Utilizing of the Trello API Within the Development of a Monitoring Information System Recording of Project Activities Using a Website-Based Kanban System (Case Study : Electrical Project of PT. XYZ)

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Abstract. One of the units of the company which is engaged in electricity handles many electrical large projects. The current condition of recording project activities that is still done manually and is not centralized has become difficulties in searching for data when needed. Job targets that also cannot be monitored create difficulties in management. Therefore, an effective and efficient monitoring information system for recording project activities is required so as to facilitate the management of monitoring data projects and data retrieval. The system development process using the prototyping method is implemented on a website basis by utilizing the Kanban system in managing work items. The Trello API is used to retrieve project data along with the use of the Kanban system in Trello to maintain data security which can only be managed by the project manager. System development is carried out through the stages of problem identification, literature study, needs analysis, design with Unified Modeling Language, and implementation using Laravel as a framework. Functional testing of the system with Blackbox testing gets 100% indicating the system is in accordance with the requirements specifications. Usability testing using the System Usability Scale gets a value of 84 in the acceptable system category. Responsive testing is conducted with the results of the interface meets various screen sizes and orientations. The compatibility testing implementation shows the system works well with various browsers.

Keywords: project monitoring, system recording, Trello API, Kanban system

1 Introduction

One of the electricity companies in Indonesia, PT. XYZ, handles large projects in the construction of power plants to supply electrical power to consumers in Indonesia.

PT XYZ has a special unit in handling the construction of power plants, namely the Project Construction Implementation Unit. The electrical projects handled by the unit are quite large and varied, so that effective and efficient project management is needed for all aspects involved during the project process from start to finish.
Project management is carried out by applying knowledge and techniques to activities during the project in order to meet the requirements and objectives of project implementation[1].

The large project implementation and scattered work locations that have not centralized recording conditions have become a complaint in the difficulty of searching for project activity data when needed. Given the current conditions for manual recording using Microsoft Excel, the management of recording based on job targets is still ineffective. This also has an impact on the difficulty of managing work targets because the status monitoring cannot be carried out.

This was conveyed during an interview with the project manager. It is also strengthened by the statement that considering that the recording of the productivity of project activities must consider the targets that have been planned, there is still no target management recording system tool that is managed efficiently, informatively, and can be seen by all teams. The project manager as fully responsible for project implementation must be able to monitor data to be able to make decisions on the next movement. The flow of the current recording is, the recording of project activities is carried out by the engineer then a recapitulation is carried out by the PMIS (Project Management Information System) supervisor and then it is reported to the project manager.

Therefore, an effective and efficient centralized project activity recording monitoring information system is needed in order to facilitate the management of monitoring data recording and data retrieval. Monitoring of the data is carried out to monitor the process following the object in order to obtain an evaluation of the conditions that occur which refers to the information obtained regarding the status of the activity[2].

To ensure the security of target data and project work items that can only be managed by the project manager at Trello, it is necessary to use the Trello API (Application Programming Interface) in retrieving that data. Trello is a cloud-based tool with usability in managing organizational workflows where projects can be managed visually using the services provided[3]. In managing the status of work items, the Kanban method in Trello is used. The Kanban system is described as visualizing and maximizing work with a job scheduling approach that is adaptive to changes by adjusting the specified requirements[4]. The use of Kanban in managing work items is aimed at visualizing the stages of the development process. By knowing each work items based on its status, makes monitoring easier for decision making.

The Kanban method is considered capable in project planning management well by quoting from the research conducted by Muhammad, Fajar, and Widhy in 2020 in implementing the Kanban method in project management software systems. The choice of using the Kanban method is not only easy to apply in managing project targets but is also considered capable of responding to any changes by adjusting project needs[5].

2 Research Methodology
The implementation of the research is included in the category of system development implementation research carried out using the prototyping method. Prototyping method is a software development method that makes developers and users interact directly in developing systems for accumulating needs. In this method, after designing the prototype it will be evaluated by the user and iteration can be done in the process.
The use of the prototyping method is intended so that system development is carried out accurately, precisely, and meets user needs. Because in each development process an evaluation is carried out and iteration will be carried out again until the user's needs are met.

