Implementation of a Digital-Based Hazardous Work Licensing Management System

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Article Information	Abstract
	Implementing a digital-based hazardous work licensing management system at PT Citra Palu Minerals is intended to enhance the efficiency and transparency of the work permit process. The research methodology involves a qualitative approach, Agile methodology system development, and integration with WhatsApp for notifications. The research findings indicate that this system simplifies the submission, approval, and monitoring of work permits in a structured manner, thereby reducing the risk of work accidents. Black box testing demonstrates that the system's performance meets expectations, while the questionnaire results indicate a high level of user satisfaction with an average score of 4.3 out of 5. Implementing this system can serve as a model for enhancing occupational safety and health management in similar industries.

A. Introduction

In this era of globalization, the rate of use of technology is increasing. This is also related to the level of internet use [1]. Advances in hardware and software technology aim to enable the collection of various data, which can then be processed into information. Therefore, computer technology has become important for determining the quality of certain products and is essential for maximizing profits [2].

In 2017, there were 123 million cases of work-related injuries, an increase of more than 20% compared to 2016. In addition, the number of cases increased to 157,313 in 2018 [3]. Based on law number 4 of 2009 where Minerals and Rock Resources are replaced by law number 3 of 2020 [4]. Risks associated with business operations due to fire include: fire sensitivity from glass processes, burnt bearings, easily broken unprotected cables or flexible electrical panels that result in fire sensitivity [5]. This means that the implementation of K3 (Health and Work Ethics) in an organization is quite important and must be in accordance with established policies [6].

Licensing procedures for carrying out work are very important, which aims to ensure that work with high potential risks is carried out in an ethical way. One procedure that is often used is the work inspection procedure, which is also one of the safest operating procedures in a procedural unit [7].

Designing a system, the authenticity of an approval process can be ensured to be genuine by using existing problems [8]. Several things that need to be followed up are documented in Standard Operating Procedures (SOP) based on company policy, where each company has its own policy [9].

Based on research conducted [10] revealed that the system at PT. Etowa Packaging Indonesia has not fully implemented Occupational Safety and Health (K3) standards in the company environment. This could potentially endanger workers' safety when carrying out work in the field. Lack of supervision and implementation of adequate work safety can increase the risk of work accidents. Researchers revealed that companies still do not provide appropriate personal protective equipment (PPE), such as gloves, masks and ear plugs, for employees who carry out work in the field.

The implementation of the management system in this research is an important effort in the form of the company's commitment to ensuring occupational safety and health for all employees. This system is the key to creating a work environment that is safer, more controlled and adheres to applicable procedures. A structured licensing process, from application to monitoring, through a digital system is the key to creating a safe work environment that complies with company regulations. Integration between the WhatsApp system and application allows effective control over the implementation of dangerous work, thereby minimizing risks that may arise.

B. Research Method

In this research PT. Citra Palu Minerals (PT. CPM) is a gold mining company in Palu City, Central Sulawesi which is a research site [11]. The research method used is analysis with a qualitative approach focusing on understanding existing data as a whole [12] shown in Figure 1.
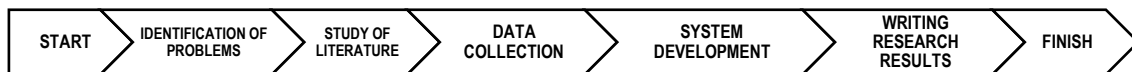
| START | IDENTIFICATION OF PROBLEMS | STUDY OF LITERATURE | DATA COLLECTION | SYSTEM DEVELOPMENT | WRITING RESEARCH RESULTS | FINISH |

Figure 1. Research Flow

The stages shown in Figure 1 are as follows :
Identify the Problem
This research is motivated by the problems faced by PT. CPM, namely the process of processing work permits which is still done manually. This has an impact on slow work permit approval processes, the potential for losing important documents, and difficulties in monitoring the work permit approval status.

