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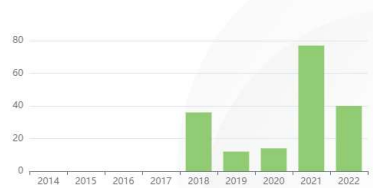

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E-Budgeting Applications Design and Analysis using an Object-Oriented Approach for The Aircraft Service Company

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Abstract−This study aims to analyze and design an e-budgeting application at an aircraft service company in Indonesia. This aircraft service company has a budget management division plan in preparing budget planning and monitoring budgets. In its implementation, the current system procedure has experienced several errors including 1) slow data processing; 2) budget monitoring is not running according to procedure; and 3) the system is not integrated with one another. The method used in this research is a case study while the data were collected through interviews and direct observation. The analysis and design used object-oriented approach with the Unified Modeling Language as a tool. In addition, the system development model used in designing the system is prototype. The result of this research is an e-budgeting application which can facilitate the program management division of aircraft service companies in budget planning and monitoring of budgets effectively and efficiently. The proposed e-budgeting has been designed, built, and tested using the black box testing method. Every function that is part of the requirements for the budget management system has been fulfilled 100%. The activity flow of the budget submission process to validation and confirmation can be carried out properly. The results show that the proposed E-budgeting application gives an alternative solution to solve their known issues compared to the budgeting existing system before.

Keywords: Application; Object-Oriented Approach; E-Budgeting

1. INTRODUCTION

During the Covid-19 pandemic, keeping a distance must always be done by the community. This is done in order to suppress and break the chain of virus transmission by 82% [1]. Due to every activity must be kept at a distance, almost all countries in the world have made a policy to maintain distance and wear masks [2]. This policy also impacts on office activities throughout Indonesia. Companies began to shift office and administrative activities to online mode. Online activities can provide alternative solutions when government policies on handling Covid-19.

One of the largest Indonesian aircraft companies is also one of the companies affected by this policy. Activities of the company is limited, as office and administration activities must be carried out online. Face-to-face meetings in office activities began to be reduced. Despite the limitations, the activities of the office should still work. One of them is in the budget planning division, and this division must be able to plan and monitor budgets amidst limited human movement. With the Covid-19 pandemic, the application of digital technology in providing social activities related to support for the business activities is required [3].

In its implementation, the planning and budget monitoring division faces several problems. Existing procedures are unable to adapt to changing work environments. This results in several problems, which are: 1) it takes a lot of time to process budget data; 2) Budget monitoring cannot run according to existing procedures due to limited activities, and 3) current systems are not integrated with each other. These problems result in a decrease in the level of efficiency and absorption of the budget. In industry, budget management is very important to control costs from reduction to planning[4].

The importance of budget management in the industry and also is the necessity to take advantage of digital technology. Companies must take advantage of e-budgeting because it can provide more quality information than traditional budget management methods [5]. E-budgeting is developed based on the use of information systems in terms of budget management support [6]. Utilizing e-budgeting in budget management activities can realize transparency, accountability, and performance[7], [8]. In addition, an e-budgeting information system is able to provide activity efficiency in terms of budget planning and implementation [9]. In addition, companies often involve third parties in building e-budgeting applications [10]. However, using third-party services sometimes making it difficult to adapt to existing business processes. One company cannot use the same e-budgeting as another company. Therefore, the e-budgeting that is built must be able to provide the procedural characteristics of this aircraft company.

The implementation of e-budgeting in companies can increase efforts to fulfill efficiency, budget management efficiency, budget control, speed of decision making, and minimize financial planning failures[11]. However, every budget proposal must be prepared with consideration, especially in the transition from a traditional budget system to a budget[12]. Therefore we need a budgeting model design that suits the needs of the company. To get a budget that fits the needs, we need a system design method that can describe the actual business model. Object-oriented modeling provides a new way of looking at problems in the company. Several studies on object-oriented budget design provide an overview of meeting the needs of application-based budget management that can solve company problems by implementing object design[13][11][14].

The Aircraft Service Company which is the object of research has serious problems regarding budget management in its program management division. Especially during the COVID-19 pandemic, budget policy holders cannot directly monitor the activities of their employees due to the implementation of Work From Home (WFH). This causes some

budget planning cannot be completed on time. A budget management system that is not yet paperless has an impact on time efficiency. Budget documents are not properly monitored because there is no clear verification flow. The non-integration of the current system has an impact on the fulfillment of budget data and information.

This research aims to analyze the characteristics of budget management procedures and also to design e-budgeting applications according to company needs. The e-budgeting that is built is expected to be able to solve problems that occur, especially those related to policies, to maintain distance between activities in the budget management and monitoring division. The analysis and design approach used is object-oriented.

