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Analysis of business intelligence system design for student performance monitoring

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Analysis of business intelligence system design for student performance monitoring

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Abstract. The Informatics Engineering Study Program at the University of PGRI Madiun is one of the institutions that provide education services. The increasing number of students each year requires supervision and measurement of student performance in order to create an optimal process. The optimal process will produce output that is in accordance with BAN-PT standards related to student performance. Looking at these problems, it is necessary to have an information system that can present student performance data for the purposes of accreditation and evaluation of student performance. The purpose of this research is to analyze and design student performance monitoring information systems by applying the Business Intelligence concept. The systematics of this study refers to the Bussiness Intelligence Roadmap Method of Larissa T Moss and Shaku Atre. The results of this study are a design of data sources and system architecture that will be used in the system development process in the future.

1. Introduction

BAN-PT accreditation is one form of evaluation to determine the feasibility of a university or study program determined by the National Accreditation Agency. Student data processing will experience difficulties if the Study Program does not provide a means of access to all data needed to meet the standards of BAN-PT.

The Informatics Engineering Study Program at the University of PGRI Madiun is one of the institutions that provide education services. Currently the Study Program has students with a range of 450 students. With the increasing number of students each year, the study program needs to monitor and measure student performance in order to create an optimal process. The optimal monitoring and measurement process will produce output that is in accordance with BAN-PT standards related to student performance.

Looking at these problems, it is necessary to have an information system that can present student performance data for the purposes of accreditation and evaluation of student performance. The results of monitoring student performance will be the basis for making decisions quickly and precisely. Asstated in research[1] . Business Intelligence-based information system can collect, store, organize and provide the information needed to input student data according to BAN-PT standards

Business Intelligence System is one of the information technologies that is used as a tool to increase the value of business organizations or companies[2]. Business Intelligence is a concept to improve the quality of business decision making based on data-based systems that are commonly applied by business actors or companies[3]. This monitoring system with the Business Intelligence concept can process

extensive data so that the values contained in the data can be represented in several concise pages and display information needed by decision makers[4].

Therefore, the implementation of this study aimed to analyze and design student performance monitoring information systems by applying the Business Intelligence concept. This student performance monitoring information system can process and present data for standard needs of BAN-PT forms. The development of this software system used the Bussiness Intelligence Roadmap method of Larissa T Moss and Shaku Atre.

2. Study ofLiterature

2.1. Business Intelligence

Universities are good candidates for the application of the BI system, this is because competition in the education sector is very competitive in recruiting students both domestically and abroad. The BI system is able to carry out the process of collecting information correctly and precisely so that it can achieve its objectives because the decision-making process runs well [5].

Business Intelligence systems must have the ability to allow leaders to view data in different perspectives. Data generated by the BI system must be able to navigate business processes so that leaders can anticipate and estimate organizational changes[6].

Business Intelligence System is a technology that functions as a tool to convert data into information. This information will be used by the leadership to guide organizational leaders to make better business decisions[7].

BI is an important component of Higher Education which has a function to measure, monitor and manage the performance of Higher Education management more effectively based on its resources and business processes[8].

2.2. LarissaAtreBusiness IntelligenceRoadmap

*Larissa AtreBussiness IntelligenceRoadmap*is a visual guide in developing effective Bussiness Intelligence systems through 6 stages, namely Justification, Planning, Business Analysis, Design, Construction, Deployment[1].

The integrated BI decision support system environment cannot be built in an instant, data and system functionality must be updated repeatedly. The BI Roadmap does not discuss organizational change, the BI roadmap aims to define BI project activities needed to support organizational system infrastructure both technical infrastructure and non-technical infrastructure[9].