Literature Study
At this stage, researchers conducted a literature review to understand the concepts and best practices in managing work permits, as well as identifying technological solutions that can be applied in the hazardous work permit system..

Data Colecction
This research uses a data collection approach through in-depth interviews with related parties in the company, field observations, and analysis of relevant documentation.

System Development
In the system development process, this research adopts the Agile Software Development methodology. Several advantages of using this method in application development include the ability to evaluate the suitability of the system to user needs, minimizing the impact if errors or failures occur, both material and non-material and reducing the risk of non-technical problems occurring during the implementation of the device strategy soft [13].
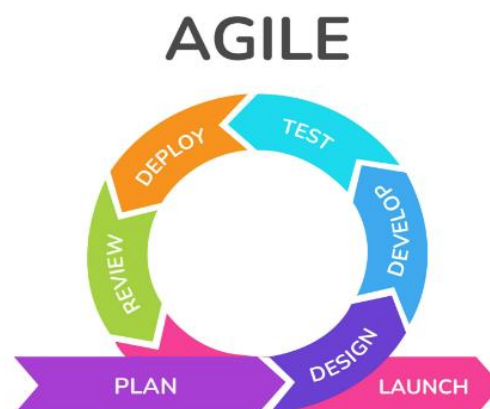
Figure 2. System Development Method

Figure 2 shows the process of system development stages using the agile method. The following are the stages of implementing a development system using the agile method :

a. Plan

At this stage a dangerous work permit management system is created which is equipped with quantitative methods. Then increasing process efficiency to increasing transparency is very important, with the aim of achieving detailed results including features that will be included with user needs which must be fulfilled in the dangerous work permit management system properly, and in accordance with company needs.

b. Design

In the system design phase, the main focus is determining the system architecture, designing the user interface, and designing the database. To support an effective design process, the use of flowcharts and use cases plays an important role. Using these two techniques in an integrated manner can improve design quality and ensure the system meets specified specifications.

c. Develop

Phase of implementing the hazardous work permit management system at PT. CPM includes installation, configuration, and data migration, taking into account user and stakeholder input to ensure the system is acceptable and usable. In the development, JavaScript was used to provide interactivity and responsiveness to the interface, React.js to build a modular, efficient and scalable interface, and MongoDB to manage complex and structured permissions data, resulting in a more interactive, responsive and effective system.

d. Test

System testing stage at PT. CPM involves executing pre-designed test cases. Researchers carried out a comprehensive evaluation of the functionality, reliability and quality of the system, including using a black box testing method which focuses on functionality testing [14]. Test results, including failure or problem findings, are well documented to be used as a reference for system improvements and improvements.

e. Deployment

The system implementation phase includes the process of installing software, setting configurations, and moving data into the new system. In this stage, feedback from users and other stakeholders must be considered to ensure the system can be accepted and used effectively.

f. Review

The system evaluation stage is carried out to assess the effectiveness of the testing team and the testing procedures that have been implemented. Analysis of test results, including questionnaire testing using the EUSC (End-User Satisfaction Checklist) method [12] involving 20 respondents from the company, as well as user feedback are used to identify areas for future improvements or improvements to the system.

g. Launch

In this phase, the Dangerous Work Permit Management system which has been tested and approved, is introduced to users. This stage also includes monitoring system usage and providing technical support to users to ensure a smooth transition to the new system.

Several supporting components in this research are as follows :

1. Diagrams and Flowcharts

A flowchart is a graphical representation that depicts the process flow, steps and their relationships in a program procedure. Flowcharts help in analyzing, planning, and programming to break down problems into manageable and operable parts. Apart from that, use case diagrams are also used to describe interactions between actors (users) and the system as well as the features provided by the system. The use of flowcharts and use case diagrams often makes it easier to solve a problem during the next evaluation [15]. Flowcharts can be used to represent manual processes, processing, or a combination of both. In building a flowchart, a standardized set of symbols is needed [16].

