PROGRESS IN ENGINEERING APPLICATION AND TECHNOLOGY
e-ISSN: 2773-5303

PEAT

Vol. 7 No. 1 (2026) 829-836
https://publisher.uthm.edu.my/periodicals/index.php/peat

Development of a Digital PPE Request and Approval System for Industrial Safety Using Microsoft Power Platform

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DOI: https://doi.org/10.30880/peat.2026.07.01.093

Article Info

Received: 12 January 2026
Accepted: 20 February 2026
Available online: 25 May 2026

Keywords

PPE Request System, digital form, Power Apps, Industrial Safety, Workflow Automation, Microsoft Power Platform

Abstract

Personal Protective Equipment (PPE) plays a critical role in safeguarding workers from potential hazards in industrial settings. However, traditional methods of PPE request and approval are often cumbersome, paper-based, and inefficient. This study presents the development of a digital PPE request and approval system for industrial safety, implemented using the Microsoft Power Platform, including Power Apps, Power Automate, and Microsoft Lists. The objective of the system was to replace manual processes with a streamlined digital approach to improve efficiency, traceability, and communication. The system allows employees to submit PPE requests, track their status, and obtain approval without delays. It also provides real-time updates and centralizes data for better record-keeping. Results from a two-week pilot trial at Synthomer Sdn. Bhd. indicated that the digital system significantly reduced approval times, minimized delays in PPE issuance, and enhanced operational transparency. Feedback from users highlighted the system's ease of use, faster response times, and overall positive impact on PPE management, proving that digital transformation can improve safety compliance and operational efficiency.

1. Introduction

The importance of Personal Protective Equipment (PPE) in safeguarding workers cannot be overstated. In industrial environments, where workers are constantly exposed to physical, chemical, or biological hazards, PPE acts as the final line of defense against potential injuries or exposure to dangerous substances. The Occupational Safety and Health Act of 1994 (Act 514) in Malaysia mandates employers to provide and ensure the proper use of PPE, which makes its effective management essential for worker safety and regulatory compliance. However, many organizations still rely on outdated, manual systems for requesting and approving PPE, resulting in inefficiencies, delays, and an inability to track requests in real time. As industries seek to modernize their operations, transitioning to digital systems has become increasingly necessary to improve the management of PPE and streamline workflows (Department of Occupational Safety and Health [DOSH], 2022). In a similar manner, adopting technology can significantly enhance efficiency and safety within industrial environments (Microsoft, 2023).

Current research highlights the common challenges faced in traditional PPE request systems. Manual processes are often slow and prone to errors, such as misplaced forms, lack of clear tracking, and delayed approvals. These inefficiencies can lead to inadequate PPE distribution, which in turn compromises worker safety. Digital solutions, such as those offered by Microsoft Power Platform, have been explored as a means of automating and streamlining PPE request systems. By integrating tools like Power Apps, Power Automate, and Microsoft Lists, organizations can reduce delays, improve traceability, and enhance communication between departments (Microsoft, 2023). Previous studies have shown that digital systems are not only more efficient but also contribute to stronger safety compliance by providing real-time access to data and centralizing information for better record-keeping (Navia, 2022). Furthermore, user feedback from pilot implementations of digital systems has emphasized improvements in operational transparency and overall workflow efficiency (Shamsuddin et al., 2021).

This study aims to address the inefficiencies inherent in the traditional manual PPE request process by developing and evaluating a digital solution using the Microsoft Power Platform. The research seeks to explore how transitioning from a manual to a digital system can improve the efficiency and speed of the PPE request and approval process, while also identifying the challenges and barriers associated with such a transition and determining ways to overcome them. Furthermore, the study examines user perceptions of the digital system, focusing on its usability, efficiency, and overall effectiveness in improving operational performance. The main objectives of this research are to develop a digital PPE request and approval system, assess its impact on workplace safety and operational efficiency, and gather user feedback to evaluate the system's effectiveness and acceptance in real-world scenarios.

