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Design of Safety Management System Reporting Website at the Politeknik Penerbangan Surabaya

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Abstract

This research aims to design and develop a website -based Safety Management System (SMS) reporting system that can be used by the academic community at the Surabaya Aviation Polytechnic for digital hazard reporting. The background of this research is the lack of an efficient, structured, and easily accessible hazard reporting platform, which impacts the less than optimal identification and follow-up of potential hazards on campus.

The system development method follows five main stages: needs analysis, system design, development, implementation, and evaluation. The system was designed using the PHP programming language with the laravel framework, a MySQL database, and a Bootstrap 4-based interface. The result of this development is a hazard reporting website that features user login, a reporting form, evidence upload, admin validation, and real-time report status monitoring.

The evaluation results indicate that this system supports increased hazard reporting effectiveness, simplifies the documentation process, and raises safety awareness within the Surabaya Aviation Polytechnic. This system is expected to contribute to the implementation of a safety culture in accordance with ICAO standards and support the development of a Safety Management System in aviation educational institutions.

1 INTRODUCTION

Safety is an absolute priority in aviation and must be managed through structured, proactive systems and measures. As a vocational education institution under the Ministry of Transportation, the Surabaya Aviation Polytechnic is responsible not only for producing aviation professionals but also for instilling a safety culture throughout its academic community. However, several incidents, such as the slipping of a cadet due to a water leak and the occurrence of flooding during heavy rain, reflect the weakness of the hazard identification and reporting system on campus. This indicates the suboptimal implementation of the hazard reporting mechanism, which should be an integral part of the institution's Safety Management System (SMS).

To address these issues, an information technology-based solution is urgently needed. A web-based reporting system offers advantages in real-time data monitoring, structured recording, and transparent follow-up. Such a system has been recommended by ICAO (2018) and aligns with Minister of Transportation Regulation Number PM 69 of 2021 concerning the implementation of SMS (U.S. House, 1991).

Previous studies have demonstrated the benefits of web-based safety reporting systems (Wachdin et al., 2022; PROCESS Corporation, 1996). Wachdin et al. (2022) developed a safety reporting application for ATS laboratory activities to encourage voluntary reporting (H. V. Habi & Messer, 2021). Krismonica (2020) designed a web-based OJT reporting repository system that improves the accessibility of academic data (Hijmans & van Etten, 2012). Anwar et al. (2022) also emphasized the importance of digital systems for safety training and hazard reporting (D. Ebehard & Voges, 1984). However, most of these studies focused only on reporting academic activities or limited functions, rather than on a general hazard reporting system within the context of aviation education institutions as a whole.

A gap identified in this study is the lack of a centralized hazard reporting system accessible to all parties within non-operational institutions such as aviation campuses. Existing systems tend to be partial and not yet integrated into the overall institutional SMS scheme. Therefore, a new approach is needed to fill this gap.

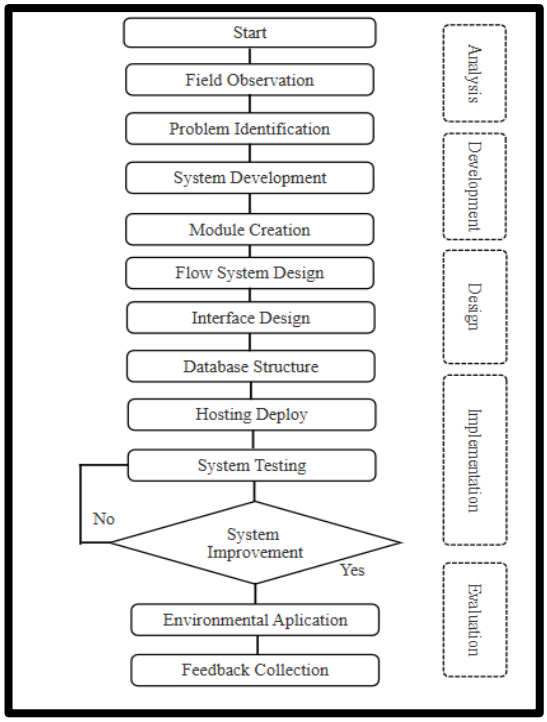
This research offers a novel approach in the form of developing an integrated web-based hazard reporting system specifically designed to support SMS implementation at the Surabaya Aviation Polytechnic. The system is built using the Laravel framework, a MySQL database, and a responsive interface based on Bootstrap 4. The Model-View-Controller (MVC) architectural approach is applied to ensure the separation of program logic, display, and database for easier development, security, and efficiency (G. O. Young, 1964; W.-K. Chen, 1993).

The purpose of this research is to design and evaluate a web-based SMS reporting system to support the safety management of facilities and infrastructure at the Surabaya Aviation Polytechnic. This research also analyzes the system's operational flow and its suitability to the institution's needs. Theoretically, this research is based on the principles of user-oriented design (Krug, 2014) and database integrity (Elmasri & Navathe, 2017), which serve as the foundation for building a reliable and user-friendly system.

