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Implementation of Organization Goal-Oriented Requirements Engineering (OGORE) Method in Designing a Muhammadiyah High School Library Information System

Imam Marzuki Shofi [1], Rendy Nugraha [2], Nenny Anggraini [3], and Nashrul Hakiem [4]
Department of Informatics, Faculty of Science and Technology
Universitas Islam Negeri Syarif Hidayatullah
Jakarta, Indonesia
[1] 0000-0001-5805-4667, [2] rendy.nugraha13@mhs.uinjkt.ac.id, [3] nenny.anggraini@uinjkt.ac.id, [4] 0000-0002-8079-5274

***Abstract*—The use of information systems in an organization has become an obligation to support the organization's business process. However, the development of an Information System still often faces problems, the most important problem occurs in the requirements engineering phase where developers try to meet user needs, these problems can also increase when user needs are not following the standards in general. The objective of this research is to design a digital library information system based on the organization goal-oriented requirements engineering (OGORE) method. OGORE is a Requirements Engineering method that focuses on organizational needs and is expected to eliminate the (noise) needs of users. The OGORE method has been used since its goal is to reduce the risks that arise because of user needs based on personal desires. The Development Method used is the Extreme Programming (XP) method. Data collection methods used were observation, interview, and literature study. With OGORE method, the results of a Library Information System can fulfil all the vision and mission of the library.**

Keywords— Requirements Engineering, Library Information System, Goal Oriented, GORE, OGORE

I. INTRODUCTION

The use of information systems in an organization has become an obligation to support the organization's business processes. Information systems not only have an important role in a company but can also provide added value that significantly increases business competitive advantage. However, the development of an Information System still often faces problems. The main problem occurs in the Requirements Engineering phase where the developer is trying to meet User Needs. In the Requirements Engineering process, needs can come from the User, the Business Process, or the Organizational Goals. The large variety of requirements can increase the risk of failure in the development of Information Systems [1].

These risks can also increase when User Needs do not meet the standards being undertaken in general. The system must also adjust to user requests, user knowledge patterns, and user work patterns, with emphasis on the user's personal needs. Understanding User Needs is important, but sometimes it's better to apply common practices before meeting those User Needs [1].

One of the Requirements Engineering techniques that are currently being developed is Goal-Oriented Requirements Engineering (GORE), wherein this method all needs are racing against the Goals. This method is expected to minimize the growing needs that come from user requests [1].

Several methods/ techniques that have been developed in GORE include Deriving Tabular Event-Based Specifications from the goal-oriented requirements model (DTEBS), GBRAM (Goal-Based Requirements Analysis Method), AGORA (Attributed Goal-Oriented Requirements Analysis Method), Visual Variability Analysis for goal models (VVA), Goal-Oriented Idea Generation Method (GOIG), Deriving Operational Software Specifications (DOSS), Agent-Based Tactics for goal-oriented requirements elaboration (A-BT), and goal-oriented requirements-based elicitation requirements on General Systems Thinking Heuristics (GSTH). Besides, there are also: Non-Functional Requirements Framework (NFR Framework), i* / Tropos, Knowledge Acquisition in AutOmated Specification or Keep All Objects Satisfied (KAOS), and Goals-Skills-Preferences Framework (GSP Framework). There are also methods: i*, ConGolog, Albert language, F3. Meanwhile, Van Lamsweerd explained that the combination of NFR, i *, and Tropos was further developed into the GRL method [2], [3].

One of the Requirements Engineering methods currently being developed which is an extension of the GORE Method is the Organization Goal-Oriented Requirements Engineering (OGORE). The OGORE method is a needs engineering method that bases each of its activities on the goals of the organization, from the elicitation process, analysis and refinement, as well as validating its needs. OGORE's goal is to reduce the risks that arise because of user needs based on personal desires [1].

A library is a place that can be used to find several sources of information and book references to borrow or just read on the spot. In the Law no 43 of the Republic of Indonesia of 2007 Article 3 concerning libraries [4], it is stated that the function of libraries as a vehicle for education, research, preservation,

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information, and recreation is to increase the intelligence and empowerment of the nation.

The School library is a library that is held in schools, by schools, and for the benefit of teaching and learning in schools. According to [5] on the definition of school libraries, which are libraries that in the formal education units in the primary and secondary education environment, which are an integral part of the school's activities, and are a learning resource center to support the achievement of the educational goals of the school concerned.