2. Approval Process

The approval process plays an important role in ensuring that an action or change is carried out in accordance with applicable procedures. The contribution of the approval process is to improve compliance, reduce risks and ensure informed decision making. Through an effective approval process, companies can ensure that critical activities have gone through the appropriate review and authorization stages. This helps identify and mitigate potential problems or unintended consequences before an action is implemented [17][18].

3. Hazardous Work Permit System

The Work Permit System is an important administrative procedure to ensure hazardous work processes are carried out safely and effectively. A work permit functions as a labor document submitted to the Occupational Safety and Health (K3) system to identify potential risks, assets that can be used for mitigation, and monitor the progress of hazardous work [19]. This system contributes to identifying hazardous types of work, assessing the risks involved, as well as establishing safe work procedures. Apart from that, work permits can also be used as a tool to track the progress of high-risk work and ensure compliance with applicable K3 regulations. Thus, the effectiveness of implementing the Work Permit system is a key element in ensuring worker safety and operational sustainability in high-risk work environments.

4. WhatsApp

WhatsApp is a messaging and social networking application platform that aims to replace the function of short message services (SMS) through the use of an Internet connection [20]. WhatsApp's main contribution is providing an effective notification system, so that users can immediately find out about incoming messages and interact quickly.

C. Result and Discussion

1. System Development and Design

The use case diagram used in this research to design a dangerous work permit management system is shown in Figure 3. This diagram describes the interaction between the actors involved in the system as well as the main functions of the dangerous work permit system at PT. CPM.
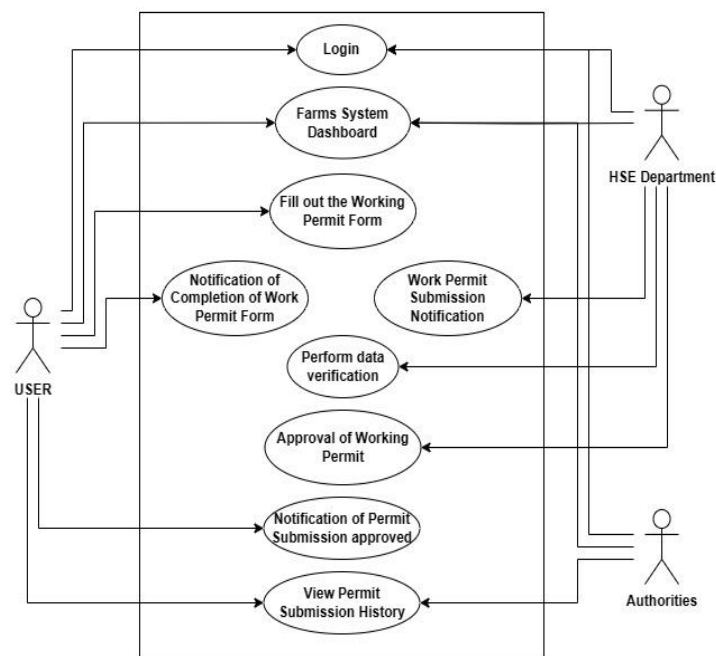
Figure 3. Management System Use Case