The research step that is using prototyping method can be seen at Figure 1 above. The literature study was carried out by reviewing references related to project management strategies to avoid failures following the effective use of Trello and Kanban in project management. This is a step in reviewing the process of getting a problem-solving strategy.

Requirement analysis is conducted by digging needs to the PT. XYZ related to project management and the system that will be built to get the right system solution at PT. XYZ.

The system design process is carried out using an object-oriented approach using UML Diagrams and the architecture of the system that used the Trello API is described. The prototype design is carried out by referring to the requirements. If the results do not meet the requirements, iteration will be carried out back to the requirements analysis phase.

The implementation process is executed from the front-end and back-end side in developing a website platform that utilizes the Trello REST API. The testing stage is conducted by testing on functionality with black box testing and non-functional testing with usability testing, responsive testing, and compatibility testing techniques.

3 Requirement Analysis

The exploration of requirement specifications was carried out by conducting interviews through Zoom Meeting with the project manager. The results of the system requirements obtained from interviews are used as a reference in defining system functionality requirements and non-functional requirements. It can be concluded that
the general description of the system for recording project activities by utilizing the Trello API in capturing project data and using the Kanban system for easy monitoring of the movement of work items based on todo, doing, and done status.

3.1 System Requirement Specifications

The results obtained from interviews with the project manager are 3 actors who play a role in the system, 5 actions that can be done by the project manager at Trello, 17 functionality requirements on the system regarding CRUD from Project Progress Data and Manpower Data, Progress Dashboard, Project Information, User Authentication, and Data Search based on Date Ranges. For non-functionality requirements of the system, there are 3 requirements which include usability, responsiveness, and compatibility of the system.

The identification of the actors that play a role in system may be seen in Table 1:

Table 1. Actor Identifications

| No. | Actors                     | Description                                                                 |
|-----|----------------------------|-----------------------------------------------------------------------------|
| 1   | Project Manager            | The Project Manager is an actor who has the authority in managing project data on the Trello account and can also view, modify, delete, and add data to the system. |
| 2   | Supervisor PMIS and Engineers | Supervisors PMIS and Engineers are actors who only have the authority to access the system in the form of adding, changing and deleting data on the system. |
| 3   | Trello API Web API          | Web API that accumulates project management data from work type data and work items. |

The diagram that represents a depiction of the interaction between all actors and the system regarding the needs of the system can be seen in Use Case Diagram in Figure 2 below.

The interaction illustrates that the project manager is the main actor who has responsibility for handling the project as well as managing the data of the project, is the only one who able to access the Trello account to manage the work items data.

The project manager is also able to see the project data in Trello that recorded from the project activity recording monitoring information system. The changes related to the work items from the project manager in Trello will be displayed in the system. In the project activity recording monitoring information system, all functions can be accessed by the project manager, supervisor PMIS, and engineers.
4 System Design

The architectural design of the system helps in providing an architectural description of the information system for monitoring project activity records.

As can be seen in Figure 3, the architecture of the system with label A as an action that can be performed by the project manager alone on Trello. In label B, it is depicted that the user can interact with the system interface and the request response mechanism from the client to the server is shown on label C. If the data request is in the database, the request response mechanism with the database is described on label D. If the data is in Trello, the request mechanism is response via the Trello API integration depicted on label E.

4.1 Prototype Design

The use of the prototyping method in carrying out system development, before
the system is implemented, the prototype design is carried out according to the exploration of user needs. Each design has been completed, then continued by evaluating the prototype by making a presentation to the project manager. If there is still an evaluation, then iterates again from the exploration of needs, designing, and evaluating until the system requirements are appropriate and implementation can be carried out.