One of the goals to be achieved by schools is the success of the education process held in schools. To achieve these objectives, the school library must be a center for information resources and provide library services by opening access for its users. As an information resource, the school library requires good and professional processing of the collections in the library. In [6] argues that collection processing is the activity of organizing a collection that starts from checking the collection that has just been received at the library to its placement on the shelves that have been provided.

According to [6] in general, school libraries in Indonesia are still experiencing various obstacles so that they cannot run as they should. These obstacles come from two aspects. First is the structural aspect, in the sense that the existence of a school library is not getting enough attention from the school management. Second is the technical aspect, meaning that the existence of the school library is not yet supported by technical aspects which are highly needed by the school library such as personnel, funds, facilities, and infrastructure.

Muhammadiyah is a private and independent organization which has engaged in social religious, healthcare, and education sector. It has more than 4500 elementary, middle, and senior high schools spreading throughout Indonesia [5]. Muhammadiyah 25 Senior High School is a school that joins in Muhammadiyah Setiabudi Pamulang College which has been established since 1991. This school has a library where all the work processes are still done manually, where book data is stored on the Excel Sheet and the book-lending process still uses a borrowing list book. Based on an interview the Main Board of Facilities and Infrastructure of Muhammadiyah High School 25 (SMAM25) on March 23, 2018, expressed several complaints in the SMAM25 library namely lack of equipment and space, lack of staff to keep libraries and books available are still less organized in the list.

Based on the review, the authors are interested in developing an Online-based Library Information System. At the Requirement Engineering stage for the development of this system, the OGORE method will be used. In this case, needs will be extracted from Organizational Objectives and mapped using the Business Process Model and Notation (BPMN).

The results of Requirement Engineering will be translated into the design process using the Unified Modeling Language (UML) diagrams by utilizing the Agile Extreme Programming (XP) method. In this case, the translation into UML diagrams is done as a proof of the success of the library information system Requirement Engineering process that has been obtained based on the OGORE method.

II. Literature Review

A. Goal-Oriented Requirements Engineering (GORE)

According to [7], GORE is a need engineering that rationalizes various needs needed by a system that will be made based on the objectives formulated so that the expected needs are not only based on data and manual business processes.

Fig. 1 shows several methods/ techniques that have been developed in GORE [8][3] include Deriving Tabular Event-Based Specifications from the goal-oriented requirements model (DTEBS), GBRAM (Goal-Based Requirements Analysis Method), AGORA (Attributed Goal-Oriented Requirements Analysis Method), Visual Variability Analysis for goal models (VVA), Goal-Oriented Idea Generation Method (GOIG), Deriving Operational Software Specifications (DOSS), Agent-Based Tactics for goal-oriented requirements elaboration (A-BT), and goal-oriented requirements-based elicitation requirements on General Systems Thinking Heuristics (GSTH).

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Fig. 1. Methods in GORE [3]

B. Organization Goal-Oriented Requirements Engineering (OGORE)

According to [7], OGORE is a new method being developed that places more emphasis on organizational goals, which have the goal of reducing risks that arise due to user needs based on personal desires.

In [7], introduced an approach that uses organization goals that are extracted to IT goals and places the Key Performance Index (KPI) on each goal which is shown in Fig. 2.

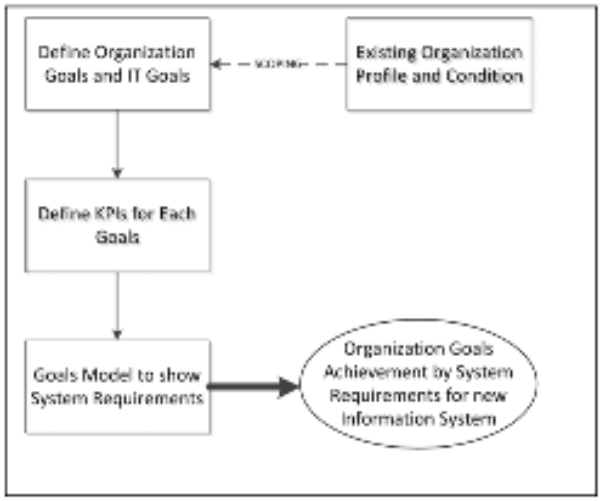

Fig. 2. Requirement Elicitation Concept using Organization and IT Goals Concept [1]