2. RESEARCH METHODOLOGY

The method used in this research is descriptive through case studies. This research was done by following the stages of system design, namely the data collection stage, identification of needs stage, analysis and design stage, implementation of design and coding stage, as well as a testing stage [15]. The stages of data collection were carried out by direct observation and interviews. System user involvement is described using object-based modeling. The analysis tool used is the Unified modeling language which includes Usecase, Sequence diagrams, and Deployment diagrams. The use of an object-based approach in analysis and design activities can make it easy for programmers to build, realize, and improve application development [16].

The steps of the research carried out include (see Figure 1) below.

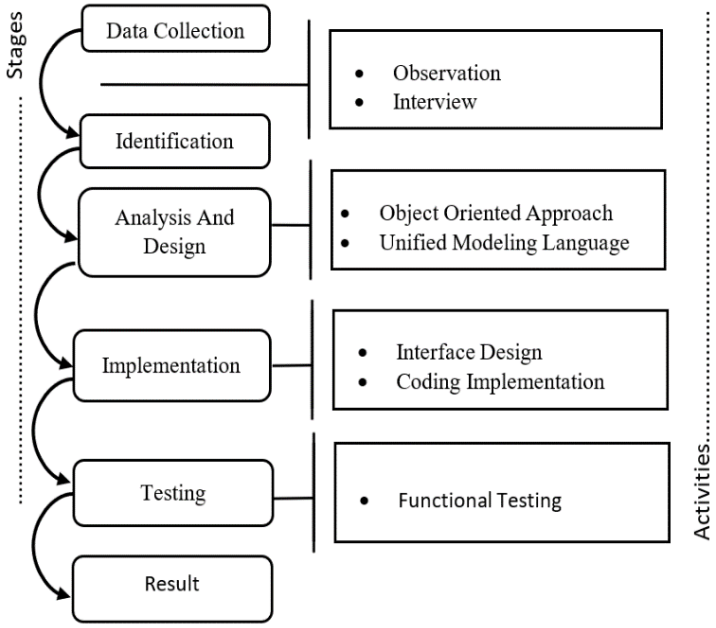

Figure 1. Stages of the research

In the stages of carrying out research carried out sequentially, it is expected to get measurable results. The stages of data collection and identification are carried out to obtain the appropriate ebudget system requirements. Furthermore, the analysis and design stages are carried out using an object-oriented system approach using the unified modeling language (UML) analysis tool.

2.1 Analysis and Design Methods

Object-oriented systems approach is used to get a real picture of the business system running from different perspectives. This stage is done by describing the system into objects and classes. E-budgeting system is built will be divided into several objects. The concept of object orientation focuses on creating classes as blueprints of objects[17]. Unified modeling language (UML) is used as a modeling tool for e-budgeting systems. With UML, visual communication of the system can be described through diagrams and supporting text[18]. In this research paper, the author performs system modeling using use case diagrams and sequence diagrams.

2.2 Implementation

The implementation stage is carried out to transform the results of the analysis and design into a real system. In this stage the system interface design is made and the functions of the e-budgeting process are built. This e-budgeting system is built on a web application platform with data storage in MySQL. The determination of this web interface platform is to facilitate maintenance when the system is migrated and applied to the object of research. In addition, this system will be

implemented online, therefore the web platform is very appropriate to be developed into a proposal for making an e-budgeting system.

2.3 Testing Methods

To obtain an e-budgeting system that is in accordance with the identified requirements, and to achieve a functional system, it is necessary to test the system. In this research, blackbox testing is used to obtain the effectiveness of testing in accordance with the expected functions of the e-budgeting system. Blackbox testing is a software testing technique that focuses on functionality and without knowledge of the source code of the software[18]. So that the testing of this e-budgeting system will focus on the input and output of the system software that is built in the hope of meeting user needs.

3. RESULT AND DISCUSSION

The program management division has tasks, one of which is making operational budget planning. Based on the results of observations and interviews, there are several problems that hinder employee performance in the budget division as mention in the indtroduction section. The main problems are:

a. It takes a lot of time to process budget data
b. Budget monitoring cannot run according to existing procedures due to limited activities
c. The running systems are not integrated with each other.

To gain the fulfillment of the e-budgeting system requirement, need to evaluate the ongoing system or the existing system. We analyzed the ongoing system, create a model using a use-case diagram, and get effective solutions to fix the budgeting problems.

