Occupational Health and Safety Management System in Engineering Faculty of Diponegoro University Using Scrum Model

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ABSTRACT

ISO 45001 is a standard that provides a framework for an organization to manage risks and opportunities to help prevent work-related injury and ill-health to workers. In campus area, there is also injury and ill-health possibilities happened to student, lecturer, laboratory assistant, or other academic staff especially in laboratories. This work proposes the development of occupational health and safety management system in Engineering Faculty of Diponegoro University. The methodology used is Scrum Model. The Test Case also used to make sure the application meets the Client expectation. The result showed that the methodology used reduces the design time and lead to an application that meet Client expectation.

CCS CONCEPTS

•Software and its engineering~Software creation and management~Software development process management~Software development methods~Agile software development•Information systems~Information systems applications

KEYWORDS

ISO 45001 application, Scrum Model, agile, real-time software management.

1 Introduction

Safety in the work place is one of important issue that must be considered, it means there is a prevention concept to reduce risk from varies hazard and threads [13]. There are several examples of occupational health and safety management systems applied in International Platforms in several country [3]. ISO 45001 is an international standard provides framework to manage the occupational health and safety issue in the organization [6,7]. ISO 45001 implement Plan Do Check Action (PDCA) cycle in maintaining the standard management, so that the occupational health and safety issue in the organization run properly and minimize the possible risk and accident to occur. Silva and Amaral [16] also said there are several critical factors of success and barriers for the implementation of occupational health and safety management systems. It is also said that there are some indicators must be considered to manage occupational health and safety in the workplace.

To perform safety in the workplace, an organization can do Hazard Identification, Risk Assessment and Risk Control (HIRARC) modeling. It is very important to classify the work activities, do consultation between employee and worker representative, identify hazards on each work activities, do the risk assessment, prepare risk control action plan if necessary, and finally implement the HIRARC [15]. HIRARC is one of the models that can be used to perform the safety in the workplace.

The development of the technology also supports the implementation of safety in the workplace. Take on [5,8,14] as examples of fire prevention in the building. One of the common hazards is fire. Those researches showed how to build a wireless sensor network to sense fire and extinguishers monitoring system to prevent and minimalize accident that possibly happened because of fire. There are also several another example like [12] that showed the occupational safety and health capability maturity indicator on a web-based system.

University or campus is also an organization that must hold into ISO 45001. One of the concerns is mainly in a laboratory. Laboratory is a place on campus when a safety issue must be considered because there are various hazard can occur in the laboratory. Laboratory safety guidance and laboratory standard usually also need to pay attention to ISO 45001 when the implementation happened[1,10]. It is not only in laboratory, but hazards can also occur in the other place inside campus, that's way campus may also pay attention to ISO 45001. This paper presents the development of the occupational health and safety

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management system in Engineering Faculty of Diponegoro University. The system built as a tool of the ISO 45001 implementation in campus.

2 Scrum Model

One of the software development methods is Scrum Model, which part of Agile Methodology. It is applicable to Software Product Management in development process [18]. Scrum also approach on client's need by working in cycles called Sprint [17]. Pérez, et all [11] also used Scrum to bridge user stories and software architecture. Scrum is adaptable and flexible to scenarios that has possibly changing and must be finished in some periods of time [4].

Based on [2,4,9,11,17], there are 3 roles in Scrum, namely Product Owner, Scrum Master, and Development Team. Product Owner is responsible to manage the application development or maximize the application by identifying the application features and all. Scrum Master is responsible to make sure everyone understand and follow the sprint. Development team is responsible to develop the application in each sprint. The Scrum process [4,17] can be seen on Figure 1.

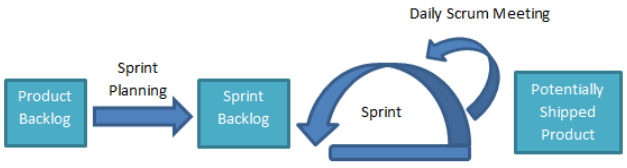

Figure 1: Scrum Process

As on this work, the Scrum Roles are the research leader as the Product Owner, one research member as the Scrum Master and the rest of the four are the development team. The Client here is ISO 45001 team from Engineering Faculty of Diponegoro University.