In [1], the first step taken was to define the profile of an organization. Engineer (in this case the author) and the owner of the organization will discuss and extract IT Goals that are expected to be achieved with the Information System that will be created. Next, the Engineer and the owner of the organization will define Key Performance Indicators (KPIs) for each Goal as the target to be achieved. The KPI can also be used as a controller. In defining the KPI, the Engineer and the owner of the organization must ensure that the KPI can be achieved if the organization's owner and user use the new Information System based on predetermined goals. These factors can reduce problems that result from User Interest and views of users who are not under the owner of the organization because the Goals that have been determined all come from the owner of the organization itself, and not from the user.

This method uses the Goal-Oriented Requirements Language (GRL) as the Goal-Modeling language to describe the relationship of each element. The results of this method are Organization Goals and IT Goals, each of which has a KPI, to identify and define System Requirements. Fig. 3 illustrates the steps of using the OGORE method.

Fig. 3. Organization Goal-Oriented Requirements Elicitation Flowchart Diagram [1]

C. Digital Library

According to [9], Digital Libraries are various organizations that provide resources, including specially trained employees, to select, manage, offer access, understand, disseminate, maintain integrity, and ensure the integrity of digital works in such a way that collections are available and economically affordable by one or a group of communities who need it.

From the description above it can be seen that a digital library is an organization that provides, packaging information into digital form by expert resources to facilitate users in finding the desired information.

Some of the advantages of the Digital Library are as follows:

1. Save space, because digital library collections are digital documents, so storage will be very efficient. Hard disk with a capacity of 30 GB (now the standard size of the hard disk is 80 GB) can contain as many as 10,000-12,000 e-book titles with an average number of book pages 500-1,000 pages. This amount is equal to the total number of book collections from small to medium size libraries.

2. Multiple access, the lack of conventional libraries is that access to the collection is single. This means that if there is a book borrowed by a library member, the other members will borrow it must wait for the book to be returned. Digital collection is not the case, each user can simultaneously use a collection of the same digital book both for reading and for downloading or transferring to his personal computer (download).

3. Not limited by space and time, digital libraries can be accessed anywhere and anytime provided there is a computer network (computer internetworking). Whereas conventional libraries can only be accessed if the person comes to the library when the library opens services. If the library is closed then people who come cannot access the library.

4. Collections can be in the form of multimedia, digital library collections are not just collections in the form of text or images. Digital library collections can be in the form of a combination of text, images, and sound. Even digital library collections can store documents that are only in the form of moving images and sounds (films) that cannot be replaced with text.

The cost is cheaper, relatively speaking it can be said that the cost for digital documents is cheap.

D. Laravel Framework

According to [10], Laravel is an open-source PHP framework with a Model-View-Controller (MVC) design that is used to build website applications. Laravel is one of the few PHP programming language frameworks that offer modular code. This is achieved through a combination of drivers and bundled systems. Drivers allow us to easily change and expand caching, session, database, and authentication functions. The use of a bundle can package up to any type of code for reuse or give to all Laravel users. Laravel is very interesting because anything written in Laravel can be packaged in a package [11], [12].

E. Related Works

There are many researches which concern with this topic, for example [13] which supports the goal-oriented requirement engineering for business continuity planning. Research [14] also implements the organization goal-oriented requirement engineering (OGORE) methods in ERP-based company

business processes. While [15] specify the goal-oriented requirements for digital libraries.

III. Development Methodology

A. Data Collection

The authors interviewed Library Managers, Head of Libraries, and Headmasters of Muhammadiyah High School 25. This interview was proposed relating to the problems that the authors put forward and discussed problems in the library and discussion of solutions that could be used for problems the problem.

B. System Development

In designing this system the writer uses the Agile Extreme Programming (XP) system development method. XP uses an object-oriented approach as a development paradigm and includes a set of rules. In XP, there are 4 (four) activity frameworks, namely planning, design, coding and testing) as shown in Fig. 4 [16].