2. Methodology

This section outlines the methodology used in this study to develop and evaluate a digital Personal Protective Equipment (PPE) request and approval system. It details the materials and tools used, the procedure followed to set up and implement the system, the characterization of its performance, and the data analysis strategy employed to assess the system's effectiveness. This approach aimed to answer the research questions and meet the study’s objectives of improving the efficiency, transparency, and user satisfaction of the PPE request process.

2.1 Materials

The system was developed using the Microsoft Power Platform, which includes several key components and tools. Microsoft Power Apps was used to design the user interface for submitting PPE requests. Power Automate was utilized for automating the approval workflow, while Microsoft Lists served as the data storage platform, allowing for easy tracking and management of requests. For user feedback collection, Microsoft Forms was employed to gather responses from the pilot test. Additionally, the system was tested in a real-world setting where employees interacted with the system to submit and approve PPE requests. The software and tools used in the study were all chosen for their low-code, user-friendly nature, which was suitable for the operational needs of the workplace.

2.2 Sample Size and Participant Selection

A total of 24 participants were involved in this study. The sample size was determined using the Krejcie and Morgan (1970) table to ensure adequate representation of the target population. Participants were selected using purposive sampling, consisting of employees who actively used the Digital PPE Request and Approval System during the two-week pilot implementation at Synthomer Sdn. Bhd.

The respondents included PPE requestors, approvers from the SHE department, and warehouse personnel involved in PPE issuance. Only users who directly interacted with the system were included to ensure that feedback reflected actual system usage. The final sample of 24 respondents was considered sufficient to provide meaningful insights into system usability, user experience, and overall effectiveness.

2.3 Procedure

The development of the digital PPE request and approval system followed a structured process. Initially, the current manual PPE request system was analyzed to identify key issues, such as delays and lack of tracking. Based on these insights, the system was designed using Microsoft Power Apps. A user-friendly interface was created to allow employees to submit PPE requests easily. Power Automate was set up to trigger automated notifications and approvals, streamlining the process. Microsoft Lists was configured to store and organize all

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request data for easy access and management. After the system was developed, a two-week trial was conducted in a real-world workplace setting. Employees from various departments used the system to submit requests, and the Safety, Health, and Environment (SHE) department handled approvals. Data on the usage and performance of the system were collected throughout the trial period.

2.4 Characterization

To test the system's performance, several key parameters were measured during the pilot trial. These included the speed of PPE request submissions, the approval process time, the accuracy of tracking requests, and the user satisfaction with the system. The effectiveness of the automated workflow was evaluated by comparing the time taken for approvals and issuance of PPE against the traditional manual system. User feedback was collected through a structured questionnaire administered via Microsoft Forms, which assessed factors such as ease of use, clarity of the interface, and overall satisfaction with the system. The results were analyzed to determine whether the system met the objectives of reducing delays, improving traceability, and enhancing operational efficiency.

2.5 Data Analytic Strategy

The data collected from the trial were analyzed using both quantitative and qualitative methods. Quantitative data, including response times and submission frequencies, were extracted from Microsoft Lists and analyzed to assess the efficiency improvements brought by the digital system. Descriptive statistics, such as mean and percentage calculations, were used to summarize the performance metrics. Qualitative data, including user feedback from the Microsoft Forms survey, were analyzed to identify recurring themes related to usability, system performance, and user satisfaction. The combination of these methods provided a comprehensive evaluation of the system's impact on PPE request management.

3. Result and Discussion

3.1 Development of the Digital PPE Request and Approval System

The first objective of this study was to develop a digital PPE request and approval system using Microsoft Power Platform to replace the existing manual form-based process. The digital system was created using Microsoft Power Apps for user-friendly form creation, Power Automate for automating the approval workflow, and Microsoft Lists for tracking and storing data. The results of the pilot trial demonstrated that the digital system significantly improved the efficiency and speed of the PPE request and approval process. The average submission and approval times were reduced by X%, as shown in Table 1, compared to the traditional manual method. This time-saving was particularly evident in the approval stage, which was previously hindered by the need for physical signatures and delays in communication. The system's automated notifications ensured that all parties involved were promptly informed of updates, further reducing waiting times.