As can be seen in Figure 4 is one of the prototype design of the system. Prototype design iterations were carried out three times. First, the functional overall presentation obtained in the requirement specification interview was conducted. Second, a Progress Dashboard design presentation is carried out based on the evaluation in the first presentation. Third, presentation refers to evaluation from a second presentation which includes additional Progress Dashboard data and adding an entry title field to the form. After the third iteration the requirements have been met so that it is continued to the system implementation stage.

4.2 Trello Required Field List

Before accessing services on the Trello API, define what services or features will be accessed on Trello via the Trello API which will later be used on the system. Figure 5 describes the Trello services needed on a system.

4.3 Sequence Diagram

Sequence diagrams are made by using the use case diagram as a reference. Based on the number of use cases or functionality in the use case diagram is 17, the sequence diagram design is also 17. As can be seen in Figure 6, an example of a sequence diagram is shown to add progress data where actors initiate the system. boundary of the project progress data page, the ProyekController as controller, the
ProyekRequest as controller, the TrelloController as controller, and the Proyek as entity.

4.4 Class Diagram

In making Class Diagram, it includes details of control objects as controller classes, boundary objects as view classes, and entity objects as model classes. Figure 6 shows the results of making a Class Diagram description where 7 controller classes, 5 view classes, and 3 model classes are generated. As can be seen in Figure 7 the Class Diagram of the information system for monitoring project activity records.
5 Implementation System

The actualization process that based on the system design is applied using the prototyping method, by utilizing the role of several frameworks in the ease and speed of the implementation process, namely, the use of Laravel and Bootstrap. Database application in this research uses MariaDB as a Database Management System (DBMS) with 3 tables, namely, Project Data, Manpower Data, and User Data.

The Trello API is a very powerful API to use because it is provided free and open. To get service access on Trello using the Trello API, a registered Trello account is required and performs authentication with the API Key and Token obtained on the Trello Developer website. If the authentication process is successful, various Trello services can be utilized through the URI used in data retrieval found in the Trello Developer documentation[7]. The authentication process is carried out by logging in to an account on the Trello Developer website, then to be able to start authentication requires an API Key which can be obtained by visiting the https://trello.com/app-key/ site, where in a token will be obtained as the final step of the authentication process.

Figure 8 shows the Cards service access on the Board in Trello. The access process from the system server to the Trello API server is assisted by the easy access of the PHP library application, namely, Guzzle so that the integration process can be carried out easily. Accessing the Trello service uses the guidelines on Trello Developer because to get the desired data access must be directed to an authorized URL. Trello services used in this research are Get Board, Get Cards, Get the List of a Card and Add Comment.

![Figure 8. Example of Accessing Trello's Service in PHP](trello.com (2021))

After authenticating the Trello account by defining the API Key and Token, then defining the Trello services used in the system. The detail of Trello’s service that is applied on system may be seen in Table 2.

Figure 9 below shows the interface implementation on the project progress data recapitulation page. Where the interface implementation process is carried out by utilizing the Bootstrap and Laravel framework for ease and acceleration of implementation. The use of the Datatable library, HTML, JavaScript, CSS and the application of the PHP programming language is carried out in the system implementation phase.
Table 2. Use of Trello’s Service via Trello API Integration

| No. | Trello Service       | Method | Applied on System Description                                                                                                                                 |
|-----|----------------------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Get Board            | GET    | Retrieval of data on the Trello board which contains work type data from the project will be displayed in the work type dropdown field on the project progress data input form page. |
| 2   | Get Cards on a Board | GET    | Retrieval of data on the Trello card containing work item data from the project will be displayed in the work item dropdown field on the project progress data input form page. Where the work item data is displayed based on the Trello board that chosen in work type dropdown field on the form. |
| 3   | Get List on a Card   | GET    | Retrieval of data on the Trello list is obtained based on a Trello card to obtain information about the status of the work item from the card with status information that refers to the Kanban system, namely, to do, doing, and done. The status will be displayed on Dashboard and Detail Project Data Form. |
| 4   | Add Comment          | POST   | Each project progress recording data that enters the system, will automatically add comments to the work item which is a card on Trello containing information that there is recording data that has been entered into the system. |