C. Research Flow

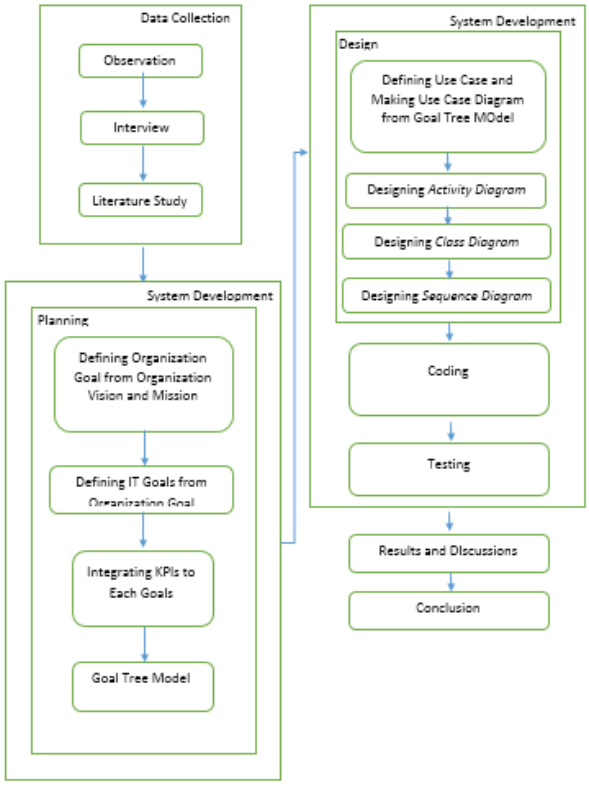

Fig. 4. Research Flow

IV. Implementations

A. Planning

1) Defining Organization Goals from the Organization's Vision and Mission

Chief of Facilities and Infrastructure described the Vision and Mission of the SMAM25 Library as follows:

a) To increase the control of purchasing books for the library.
b) To improve library work efficiency.
c) To increase the scope of library readers.

From the Vision and Mission stated by the Chief, the author concludes that the Organization Goals to be achieved are "Improving Library Work Efficiency and increasing the scope of library users".

2) Defining IT Goals from Organization Goal

Authors discuss several IT Goals that are expected to be achieved by the application of this new Information System:

a) Data Management of Books well recorded.
b) Data Management of Members is recorded properly.
c) Data Management of borrowed books properly recorded.
d) Access controlled digital books.

To ensure that all IT Goals above can meet the specified Organization Goals, the following Mapping table is used:

TABLE I. Mapping Organization Goals to IT Goals

IT Goals	Organization Goals	
	Improving Library Work Efficiency	Increasing the Scope of Library Users
Book Data Management Well Recorded	✓	
Members Data Management Well Recorded	✓	
Data Management of Borrowed Books properly recorded	✓	
Access Controlled Digital Books	✓	✓

From Table I it can be seen that all IT Goals determined can meet the existing Organization Goals. While Fig. 5 shows the Goals that are described in the Goal Tree Model Elements.

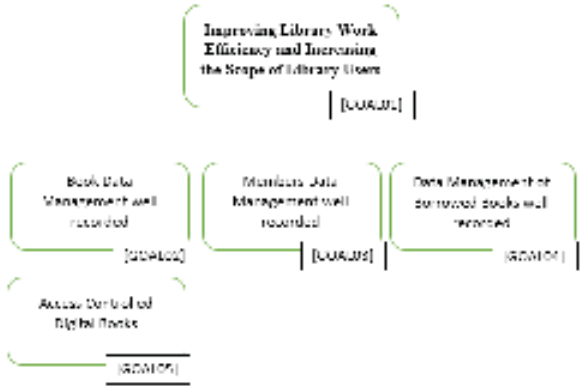

Fig. 5. Organization Goal and IT Goals

3) Defining Tasks, Resources and Actors

Following are Tasks, Resources and Actors extracted from the work process that runs in the Muhammadiyah 25 High School Library as displayed in Fig. 6.