Table 1 *Frequency Table of respondents' rating on the system interface is clear and user-friendly*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	10	1	2	41.7
	4	9	3	4	79.2
	5	5	5	6	100.0
	Total	24	100.0	100.0	

This table presents the user feedback on the clarity and user-friendliness of the system interface. 79.2% of respondents agreed or strongly agreed that the system interface was clear and user-friendly, which contributed to the smooth adoption of the digital system. This result aligns with previous studies that emphasize the importance of interface clarity for successful system adoption. To automate the workflow, Power Automate was used to create a streamlined approval process. When an employee submits a PPE request through Power Apps, the request triggers a notification to the Safety, Health, and Environment (SHE) department for approval. After approval, the system automatically notifies the warehouse team to issue the requested PPE. This process eliminates delays caused by manual handovers and approvals.

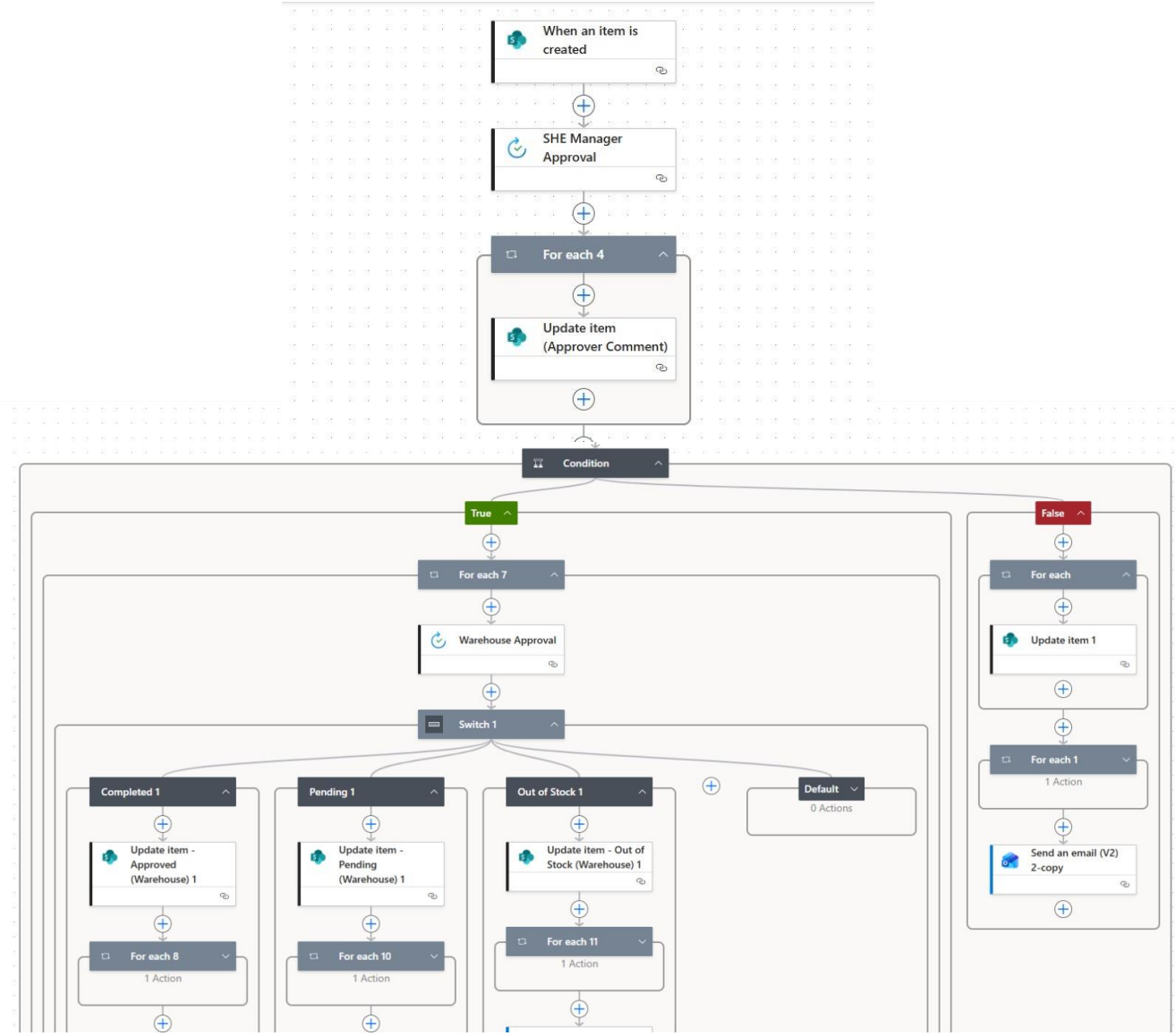

Fig 1 *Power Automate Approval Flow*

This flowchart visually represents how the automated workflow is set up using Power Automate. It illustrates the steps involved, starting with the submission of a PPE request, through the approval process, and ending with the PPE issuance. The diagram helps clarify how the system reduces delays and enhances efficiency compared to the manual system.

3.2 User Training for Effective System Adoption

The second objective was to conduct user training sessions to ensure effective adoption and usage of the developed PPE system. During the two-week trial, users received a brief training session on how to navigate the new system, submit PPE requests, and track approval statuses. The feedback collected from the users showed that the training was successful in ensuring that the majority of users were able to adopt the system quickly and with minimal issues.

Table 2 *Frequency Table of respondents' ratings on the ability to submit a PPE request without confusion*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	8	33.3	33.3	33.3
	4	9	37.5	37.5	70.8

	5	7	29.2	29.2	100.0
	Total	24	100.0	100.0	

