Designing Information Systems for Transportation Permit of the Coal Mining Industry Based on Rational Unified Process

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Abstract
Indominco Mandiri Ltd. is a private company engaged in coal mining and general trading. The permit process for the transportation of goods is a vital sub-process in supporting the organization's business activities. The transportation permit process employed by the Indominco Mandiri Ltd. is still the manual one. The present study aimed to develop a Transportation Permit Information System for the company. The rational unified process methodology was employed in the designing process, the system and user requirements, and the system design. The results obtained from working on specific practical work tasks are the business process model, software requirements specifications, and software design documents. The resulting software requirements documents, and software design documents were produced based on IEEE Std 830™-1998 (R2009) and IEEE Std 1016™-2009. The business process modelling was used in the business process notation model. The system requirements were documented in the software requirements specification based on the use case. The point of view used to design the software was the points of view of composition, logic, dependency, information, and interaction. The diagrammatic models to describe the points of view were a unified modelling language, relational models, data dictionaries, and entity-relationship diagrams. Several processes needed in the transportation permit information system, namely managing form, managing account, validating the form, verifying the form, and managing the register. This research aids developers to develop information systems to suit the needs of the customers.

Keywords: rational unified process, business process, software requirement specification, software design description, transportation permit

1. Introduction
Indominco Mandiri Ltd. is a private company engaged in coal mining and general trading of coal, located in Bontang City, East Kalimantan. Indominco Mandiri Ltd. is a subsidiary of Indo Tambangraya Megah Ltd. The mining sector's main activities are generally divided into several processes, such as mining, storage, transportation, and loading onto barges or transport vessels. In each of the processes, some sub-processes support the bigger one. One of those processes is transportation permit as one of the sub-processes under the transportation activities (PT. Indo Tambangraya Megah, 2015).

The transportation-permit process employed by Indominco Mandiri Ltd. is still operated manually. Licensing carried out by the applicants still uses an application form that must be signed by various parties, such as the head of administration, the summit, or the head of the port. After that, the form must be re-checked by the head of security. The permission and inspection processes are also carried out manually, in which the documents are delivered by hand to the manager, causing the process to take quite a long time to complete. This long process of the permit application can cause delivery delays, which also impacts the business achievement at Indominco Mandiri Ltd.

The business process for the transportation-permit can be more efficient if an information system is used to replace the manual one. An information system is essential for the company to make it easier for the stakeholders and management to run activities faster. Besides, the information system that supports transportation-permit activities assists the
managerial staff in exercising control over providing recapitulation reports for transportation-permit activities (Fatta, 2007).

Developing an information system for the transportation permit of Indominco Mandiri Ltd. requires a good planning and designing stages. Many information systems have been successfully developed, but they are not used because they are deemed failed to meet the stakeholders' needs due to various non-technical problems. One of the non-technical problems can be in the form of users’ reluctance to shift from jobs that were previously carried out manually to the automatic ones (A.S. & Salahuddin, 2016).

In planning an information system, several methods can be employed. One of which is the Rational Unified Process (RUP). This method has an iterative and incremental process in software development (Sulianta, 2017). The RUP stages, if applied, can help Indominco Mandiri Ltd. in designing their business processes, systems and user requirements, and system designs. The planning can assist the information system developers to achieve the right information system criteria, such as maintenance, relevance, dependability, efficiency, and usability (A.S. & Salahuddin, 2016).

Therefore, this paper aims to design an information system for transportation-permit application for Indominco Mandiri Ltd. using the RUP method. Through this research, the developers are expected to obtain an appropriate information system design to be developed, so that the information system built can successfully meet the criteria of what a customer will call as “good software”.

2. Method

This research method refers to the iterative RUP for each activity as shown below:

![Figure 1. Research Methodology](image)

2.1. Business Process Modelling

This stage is the stage for analyzing the implementation model of transportation-permit activities. The output of this stage is a Business Process Modelling, another stage that provides a definition implementation of a business document process (Kruchten, 2000). This business document covers transportation-permit activities and defines the business processes' roles, responsibilities, and activities (Process, R. U., 2001).