3.1 Existing System Analysis

In addition to the main issue, in the stage of observation, authors found that the condition of the main problem is exacerbated by the buildup of a document and limited human resources-related units that make their reports separately. Meanwhile, looking at the development of accounting, the use of integrated reporting has become an innovation in the information age [19]. The application of e-budgeting can improve the tidiness of planning documents and reporting on the use of funds in the company. It can also improve the quality of budget planning and activate controlled budget management [20]. Therefore, it is very necessary for the program management division to make integrated financial reports. According to a study from Lampung University, e-budgeting positively influenced financial reporting [21]. The model of the existing system was designed using an object-oriented approach especially show as a use-case diagram. An object-oriented approach for design the model has to implement the design principles [22]. To obtain clearer procedures related to budget management, Figure 2 shows the diagram of budget management which runs in the program management division.

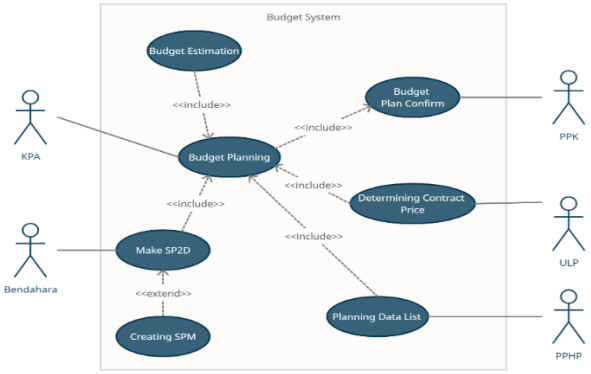

Figure 2. Existing Use-case System

Based on the results of the analysis, the evaluation results are obtained as shown in Table 1. The system running in the program management division is unable to solve budget management problems. Therefore, a system proposal was made.

Table 1. Evaluation and Solutions

No	Problems	Proposed System
1	In the process of data processing, budget planning still uses Microsoft Excel so that it takes a long time and often accumulates documents which result in damaged documents	We are designing an information system that can process budget planning data and make it paperless so that it can avoid the accumulation of documents.

No	Problems	Proposed System
2	There is no information system that can monitor budget documents	Developing an information system capable of monitoring budget planning documents in the Program Management Division
3	There is no computer-integration between the parts and the building, which causes employees to need time to send the required data and information	Developing an information system capable of integrating computers between sections which later can make it easier for employees to send documents between sections and between buildings

Based on table 1, it is necessary to have a system with a proper function. The proposed system for planning and implementing budget submissions is carried out through the application of private network technology, where users/parts involved can send files directly without having to go to other departments. Determination of system requirements is done so that the system design direction can be directed at the target. Therefore, the system design must meet the system limitations where the design of this system is a functional requirement.

3.2 Proposed e-budgeting System

The system analysis process that has been done previously provides information about the system that is currently running, including weaknesses in the system. Based on the results of the ongoing system evaluation, the existing system needs to be developed. System development is done by changing or developing an existing system. After understanding the current system and the criteria for the system to be built, the next step is to design an e-budgeting information system first. To design an e-budgeting software, an object-oriented approach is used to provide the best solution for the known issues [23].

This design includes use case diagrams, activity diagrams, sequence diagrams, class diagrams, component diagrams, and deployment diagrams that produce a better system. The process that is designed is described into several parts that can form the system into a single component. However, in order to provide a complete picture of the system, the author does not display the entire diagram but only displays the use case and sequence of one of the system activities. Figure 3 shows how the proposed system is based on the evaluation results.

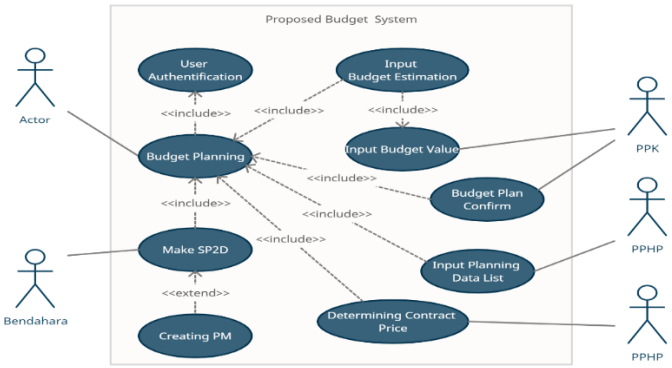

Figure 3. Proposed System

This budget system is proposed by considering user authentication (see Figure 2). User authentication provides user security in accessing data [24]. In business, especially finance, data is very sensitive. Losing data will be the same as losing money. Apart from authentication, the proposed system provides procedures that resemble the old system, namely budget planning, budget estimation, budget confirmation, Planning Data list, etc. The proposed system offers a new interface with the old way of working so that the user can quickly understand the new system. The diagram of the budget plan is shown in Figure 4.