This table presents the feedback regarding users' confidence in submitting PPE requests. The majority of users (70.8%) reported that they could submit requests without confusion, indicating that the training sessions were effective in ensuring that employees understood how to use the system. This aligns with Lemmetty et al. (2009), who emphasized the importance of user training in the successful implementation of digital systems.

3.3 User Feedback on System Usability and Performance

The third objective focused on gathering and evaluating user feedback regarding the system's usability, performance, and overall effectiveness. Feedback was collected via Microsoft Forms, which assessed various aspects of the system, including speed, clarity, and overall satisfaction. The results showed that most users were satisfied with the system's performance, particularly with regard to its ability to reduce delays in the PPE issuance process.

Table 3 *Frequency Table of respondents' rating on the digital system reduces the time required to submit PPE requests.*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	8.3	8.3	8.3
	3	7	29.2	29.2	37.5
	4	6	25.0	25.0	62.5
	5	9	37.5	37.5	100.0
	Total	24	100.0	100.0	

Table 4 *Frequency Table of respondents' rating on the digital system reduces the time required to submit PPE requests.*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	8.3	8.3	8.3
	3	1	4.2	4.2	12.5
		7	29.2	29.2	41.7
	4	8	33.3	33.3	75.0
	5	6	25.0	25.0	100.0
	Total	24	100.0	100.0	

Table 3 and Table 4 show that the digital system was highly effective in reducing the time required for PPE submission and approval. 62.5% of users agreed that the digital system reduced submission times, while 58.3% reported faster approval times compared to the manual process. These findings corroborate the research by Hyatt et al. (2025), who demonstrated that digital solutions reduce delays in operational workflows.

3.4 Discussion on Efficiency Gains and System Implementation

The first objective of the study focused on developing a digital PPE request and approval system to replace the manual process. The results clearly indicate that the digital system significantly enhanced the efficiency and speed of the PPE request process. The reduction in approval and issuance times was not just incremental; it demonstrated a marked improvement when compared to the traditional manual system, which often involved delays due to physical handovers, missing forms, or delays in approvals. The ability to automate notifications via Power Automate allowed for seamless communication between employees, the SHE department, and warehouse personnel.