2 METHOD

This research uses a Research and Development (R&D) approach with the ADDIE (Analysis, Design, Development, Implementation, Evaluation) development model, which systematically supports the information system design process (G. Brandli & M. Dick, 1978). The ADDIE model was chosen because it is considered effective in producing educational technology products based on user needs, while also enabling a continuous evaluation process of the developed system (R. Fardel et al., 2007).

This research aims to design and develop a website-based Safety Management System (SMS) reporting system at the Surabaya Aviation Polytechnic. The ADDIE model is implemented in five main stages. In the Analysis stage, observations and interviews are conducted to identify problems and user needs (Philip B. Kurland & Lerner, 1987). The Design stage includes the design of the database structure, user interface, and system flow. The Development stage encompasses the application development process using Laravel (PHP), MySQL, and Bootstrap 4 (P. Kopyt et al., 2016).



Picture 1. Research Flowchart

The Implementation phase involved limited system deployment within the campus environment, followed by an Evaluation phase to measure the system's functionality, reliability, and usability through testing. The research subjects included cadets, lecturers, and academic staff at the Surabaya Aviation Polytechnic who were directly involved in hazard reporting activities.

Data was collected through interviews, direct observation, documentation, and questionnaires (J. U. Duncombe, 1959). Interviews were used to explore existing manual reporting issues. Observations were conducted to map the hazard reporting workflow. Documentation included collecting previous reporting data, while questionnaires were used in the system evaluation phase to gauge user experience with the developed system (D. B. Payne & J. R. Stern, 1985).

The hazard reporting system was designed using a Model-View-Controller (MVC) approach to ensure modularity, efficiency, and ease of development. The Laravel framework was chosen because it supports the MVC architecture and has a robust ecosystem. MySQL served as the relational database, storing reporting data such as hazard category, incident location, description, time, and handling status. The interface is designed with Bootstrap 4 to be responsive, user-friendly, and easily accessible across multiple devices (Transmission Systems, 1985).

Fitur The system's main features include: (1) Hazard reporting form, (2) Report status, (3) Automatic notifications, and (4) Report dashboard. The dashboard displays report trends by time, category, and location, as well as Key Performance Indicators (KPIs) such as response time and report completion rate.

Data analysis was conducted descriptively to evaluate the effectiveness of the developed system. Testing was conducted using a black-box testing approach, including:

1. Functionality testing – to ensure all system features operate as designed (A. Brahms, 1967);

2. Reliability testing – to assess system stability under high usage loads (Comite & Pierdicca, 2021);

3. Usability testing – to assess the extent to which the system can be easily used by end users (U.S. Department of Health and Human Services, 2013).

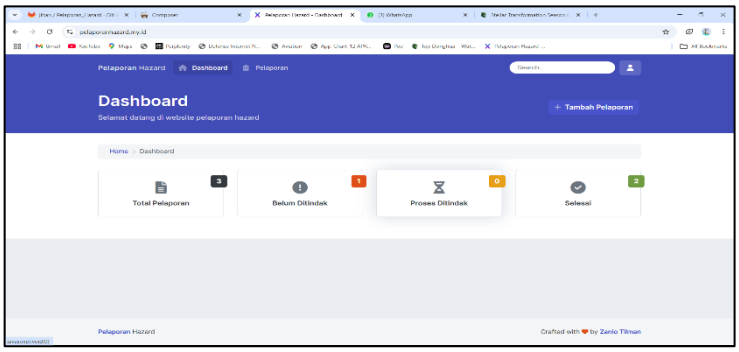
Questionnaire data was analyzed to measure user acceptance of the system, while observation and interview results were used to further validate the system's context and requirements.

3 RESULTS

This research resulted in a website-based Safety Management System (SMS) reporting system designed to improve the effectiveness of hazard reporting within the Surabaya Aviation Polytechnic. This system was developed through the systematic stages of the ADDIE model: Analysis, Design, Development, Implementation, and Evaluation. The primary

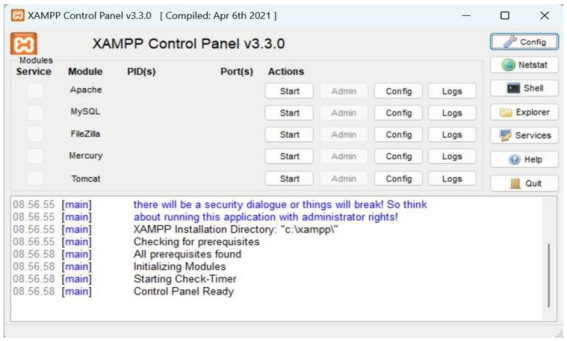
output is a digital platform accessible to users of various roles, including reporters, coordinators, and unit heads (D. Ebehard & E. Voges, 1984).

During the analysis phase, observations and interviews were conducted regarding the manual reporting procedures currently in use. The results revealed that the process has numerous weaknesses, such as late reporting, poorly documented data, and low user involvement in follow-up on reports.