3 Application Development Process

The development of the Occupational Health and Safety System application consist of four steps. The first is the client meeting to check what the client wants in this application is. Then, the result used to map the client stories to product backlog. The sprint process done by using each backlog mapped. When each sprint done and integrated a Test Case is planned.

3.1 Client Meeting

Client meeting done as the first step to gain information needed in visualizing the application as the client's wanted. Here, the team must pay attention to the application features and flow wanted, also differentiate what is the client wants and what is the client needs.

The client of this work is ISO 45001 team from Engineering Faculty of Diponegoro University. The client meeting started with a brief explanation of ISO 45001 implementation on campus, and then continued with the explanation about current condition of the standard run in the Faculty, about how the team wants an application able to inform user about safety tools around the campus building, incident report and the safety tools control checking, and also the product delivery time.

Based on client meeting, it was found that the condition of some first aid kit boxes was incomplete and there were no records of drug use and filling. As for APAR, almost all APARs are expired because they have not been routinely inspected and there are no APAR condition notebooks. Lack of supervision leads to long repairs, and can lead to a variety of new problems, so a system is needed to facilitate the monitoring of the condition of APAR and first aid kits. For this reason, an application that is capable of being used as a recording medium for APAR and first aid kit boxes is needed. Implementation of the use of the dashboard in the application is expected to facilitate the response of management related to the condition of APAR and first aid kit boxes in all twelve Departments in Engineering Faculty of Diponegoro University. Besides that, it is also needed to facilitate the initial risk, incident, and summary that happened in all of the Departments.

3.2 Client Stories and Product Backlog

Client meeting done as the first step to gain information needed in bridging what is the client want and what is the client needs. The bridging process between the client ant scrum team can be seen on Table 1.

Table 1: User stories of the system

Story No	Subject	User Story	Acceptance Criteria
1	1, 2, 3	I can report the incident happened using the application so that I don't need to write a manual report and inform it to all of the Engineering Faculty Subject	*log in using account into the system *click the incident report menu *fill out the incident report data *can't continue before filling all the empty field *save the final incident report
2	3	I can see the incident data without going and searching the manual incident report book to one of the ISO45001 team	*log in using account into the system *click on the incident data list menu *search form the incident data
4	1, 2	I can see and manage the incident data using the app so that I don't need to search the incident data document when I want to see the incident data or when there is a change on it.	*log in using account into the system *click the incident data list menu *search incident data *edit the incident data *can't continue before filling all the empty field *save the final incident data
5	1, 2	I can see and manage the HIRARC using the app so that I don't need to search the HIRARC document	*log in using account into the system *click the HIRARC menu *add the HIRARC

		when I want to see the HIRARC or when there is a change on it.	data or search the HIRARC data *add or edit the HIRARC data *can't continue before filling all the empty field *save the final HIRARC data
6	1, 2	I can see and manage the inventory list using the app so that I don't need to search the inventory list document when I want to see the inventory list or when there is a change on it.	*log in using account into the system *click the inventory list menu *add the inventory data or search the inventory data *add or edit the inventory data *can't continue before filling all the empty field *save the final inventory data
7	1, 2	I can see and manage the inspection report using the app so that I don't need to search the inspection report document when I want to see the inspection report or when there is a change on it.	*log in using account into the system *click the inspection report menu *add the inspection report or search the inspection report *add or edit the inspection report *can't continue before filling all the empty field *save the final inspection report
8	2	I can do APAR inspection without coming to each APAR location and make an inspection report on it	*log in using account into the system *click APAR inspection menu *choose inspection method *inspect the APAR data
9	2	I can do first aid kit box inspection without coming to each first aid kit box location and make an inspection report on it	*log in using account into the system *click first aid kit box inspection menu * choose inspection method *inspect the first aid kit box data

Note:
1 = Head of ISO 45001 Engineering Faculty Team
2 = ISO 45001 Engineering Faculty Team
3 = General User, i.e. lecturer, laboratory assistant, student, staff, et all.

User stories made by Product Owner in the Scrum team because the product knowledge is much needed. Besides, the vision of the product and what the product will be must be clear.

3.3 Application Development

Product backlog is all list of a job that needs to be done in developing the product. It contains user stories, bugs, and technical task. Based on the bridging process from the user stories, the job list of the Scrum Team is floored. The Scrum Team using Trello to manage the product development as seen on Figure 2.