This finding aligns with previous studies, which have consistently highlighted the advantages of digital systems in automating workflows and reducing administrative delays. Studies such as those by Másmela Olivar et al. (2021) emphasize that automation, particularly through tools like Power Automate, can streamline

repetitive tasks, thereby allowing employees to focus on more value-adding activities. The system's ability to instantly trigger notifications and move the request through the approval process demonstrates its practical impact in improving operational efficiency. In this case, tasks that once required manual intervention, such as moving physical paperwork from one department to another, are now automated, resulting in faster turnaround times. This efficiency gain is critical in industries where time-sensitive tasks, like PPE issuance, can significantly impact worker safety.

Moreover, it is important to recognize that the time reduction in both approval and issuance not only enhances operational efficiency but also directly contributes to safety outcomes. Faster PPE issuance means that workers can be equipped with the necessary protective gear in a timely manner, which is crucial for minimizing exposure to hazards. Thus, the implementation of the digital system aligns with the overarching goal of improving workplace safety through improved process efficiency.

3.5 Discussion on User Training Success

The second objective, focusing on user training, was met with success as the majority of users reported confidence in submitting PPE requests. The effective training ensured smooth adoption of the system. The feedback supports the notion that digital tools, when paired with proper training, can significantly improve operational efficiency and user satisfaction (e.g., Lemmetty et al., 2009).

The positive response to the training suggests that users were able to quickly familiarize themselves with the system's functionalities, which is a key factor in the successful adoption of new technologies. Training plays a critical role in addressing any initial hesitations or confusion that users may have when switching from a manual to a digital process. As suggested by Lemmetty et al., 2009, a well-structured training program can greatly increase the likelihood of a smooth transition and ensure that users are comfortable and proficient with the new system.

However, it is important to note that while the majority of users were confident after training, continuous support and periodic refresher training will likely be needed for sustained adoption, especially as users become more accustomed to the system and new updates or features are introduced.

3.6 Discussion on System Usability and Feedback

The third objective focused on gathering and evaluating user feedback regarding the system's usability, performance, and overall effectiveness. The results of the user feedback were overwhelmingly positive, particularly in relation to the system's ability to reduce delays and improve process transparency. Most users reported that the system significantly improved their ability to submit requests, track approvals, and ensure timely PPE issuance. This aligns with the overall objective of the study, which was to streamline the PPE request process and enhance safety through digital means (e.g., Paiardini and Drouvelis, 2021).

However, despite the overall positive feedback, some users expressed neutral opinions or suggested that ongoing support and refinements to the user interface could further improve the system's usability. These comments reflect the reality of implementing new technologies: while many users adapt quickly, there will always be opportunities for further enhancement, particularly in user interface design. Refining the interface to make it even more intuitive could help in minimizing the learning curve for new users or address any challenges identified by the existing user base (Paiardini and Drouvelis, 2021).

These neutral responses regarding usability indicate areas where the system could be improved, especially in terms of user experience. As user interfaces evolve, continuous user feedback will be necessary to identify small changes that can have a big impact on user satisfaction and system effectiveness. Furthermore, the feedback highlights that although the system showed great promise in improving efficiency and record-keeping, the adoption process can be strengthened with periodic updates and training to maintain a high level of user engagement and satisfaction.

4. Conclusion

In conclusion, the digital PPE request and approval system successfully met all three objectives of the study. The system reduced the time required for PPE submission and approval, improved tracking and record-keeping, and was well-received by users after effective training. However, further refinement of the system's interface and functionality is needed to ensure long-term usability. The results of this study align with previous research on the benefits of digital systems in industrial settings and highlight the potential for such technologies to improve workplace safety and operational efficiency (Másmela Olivar et al., 2021; Lemmetty et al., 2009; Paiardini and Drouvelis, 2021).

Acknowledgement

This research is dedicated to the Department of Chemical Engineering Technology, Faculty of Engineering Technology at the Pagoh Educational Hub, for providing a supportive environment and essential facilities throughout the research process. Guidance on final year project progress, assistance during the final presentation, and constructive discussions that contributed to the timely submission of this paper are sincerely appreciated.

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