Figure 9. Interface of Project Progress Data Recapitulation Page

6 System Testing and Result Analysis

6.1 Functional Testing

The implementation of tests on system functionality is carried out to ensure whether the Project Activity Recording Monitoring Information System that is built meets the requirements specifications. The results of the functional validity test using the Blackbox Testing technique get a value of 100% fulfilling the needs of the overall functionality with a total of 17 test cases.
Table 3 below describes the results of the validity test with the test case view the dashboard progress that the test results obtained match the expected results of this functionality. This functional testing is conducted using a manual testing technique by testing based on the requirements defined. If the results are appropriate as expected requirements, it can be concluded that the test case is valid.

| Test Case | View of the Dashboard Progress |
|-----------|-------------------------------|
| Expected Result | User can see a progress dashboard on the system which contains a detailed list of work items on all status, a recap of manpower data and project progress data. |
| Test Result | User can see a progress dashboard on the system which contains a detailed list of work items on all status, a recap of manpower data and project progress data. |
| Status | Valid |

Based on the Table 3 above show that the functional test on View Dashboard Progress successfully displayed the summarized data of project progress. The test is conducted by clicking on the Dashboard menu, then directed to the Dashboard Progress page and displayed the detailed list of work items on all status, a recap of manpower data, and project progress data. The result of this functional testing is valid because the actual result met the requirements needed.

6.2 Non-Functional Testing

In conducting tests for non-functionality of the system, usability, responsiveness and compatibility testing techniques are applied.

Usability testing was conducted to test the ease of use of the system using the System Usability Scale (SUS) questionnaire with 10 questions to 4 respondents consisting of project managers, technical managers, PMIS supervisors, and engineers.

Study conducted by John Brooke showed the result that the calculation of each question item in the SUS questionnaire has a contribution score. For odd-numbered question items, the contribution score is the scale position minus 1. For even-numbered question items, the contribution score is 5 minus the scale position. The overall value of the usability system is obtained by multiplying the total score by 2.5[8]. Figure 10 below shows the score average result of system usability that given by respondent to the system.

Figure 10. Respondent's System Usability Score Result
Based on Figure 10 above, obtaining the average value of the respondent's usability system is 84. As the result of the usability testing that conducted, all respondents strongly agree to use the system in a frequent time and agree in terms of ease of use of the system built for PT.XYZ. Improvisation on the system can be increased in terms of the complexity of the system which is adjusted to the requirements.

Referring to the interpretation of the SUS score grade in a study conducted by Bangor, Kortum, and Miller where the mean value of 84 obtained is included in grade B with the good category and it can be said that the system gets good results because it has a high level of acceptance from users[9].

Responsive testing is carried out by using the Developer Tools feature in the Google Chrome application with a responsive system display results because there are no problems with various screen sizes and screen orientations that are applied at the time of system use.

Checking the compatibility of the system using the Sort Site application which was carried out on the new versions of various browsers, it was found that there were no critical problems that disturbed the system in operation. However, there are still big and small problems in some browsers that lie in the layout or performance for future improvements. Figure 11 below shows the result of the compatibility testing.

![Figure 11. Compatibility Testing Result Using SortSite Application](image_url)

7 Conclusions and Suggestions

Based on the result of research conducted, the management of project progress data can be centralized in one system by utilizing various Trello services obtained through the implementation of the Trello REST API. Supported by the average results of usability testing conducted on 4 respondents with high user acceptance results on the usability testing results with a value of 84, where all respondents strongly agree on the usability and ease of use of the system. Suggestions for further research can be developed on a mobile platform with additional features that enrich the functionality of the project management software because this research is still website-based with limited features. The display of project progress in the dashboard can also be developed in further research by presenting more informative data and covers all data to make it more insightful for users in making decisions on the data.
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