The flow diagram in Figure 4 functions to explain the flow and sequence of steps that occur in the system, starting from submitting an application by the applicant to final approval by the authorized party. Through systematic visualization, this flow diagram helps identify and map each stage of the existing process.
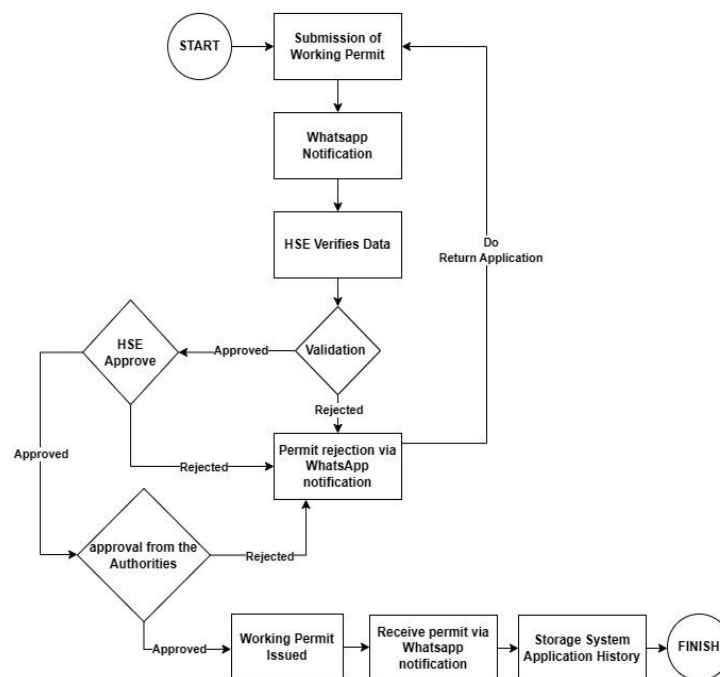

Figure 4. Management System Process Flow Diagram

2. Implementation

This management system is designed to increase the efficiency of the dangerous work permit application process at PT. Citra Palu Minerals. This system facilitates the application and issuance of work permits more quickly and in a structured manner, so that work can be carried out according to company regulations. Through the system, the process of requesting, approving and monitoring work permits is managed systematically and transparently.
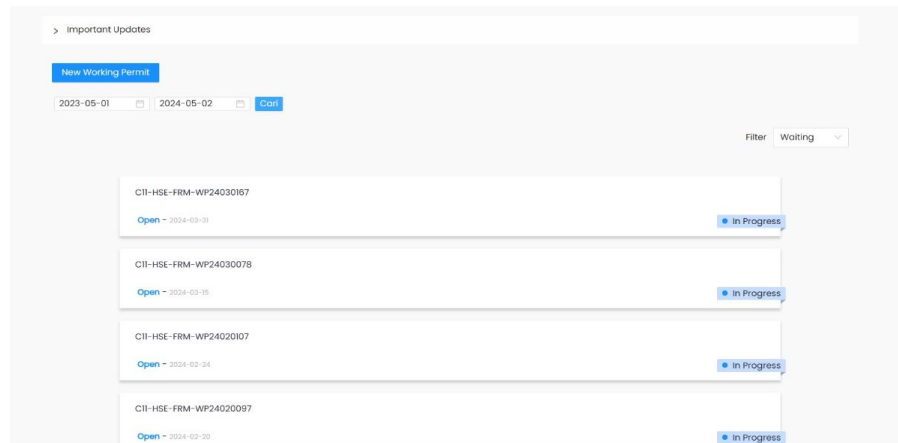

Figure 5. System Home Page

In Figure 5 is a page that displays work permits that have been carried out by the user. Where on this page users can filter the date of application for a work permit, the filters for application for a work permit include: waiting, approved, reject, closed, cancel, and monitoring. On this page, users can also directly apply for work permits.

Figure 6. General Information Filling Page

Figure 7. Attachment Filling Page and General Preparation

Then in Figure 6, there is a page for filling out work permit applications, which is a page for users to apply for dangerous work permits. Then in Figure 7 is a page that must be filled in by workers where documents need to be entered before the

application is completed, for example in dangerous types of work, users must attach mandatory documents, namely the SOP Attachment to the work permit, and don't forget to fill in the work implementation preparation form before starting the application. work permit.
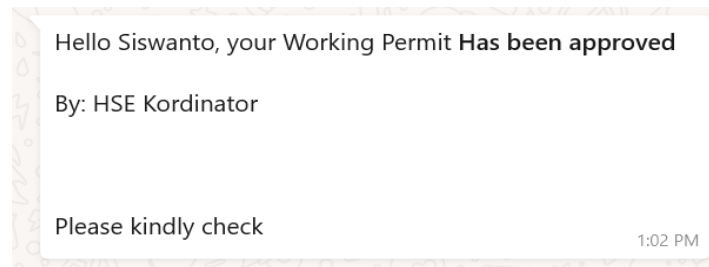

Figure 8. Approval WhatsApp Notification Display

In figure 8 is a display of the hazardous work permit approval notification that has been approved by the HSE Team and related parties. This notification will go directly to the number of the worker who submitted the application.