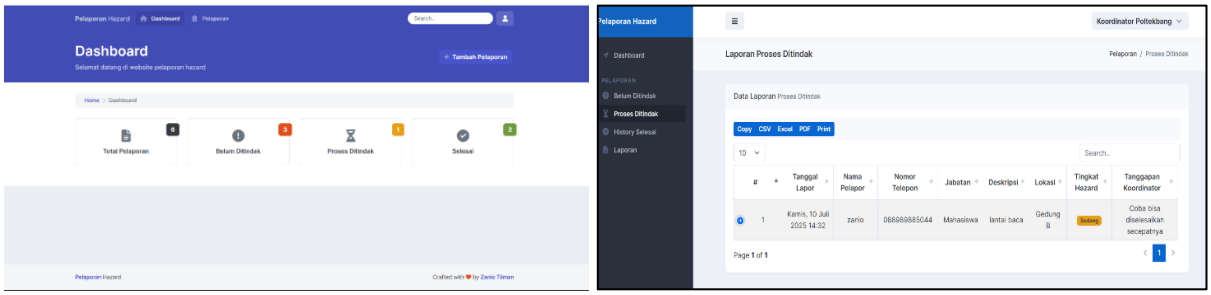
Picture 3. Website dashboard display

Based on these findings, a system was designed to provide user login features, a hazard reporting form, follow-up notifications, and a dashboard-based report summary display (B. Smith, 2014). The system was designed using the Laravel framework with a MySQL database and a Bootstrap 4-based interface, which supports responsive display. The system development process was carried out in a modular manner and began with the installation of supporting tools such as XAMPP and Visual Studio Code, followed by the creation of the database structure and coding of the user interface (Wigner, 1965).



Picture 4. XAMPPDislplay

The developed system includes several key pages, including a login page, a reporting form, a follow-up page for coordinators and unit heads, and a page for completed reports. All these features are designed to integrate with each other and provide a clear, digitally documented hazard reporting workflow.



Picture 5. User dashboard page view (left); Reporting page (right)

Implementation results demonstrate that the system can be effectively utilized by users according to their respective roles. Users can log in through their respective accounts, submit reports, and monitor the report's status until completion. Admins and coordinators can follow up on each report based on its urgency and the hazard category reported.

The evaluation also involved two expert validators, one for the material and the other for the media. Validation results showed that the system received excellent scores in terms of material and display adequacy, strengthening the system's reliability and effectiveness as a hazard reporting tool (IEEE, 1969).

Table 1. Black box test results

No	Tested Features	Test Steps	Expected Results	Expected Results
1	Login Page	Enter a valid username and password	User successfully logs into the dashboard	Success
2	Login Validation	Enter an incorrect username/pas	An error message "Login failed" appears	Success
3	Hazard Reporting Form	Complete the form and submit	The report is entered into the system, and a notification appears	Success
4	*Upload Supporting Documents/Photos*	Upload image files (.jpg/.png) when the report is complete	The file is successfully uploaded and saved	Success
5	View Report Status	Log in as a user and click the "Report Status" menu	The report status is displayed according to the latest data	Success
6	Status Change Notification	The admin changes the report status to "Completed."	*The user receives a status update notification*	Success
7	Admin - View All Incoming Reports	*Log in as an admin, open the report dashboard*	All reports are displayed according to their status category	Success
8	Admin - Validate and Follow Up Reports	he admin clicks "Process Action" and inputs a response	The response data is saved, and the report status changes.	Success
9	Export Data (PDF/Excel)	The admin clicks the "Export" button for the Hazard report	PDF/Excel file successfully downloaded	Success
10	Report Data Search	Use the search feature to find reports based on location/description	he system displays reports that match keywords.	Success
11	Responsive on Mobile Devices	Access the website via mobile	he display adapts to the screen size (mobile-friendly).	Success

The evaluation was also conducted with the involvement of two expert validators, one for the material and the other for the media. The validation results showed that the system received excellent scores in terms of material and display feasibility, strengthening the system's reliability and effectiveness as a hazard reporting tool.

These results indicate that the developed system meets the research needs, providing a digital solution for the hazard reporting process, which has previously been carried out manually. The system's effectiveness was further strengthened

by expert validation and user evaluations, which indicated that the system was easy to use, informative, and relevant to field needs.

The results of this study also reinforce the theory that information systems designed with user needs in mind and based on a modular architecture can improve service efficiency and data management. This research complements previous studies, such as those by Wachdin et al. (2022), Krismonica (2020), and Anuwar et al. (2022), which also developed web-based reporting and training systems (Motorola Semiconductor, 1989).

The success of this system also demonstrates that the ADDIE approach is not only suitable for developing learning media but can also be applied in designing institutional information systems (Payne & Stern, 1985). The combination of technical design, functional testing, and user validation resulted in a system that is not only functionally usable but also supports a campus safety culture through the active involvement of the entire academic community.

Thus, the results of this study not only resolve the previously ineffective hazard reporting problem but also contribute to the development of a web-based system that supports the implementation of Safety Management Systems in aviation vocational education environments. This system is expected to be adapted by similar institutions as part of a technology-based safety improvement strategy (T. D'Martin & S. Soares, 2019).

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