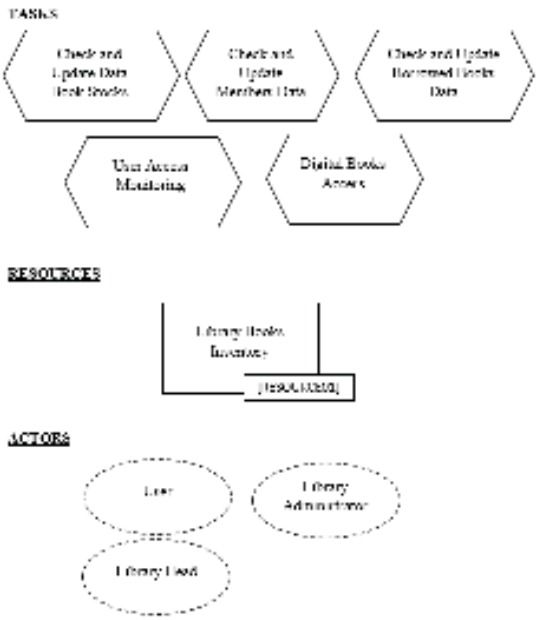

Fig. 6. Tasks, Resources, and Actors

4) Integrating KPI to each Goals

According to [17], in setting KPIs several characteristics must be met. An acronym that is often used in making KPIs is "SMART", where each letter represents an important characteristic. These characteristics are as follows:

a) Specific: Does the indicator convey well what it wants to measure, and how is the measurement carried out? KPIs must communicate clearly to the public about what they want to achieve.
b) Measurable: Can the measurement be expressed as an objective value (for example, the percentage of the number of stocks entered per month, the number of purchases of goods that can be processed in one day, the percentage of the amount of data that must be accessible every day). And is the data easy to get?
c) Achievable: Does the indicator measure something that can be controlled by the program?
d) Relevant: Does the indicator measure the most important results in an activity?
e) Time-Bound: Is there a time limit in reaching an indicator?

The results of the integration of the KPI that has been shaped into every GTM Goals are shown in Fig. 7.

In the design phase, it uses Unified Modeling Language (UML) notation, Fig. 8 shows the use case diagram, while Fig. 9 represents the class diagram which has been used in the system.

B. Implementation

The design of this system uses the PHP programming language, with the Laravel framework and MySQL database. The entire programming phase will use Sublime 3 and Xampp programs to connect to the database. Laravel uses the MVC (Model-View-Controller) architecture where each view or page has its controller.

Fig. 7. Goal Tree Model with KPI

C. Design

1) Use Case Diagram

Fig. 8. Use Case Diagram

2) Class Diagram

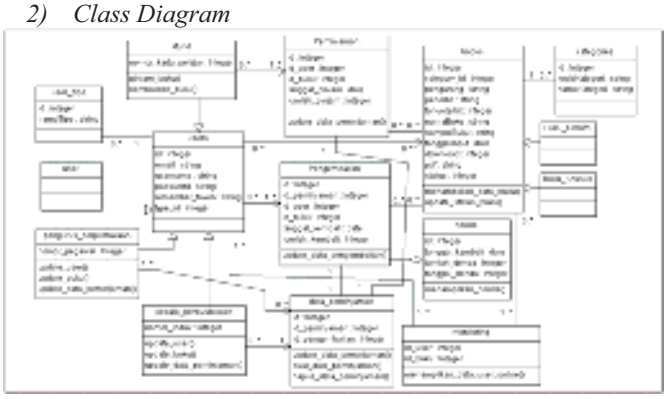

Fig. 9. Class Diagram

D. Testing

The method used in this independent testing is the Black Box Testing method. This method focuses on system functionality, especially the results of input and output carried out by the user. The test is said to be successful if the output matches the input controls entered for each command.

V. RESULTS AND DISCUSSIONS

OGORE is a Requirement Engineering technique in making information systems that are expected to meet all organizational needs entirely without interference from the needs of users or users. This information system is related to an online library system. Based on the needs of the research conducted, namely, about library management at SMA Muhammadiyah 25 by conducting observations and interviews with the head of the library and the principal, in the end, it can be known and concluded that the system created can meet all the needs of the organization in terms of making an online library. The following is an explanation of the points that the writer succeeded in accommodating:

1. Information Systems successfully meet the specified Goals: Can be seen in Section IV, Goals given by the organization described using the Goal Tree Model can be met by the Information System by converting it first into UML format and fulfilled using the XP method.

2. All KPIs are met: KPIs that have been predetermined for each Goals can be fulfilled by the Information System after being tested using the Black Box Testing method and the User Acceptance Test.

VI. CONCLUSION

With the Implementation of the Organization Goal-Oriented Requirements Engineering (OGORE) Method in the Design of Library Information Systems Using the Laravel Framework (Case Study: Muhammadiyah 25 Pamulang High School Library), it can be concluded that the application of OGORE results in the design of this system can meet the KPI and create more needs specific to the organization and minimize needs based on user requests.

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