2.2. User Requirement Analysis

The User Requirement Analysis was done by analyzing the business processes that produced the information systems' main features and a number of the information systems’ users. In addition to the features and the number of users or roles, the analysis of the description of the limits was also conducted. The description of the limits is fundamental in making use of the case and activity diagrams.
2.3. **Use Case Analysis**

The Use Case analysis was carried out after obtaining the software needs in the form of features and roles or users. The Use Case scenarios will include behaviors between the actor and the information system to be built (Kruchten, 2000). The use cases made described the features or interactions that occurred between the actors and systems that were contained in the use of the Transportation Permit Information System of Indominco Mandiri Ltd. At this stage, the scenario for each existing use case was also described.

2.4. **Software Requirement Analysis**

The Software Requirement Analysis was conducted to obtain the functional and non-functional requirements from the Transportation Permit Information System of Indominco Mandiri Ltd. The other documented requirement was the need for an external interface that contained the user's interface, software interface, hardware interface, and the activity diagrams. The software interface was done by making a prototype method that will produce a display and model of the system to be developed (Kruchten, 2000).

2.5. **Developing the Software Requirement Specification Document**

Software Requirement Specification (SRS) document creation was done after the Software Requirements Analysis results were obtained. The needs of the transportation-permit Information System of Indominco Mandiri Ltd. were documented using the IEEE Std 830™ - 1998 (R2009) standard. The creation of the SRS document was begun by defining an overview of the information system and documenting the results of the three stages above (IEEE Computer Society, 1998).

2.6. **Design Planning**

This Design Planning step described the architecture of the information system coding processes. This stage also consisted of the informational systems’ architecture analysis activities. This design planning stage aimed to make an initial sketch of the system architecture by defining architecturally significant elements to be used as a basis for analysis (Kruchten, 2000).

2.7. **Software Design Development**

The Software Design Development stage was performed after knowing the elements or diagrams of the software design such as the identification of the design mechanisms, design elements, combined existing design elements, and the distribution or dissemination of information from the Transportation Permit Information System of Indominco Mandiri Ltd. The purposes of this stage were (1) to provide a natural transition from analytical activities to the design activities, and (2) to describe the relations between each element or component. The relations were explained using UML or other diagrams (Kruchten, 2000).

2.8. **Software Design Description (SDD) Document Development**

The SDD Document development was carried out after defining the architectural elements and the information system design. Information System Design for Transportation Permit in the Indominco Mandiri Ltd. was documented using the IEEE Std 1016™ -2009 standard (IEEE Computer Society, 2009). The creation of the SDD document was begun by defining the overview and scope of writing and documenting the UML diagram.

3. **Result and Discussion**

3.1. **Business Process Modelling**

The Business Process Modelling enables general understanding and analysis of the information systems business process of transportation permits (Aguilar-Saven, 2004).
first iteration was modelling a business process following the standard operating procedure for the transportation permit. In the second iteration, there was a change in the business processes in the form of adding the role of Document Control and a validation check by Admin Security. The fundamental change in the business process was the addition of the actors. The transportation permit business process modelled using Bizagi Modeller is depicted as follow:

Figure2. Business Process of Transportation Permit

3.2. User Requirement Analysis

Based on the above business processes, the main roles and features needed were obtained. Among the main roles and features were: (1) the user can log in, logout, manage forms, and export forms; (2) the admin can manage the account, change approval status. The specific features (3) the admin of the Security and Document Control can validate or check the completeness of the application, view and print the register. Meanwhile, the Administration Head, KTT, and the Port Head can approve the application; and the Security Head can check the applications.

3.3. Use Case Analysis

The use case was obtained based on the results of the analysis of the user’s needs. ‘Log in’ and ‘log out’ will be the ones of the use cases. The outline of the use cases in the system includes managing forms, checking completeness, managing registers, validating applications, approving applications, checking applications, and managing accounts. The resulting use case diagram is as follow:
In addition to producing the use case diagram, this stage also generated a scenario for each of the use case that has been designed. One example of the use case scenario generated at this stage is as follow:

**Table 1. Use Case Scenario for Creating The Form**

<table>
<thead>
<tr>
<th>Use Case ID Scenarios</th>
<th>SC-03-01</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Allows the applicant to apply for a transportation permit of the Indominco Mandiri Ltd.</td>
</tr>
<tr>
<td><strong>Rational</strong></td>
<td>To make an application for a transportation permit.</td>
</tr>
<tr>
<td><strong>User</strong></td>
<td>Applicant</td>
</tr>
<tr>
<td><strong>Preconditions</strong></td>
<td>The applicant logs in and is on the dashboard.</td>
</tr>
</tbody>
</table>
| **Scenario**          | 1. The requester opens the forms page.  
                        | 2. The system displays the forms page.  
                        | 3. The applicant writes down the information and submits the documents requested by the system.  
                        | 4. The applicant presses the enter data button.  
                        | 5. The system stores data into a database  
                        | 6. The system displays information that the data has been successfully stored. |
| **Alternative Scenarios** | This use case has no alternative scenarios. |
| **Final Conditions**  | Application submissions are stored in the database system. The applicant is on the form page. |