3. *Blackbox* test results

The black box testing results show that the system works according to what was previously designed. Testing shows extraordinary performance which is in line with what was expected. The findings in table 1 are a display of the results of black box testing.

Table 1. Blackbox Testing Results

No	Test Case Model	Test Scenarios	Expected Test Model	Testing Output
1	View the history of filling out working permits	Open the history page menu	The system will display the history of filling out the working permit	In accordance
2	Make a working permit	Click the "New Working Permit" button, you will enter the working permit creation page	After clicking the "New Working Permit" button, the website display will go to the working permit filling page	In accordance
3	Search for submission history data	Set the date of the data you want to search for, then click the "Search" button	After setting the search date, the system will display data according to the historical date of filling out the working permit	In accordance
4	Adding Document Files	Select the "Upload PDF File" button to add the required documents	After clicking the "Upload PDF File" button, users can add the required documents according to the working permit form	In accordance
5	Whatsapp Notification	Whatsapp notification will appear after applying for a working permit	After the user fills in the working permit, a notification will go to the HSE group, to verify the data	In accordance

| 6 | Carrying out Approval | The work permit will be approved by the relevant parties | After the work permit application is made, the relevant party will approve the permit via WhatsApp notification and will display results in the system that the permit is approved and will also send notification of approval received to the author of the approval. | In accordance |

4. Measuring System User Satisfaction

Results of measuring user satisfaction with the Dangerous Work Permitn System that has been implemented. Through the EUSC method, user satisfaction is assessed based on several dimensions, namely content, accuracy, format, timeliness and ease of use. The results of the questionnaire, as presented in Table 2, show the range of values for the level of user satisfaction with the system that has been implemented.

Table 2. Range of User Satisfaction Values Using the EUSC Approach

No	Variable	Satisfaction Level
1	1 to 1,79	Very Dissatisfying
2	1,8 to 2,59	Not satisfactory
3	2,6 to 3,39	Doubtful
4	3,4 to 4,91	Satisfying
5	4,92 to 5	Very satisfactory

Based on the results of questionnaire data processing, as listed in Table 3, the average value of user satisfaction with the Dangerous Work Permit System was obtained.

Table 3. Questionnaire Results Using the EUSC Approach

No	Variable	Satisfaction Level	Information
1	Content	4.2	Satisfying
2	Accuracy	4.3	Satisfying
3	Format	4.1	Satisfying
4	Ease of Use	4.2	Satisfying
5	Punctuality	4.4	Satisfying
	Average Satisfaction Level	4.3	Satisfying

Based on the results of the questionnaire, researchers concluded that the use of the Dangerous Work Permit System is highly recommended with an average satisfaction rating of 4.3. This system has been proven to be able to provide a good level of satisfaction for users in carrying out the work permit approval process safely and according to procedures.

5. Conclusion

This research shows that the implementation of a digital-based hazardous work permit management system at PT. Citra Palu Minerals has succeeded in increasing the efficiency and transparency of the licensing process. The system designed allows the application, approval and monitoring of work permits to be carried out more

quickly and in a structured manner, thereby minimizing the risk of work accidents. Integration with WhatsApp also provides effective notifications, ensuring workers are always informed about their permit status.

The results of system testing using the black box method show that the system functions as designed, providing extraordinary performance. In addition, the results of the user satisfaction questionnaire show that this system is very well received, with an average satisfaction level of 4.3 out of 5. This confirms that this system is able to provide high satisfaction and supports the implementation of dangerous work in accordance with established safety procedures.

6. Acknowledgment

7. References

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