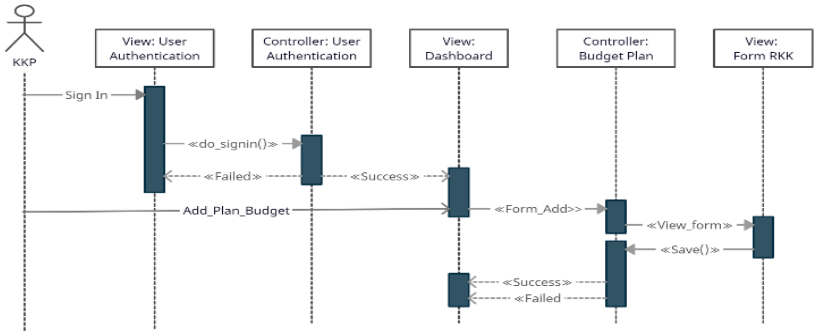

Figure 4. Budget Plan Sequence Diagram

From the use case that has been made according to the modeling in Figure 3, a sequence diagram is used to provide a full picture of how the system works. Figure 3 shows the budget planning activities carried out by users. Of the many use cases, the author only shows sequences for budget planning.

The results of the ongoing system design and analysis are continued by designing the proposed e-budgeting system to provide problem-solving solutions. At this stage, the authors develop an e-budgeting system with client-server technology. Client-server is run as needed. This e-budgeting system is also built with web technology to facilitate implementation. In addition, with the application of web technology, technology adaptation of the new system can be made easily.

The following is the design result of the user interface of the proposed e-budgeting system (See Figure 5). The author only displays an example of the interface implementation for budget planning activities shown in Figure 5. The program management division can make budget plans using the RKK form. The RKK form becomes the basis for further budget management. All submitted budget submission data can be seen on the submission data list page (see Figure 6).

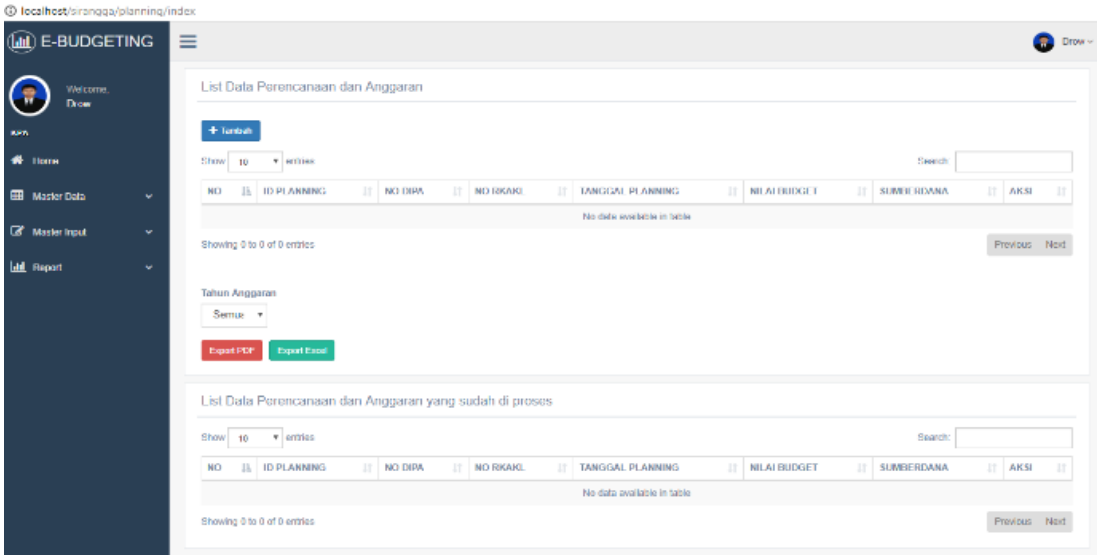

Figure 5. Budget Planning Form

The budget planning form is used by KPA users to fill out budget plans. In this form the user must enter related data, and it will be sent to another section with a notification. The procedure is continued with the confirmation scenario and approval of the proposed budget value. Each proposed plan will lead to the creation of a planning data list as shown in Figure 6. The process carried out in this activity is the awarding of a contract number for the approved budget.