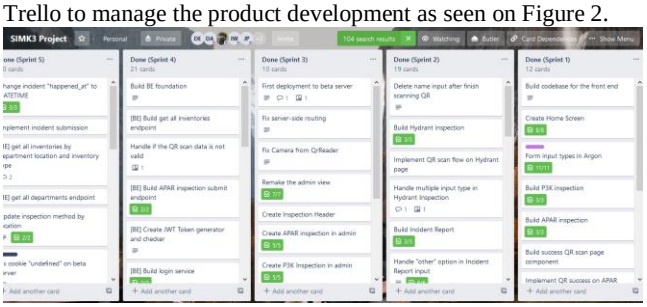

Figure 2: Sprint Process in Trello

Product backlog is all list of a job that needs to be done in developing the product. It contains user stories, bugs, and technical task that must be done. Product backlog is dynamic because it can change at any time in accordance with developments and changes in the application made. Product Backlog can increase or decrease with each Sprint, depending on the application's needs.

The planning stage of Scrum, commonly referred to as Sprint Planning. Sprint Planning is done on initial meeting involving all members of Scrum The team is a Scrum Master, Product Owner, and Development Team. Product Owner, explained Product backlog that has been created and schedules determined by all team members to be discussed back. The result of the agreement from Sprint Planning becomes a reference for the Development Team to work on their work according to the deadline time for each Sprint.

The implementation stage of each application development on one day will be monitored by Product Owner. The day before starting the work, the writer and the team gathered to carry out the Daily Sprint. Daily Sprint implemented by explaining what has been done by the Development Team, the problem is faced, and to until what stage the process is being done. It aimed so that the whole teams know the team's performance and if there is a problem can be discussed and resolved together.

4 Result and Analysis

Every completed feature created by the Development Team re-tested by Product Owner. Product Owner makes a Test Case related to the feature to be tested as shown on Table 2. The Test Case here becomes a work item in the Product Backlog. The Product Owner creates a Test Case name, test steps, and expected results in the Test Case with the initial state of Design. If the Test Case is declared ready, then the state changed to Ready.

Table 2: Product Test Case

ID	Test Scenario	Test Steps	Expected Results	Actual Results	Pass / Fail
1	Check employee login with	1. Open the app 2. Enter username	User should login to the app and the	As expected	Pass

	valid data	3. Enter password 4. Click Login	menu displayed based on user's role		
2	Check employee login with invalid data	1. Open the app 2. Enter username 3. Enter password 4. Click Login	User should get error message and cannot log in to the app	As expected	Pass
3	Check session for each user	1. Log in into the app 2. When app is open, close the app 3. Open the app again	User get into the app directly with correct credentials without the need to input credentials in Login Page again	As expected	Pass
4	Check report incident	1. Log in into the app 2. Fill all the filed on the report incident page 3. Click finish	User should get a successful message in filling an incident report	As expected	Pass
5	See incident data	1. Log in into the app 2. Click on the incident data list	User landing on the incident data list page	As expected	Pass
6	Manage incident data	1. Log in into the app 2. Manage the incident data 3. Save data	User should get a successful message in manage incident data	As expected	Pass
7	Manage HIRARC	1. Log in into the app 2. Manage the HIRARC 3. Save data	User should get a successful message in manage HIRARC	As expected	Pass
8	Manage inventory list	1. Log in into the app 2. Manage the inventory list 3. Save data	User should get a successful message in manage inventory list	As expected	Pass
9	Manage inspection report	1. Log in into the app 2. Manage the inspection report 3. Save data	User should get a successful message in manage inspection report	As expected	Pass
10	Inspect APAR	1. Log in into the app 2. Click on selected inspection mode 3. Inspect APAR	User should get the APAR information based on the method selected	As expected	Pass
11	Inspect First Aid Kit	1. Log in into the app 2. Click on selected inspection mode 3. Inspect First Aid Kit	User should get the First Aid Kit information based on the method selected	As expected	Pass

Based on the test case, it showed that all featured in the application pass the test case. The initial state of the application is now ready. All sprint in the Application Board is now completed and the product ready to be delivered to the client.

5 Conclusion

The use of Scrum Model is very suitable for this project because the Scrum Team need to be agile in every change that occurs in the application. The Scrum Team really pays attention to the ISO 45001 detail when implementing the application, so that the application really meets the client expectation in using it to implement occupational health and safety in Faculty Engineering, Diponegoro University.

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