3. Research Metodology

The systematics of this study refers to the Bussiness Intelligence Roadmap Method of Larissa T Moss and Shaku Atre. This method explains that the business intelligence information system development process consists of 6 phases, namely justification, planning, business analysis, design, construction and deployment. The stages of the phases in the Business Intelligence Roadmap can be illustrated in Figure 1 below:
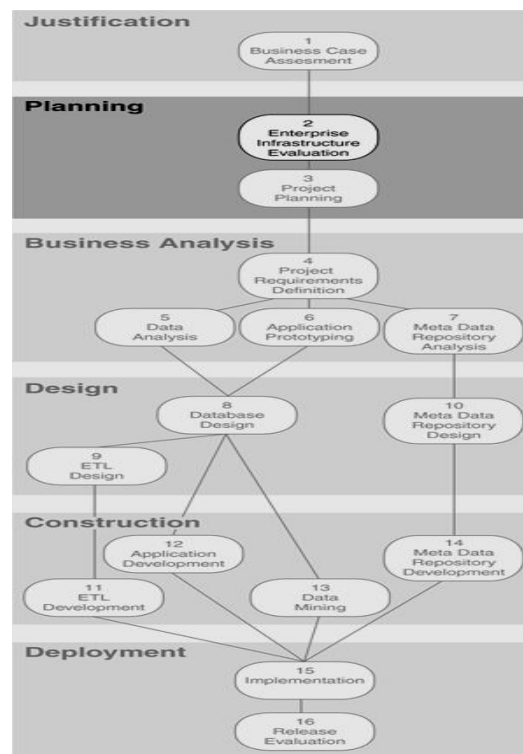
Figure 1. *Larissa Atre Bussiness Intelligence Roadmap*Method

The activities carried out at stagesofLarissa Are roadmap are as follows:

1. Justification
   Defining business problems and opportunities as a basis for determining problem solving with Business Intelligent application solutions.

2. Planning
   At this stage it is divided into two activities, namely Enterprise Infrastructure Evaluation and Project Planning. The Enterprise Infrastructure Evaluation activity is analyzing infrastructure requirements to support the development of Business Intelligent systems. The infrastructure analyzed consists of two parts, namely technical infrastructure and non-technical infrastructure. The second activity is Project Planning, which is to estimate the activity schedule.

3. Business Analysis
   The activity in this phase is to make documentation of needs that have been previously identified. Documents contain business data analysis, system specification analysis both functional and non-functional, prototype design in the form of software and hardware.

4. Design
   At this stage the activity carried out is to make a database scheme design that is able to integrate data and facilitate decision making. This stage also designs data sources and system architecture.

5. Construction
   It is the stage of developing a Business Intelligence system with planned software.

6. Deployment
   The final stage of the Larissa Atre roadmap is implementing a system that has been built and tested for the system evaluation process.

In this study based on the research objectives, the stages of the Larissa Atre roadmap adopted only reached the fourth stage, namely the design stage. The framework in this study is as shown in Figure 2 below:
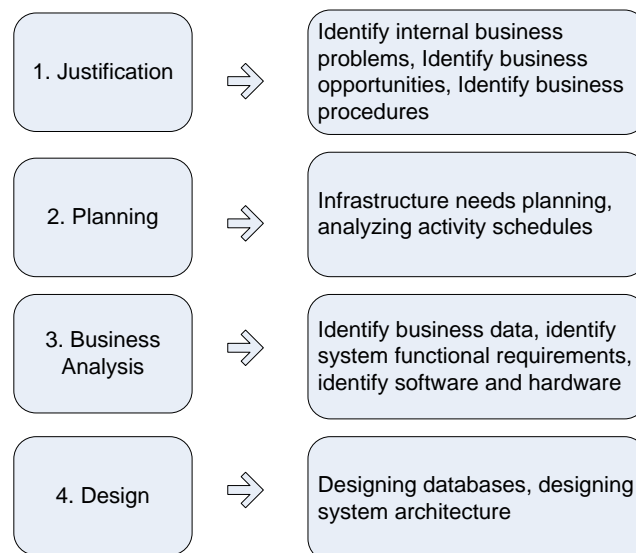

Figure 2. ResearchFramework

4. Analysis and Discussion

After determining the research framework, the next stage is to create a design analysis document for the Business Intelligence System application based on the Larissa Atre roadmap in Figure 2 above. The results of the design analysis can be explained as follows:

