming (XP) pada Aplikasi Investasi Peternakan," *Jurnal Sistem Dan Teknologi informasi (JUSTIN),* p. 272–277, 2020.

[12] K.Beck and C.Andres, Extreme Programming Explained: Embrace Change (2nd Edition), Boston, MA: Addison-Wesley Professional, 2004.

[13] E.Ngaga, S.D.B.Mau and A. Sinlae, "Mobile Application Inventory Sarana dan Prasarana Sekolah Dasar," *Jurnal Teknik Informatika Dan Sistem Informasi (JATISI),* vol. 9, no. 4, p. 2829–2842, 2022.

[14] I.Ahmad, R.I.Borman, J.Fakhrurozi and G.G.Caksana, "Software Development Dengan Extreme Programming (XP) Pada Aplikasi Deteksi Kemiripan Judul Skripsi Berbasis Android," *Jurnal Inovtek Polbeng Seri Informatika,* vol. 5, no. 2, p. 297–307, 2020.

[15] D.I.Ricoida, Deny and S.Santoso, "Sistem Informasi Penilaian Kinerja Dosen Dengan Metode Extreme Programming (Studi Kasus: STMIK MDP)," *Jurnal Teknik Informatika Dan Sistem Informasi (JATISI),* vol. 5, no. 5, p. 216–225, 2019.

[16] K.Kaur and et.al, "Analysis of various testing techniques.," *International Journal of System Assurance Engineering and Management,* vol. 5, p. 276–290, 2014.

[17] R.Pressman and B.Maxim, Software Engineering A Practitioner's Approach, New York, US: MC. Graw-Hill Education, 2019.

[18] D. Kumara and K. Mishrab, "The Impacts of Test Automation on Software's Cost, Quality and Time to Market," in *7th International Conference on Communication, Computing and Virtualization*, Mumbai, India, 2016.

[19] T.R.Devi, "Importance of Testing in Software Development Life Cycle," *International Journal of Scientific & Engineering Research,* vol. 3, no. 5, pp. 1-5, 2012.

[20] G.J.Myers, T.Badgett and C.Sandler, The art of software testing, Hoboken, New Jersey: John Wiley & Sons Inc, 2012.

[21] P. C. Jorgensen, Software Testing A Craftsman's Approach, Boca Raton, Florida: CRC Press Taylor & Francis Group, 2014.

[22] M. E. Khan, "Different approaches to white box testing technique for finding errors," *International Journal of Software Engineering and its Applications,* pp. 1-14, 2011.