3.4. **Software Requirement Analysis**

The analysis of the software requirements is divided into functional and non-functional requirements. Based on the use case scenario, eleven functional requirements were obtained for the Transportation-Permit Information System. Some of the functional requirements include: *the system performs data searches; the system stores data into a...*
database; and the system validates the suitability of the username and password.

Non-functional requirements were written based on several aspects, namely, security, quality, and performance. There are nine non-functional requirements in the first iteration and ten non-functional requirements in the second iteration designed in the Transportation Permit Information System of Indominco Mandiri Ltd. Some of the non-functional requirements include a database using MySQL and XAMPP as the database servers; the system runs using a web browser; the system requires hosting for the mail server to send an email. Apart from the above aspects, one of the other non-functional requirements was the interface requirement using Adobe XD which was described as one of the following examples:

![Interface Requirement Image]

Figure 4. Interface Requirement

3.5. Develop Software Requirement Specification Document

This software requirement specification document aids in developing software designs to design software tailored to customer's or stakeholders' requirements (Putro, 2018). This document contained an outline of the information system description, information system features, information system functional requirements, non-functional requirements, external interface requirements, use case, and scenarios of the use case.

3.6. Design Plan

Information Systems for Transportation Permit Indominco Mandiri was designed to be a website-based system. The programming of the application operations used PHP programming and running on the Windows operating system. The database system that was owned uses MySQL, phpMyAdmin, and XAMPP as database servers. Accessing data information systems required an internet network at PT. Indominco Mandiri. The server used was a cloud server to store data from the information system. In using this system or website, internet access was required because it was hosted and could be accessed using a web browser. All classes were modelled with the MVC (Model View Controller) architecture.

3.7. Develop the Software Design

The Transportation Permit Information System was designed based on several points of view, namely compositional viewpoint, logical viewpoint, dependency viewpoint, informational viewpoint, and interaction viewpoint. The compositional viewpoint was modelled using a package diagram. The logical viewpoint was modelled using the class diagram. The dependency viewpoint was modelled with a component diagram. The informational viewpoint was modelled with entity-relationship diagrams, physical data
models, clarified using a data dictionary consisting of attribute names, data types, keys, nulls, and information that referred to the version of Stony Brook University on 20 March 2018 (Stony Brook Data Governance Council, 2018). The interactional viewpoint was modelled with a sequence diagram. Some of the designs for the points of view using draw.io are as shown below:

![Sequence Diagram](image)

Figure 5. Viewpoint Design (a. Interaction Viewpoint; b. Composition Viewpoint; c. Information Viewpoint)

3.8. Develop Software Design Description (SDD) Document

This SDD document was to provide a product design description for the Information System Transportation Permit of PT. Indominco Mandiri so that the software design was continued with the perception of the design to be compiled and how the development process was. The topics, general description of design elements and their interactions, the method of how the system was structured, the functional data, and the structures were discussed further to help produce the use cases and to assist in maintenance services, as well as meeting requirements, and the design details indicated in the SRS document.

The SDD document included several explanations. This document discussed the representation of an information system of the transportation-permit design for PT. Indominco
Mandiri Ltd. The results of the presentation of the system design were used to record the design information and to communicate the design information to stakeholders. This document covers the viewpoints and design plans that had been analyzed and designed in the previous stage.

4. Conclusions

The design process of the Information System Transportation-Permit for in the coal mining industry, Indominco Mandiri Ltd., which was conducted using the Rational Unified Process method, produces three main documents for each technical discipline, namely a business process design document, a system requirements specification document, and a software design description document. Several processes needed in the transportation-permit information systems, namely the managing form, managing account, validating the form, verify the form and managing the register. The Information System Design for Transportation Permit in the Indominco Mandiri Ltd. helps the developers to carry out the development of the information systems and is designed to be a website-based information system to be used with the internet network and accessed via a web browser.

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References