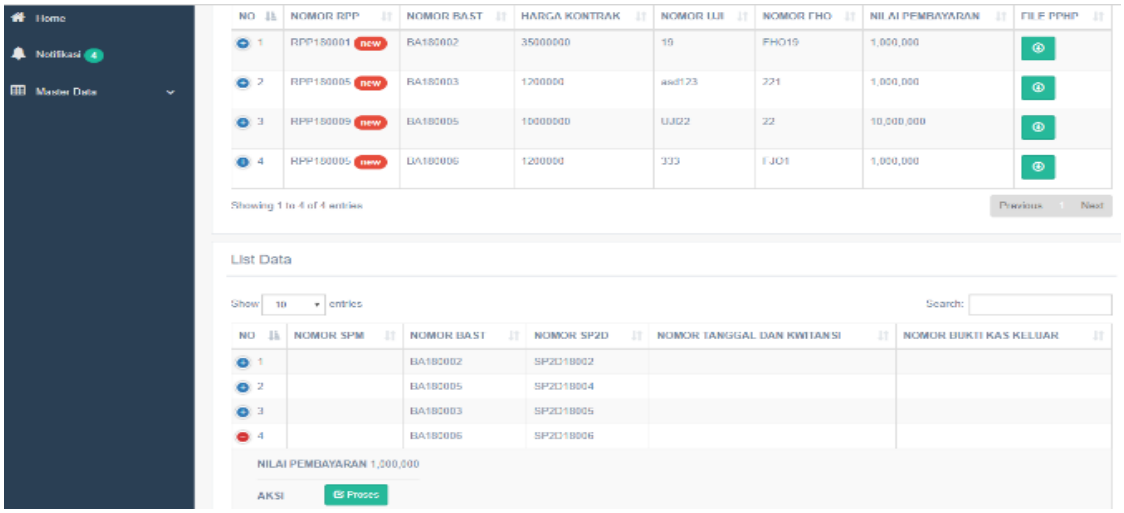

Figure 6. Input Data List Planning Form

This page can make monitoring the budget proposal easier to identify. This e-budget is analyzed and designed to facilitate the program management division in managing, monitoring, and planning budgets. This system is able to provide solutions to every problem that exists in the program management division of the aircraft service company. In order, the procedures for the proposed e-budgeting system are a transformation of the old budget system by turning it into a digital version by implementing a budget management information system (e-budgeting).

3.3 System Testing

As defined in the stages of research before, to get the best result to achieve a suitable functional system is needed that had to be done by testing. Black box testing is used to obtain these functional requirements. Testing is done by testing the input and output data. The following is shown in table 2 the results of testing the modules contained in the e-budgeting system that was built.

Table 2. Testing Plans and Results

Test items	Description	Test Detail	Test result
User Authentication	Performed to obtain suitability based user login predetermined role	*a.* Login User Verification *b.* Dashboard *c.* System Notification	Success
Data Input Testing	Performed to test the readiness of the form to the data entered into the system	*a.* Budget Estimation Input *b.* Budget Value Input *c.* Data Planning List Input *d.* Budget Plan Confirm *e.* Making SP2D *f.* Creating PM *g.* Determining Contract Price	Success
Data Validation Testing	Performed to test the validation and verification of data against input errors and data discrepancies.	*a.* Edit Data Process *b.* Delete Data Process *c.* Saving Data Process *d.* Views Data Process	Success

From the results of testing the functions of the e-budgeting system, it is concluded that the functions of the proposed system can run according to the desired needs. The proposed e-budgeting system can respond to inputs and obtain appropriate outputs so as to produce accurate information. All items suitability testing has resulted in the expected function. Every detail of the test has shown appropriate results to the budget management process on the e-budgeting system that was developed. With valid test results for all required functions, it is expected to be able to provide solutions to budget management problems in the program management division.

4. CONCLUSION

The conclusion obtained in the research is that the implementation of the information system for planning and implementing the budget (e-budgeting) has been made in accordance with the requirements. The analysis and design contains a system diagram model that is transformed into a web-based system interface. Based on the results of system testing carried out, this e-budgeting system has been able to provide appropriate and appropriate functions. So that the e-budgeting system that was built can provide solutions to the problems that arise. This e-budgeting system is expected to be understandable and make it easier for users to use this application. This budget management information system (e-budgeting) will also greatly assist in accelerating the availability of information in the monitoring and evaluation process of implementation in each related unit and the overall implementation process. The procedure for validation and confirmation of budget submissions does not take a long time because it can be done online. So that it can improve the performance of budget management in the program management division. During the Covid-19 pandemic, companies can use this e-budgeting system to avoid direct contact with fellow employees and always maintain a distance. So that budget management activities can run with high effectiveness.

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