1. Justificationstage

At this stage, identification of the problems faced by the Informatics Engineering Study Program at the University of PGRI Madiun was identified. Problems were analyzed with the SWOT approach method. The results of the SWOT analysis are as follows:
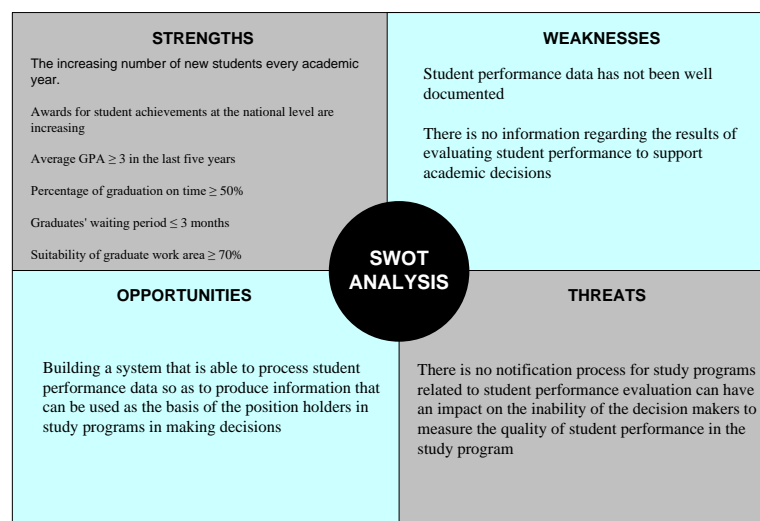

Figure 3. SWOT Analysis

From the results of the mapping in Figure 3 in the form of a SWOT analysis that there are problems that are student performance data not well documented in the study program so that there is no information related to the results of student performance evaluations that can support the stakeholders to make improvements in the study program. Data processing must be well organized through software development that is able to provide student performance data so that it can support input of accreditation forms quickly and accurately.

2. Planning Stage

The first activity at this stage is to evaluate the condition of the current technical infrastructure and then analyzing the infrastructure requirements that will be needed for the software development process. There are several problems that will be analyzed, namely the analysis of hardware requirements, analysis of HR requirements, analysis of network conditions, analysis of Database Management Systems and other non-functional requirements needed for system development. At this stage also planned the need for non-technical infrastructure through the ETL process (Extract, Transform, Load) which aims to extract data from data sources and then transfer it to data warehouse. Before the data was inputted into data warehouse, a data cleaning process was carried out. The evaluation steps taken are first assessing the current technical infrastructure platform, then evaluating and selecting the new products needed. Assessment results are written in technical infrastructure assessment reports. Based on the results of these assessments, ordering, installing and testing can be performed.

3. Business AnalysisStage

In the business analysis stage, the first activity carried out was to analyze the functional requirements of the system in managing student performance. The results of the analysis of the functional requirements of the system can be seen in Table 1 below:

Table 1. Analysis of system functional requirements

No	Business Process	Data needed by business people
1	Manage the ratio of prospective students to capacity	prospective student data
		class capacity data
2	Manage average GPA data	data on average student GPA
		data on the average GPA of graduates
3	Manage appreciation for student achievement	data on scientific competition achievements, sports competitions, art competitions at the national or international level
4	Manage graduation percentage data on time	Graduation data
5	Manage waiting period for graduate work	Data on graduate work waiting period
6	Manage data on the suitability profile of graduates in accordance with the study program	data on the suitability profile of graduates in accordance with the study program
7	Manage data on students dropping out or resigning	data on students dropping out or resigning

Based on the mapping in Table 1 above, it can be concluded that there are 7 business processes conducted by study programs to measure student performance according to the

Accreditation Form. Based on the business process, data needs can be identified related to student performance management.

4. Design stage

At the database design stage, there are several things that must be considered, namely consideration of performance, selection of DBMS and HR. Data sources to be used in the BI system are student performance adjusted to the needs of accreditation forms, while the identification of types of data can be seen as follows:

Table 2.Identification of Data Types

No	Information Needed	Data Type	Data Sources
1	Student Data Information	New student data	DbSIA
		Old student data	
		graduate data	
		student data drop out	
		Resignedstudent data	
2	Student GPA Information	Student GPA data	
3	Alumni Data Information	Alumni Data	DbTracerStudy
		WaitingPeriod Data	
		Alumni Job Data	
3	Student Achievement DataInformation	StudentAchievement Data	DbPPBK

It is known that the type of data needed for managing student performance is student data consisting of new student data, old student data, graduate data and data on students who resign. In addition to inputting accreditation forms, the data also requires student GPA data, alumni data and alumni waiting period, alumni job data and student achievement data. All of the data is sourced from the SIA database, the tracerstudy database, and the PPBK database.

The entire operational data will be managed into the student performance BI system for ETL processes (Extract, Transform, Load) and the results will be saved to data warehouse. Here is the ETL Process Flow Diagram of the BI system student performance can be seen in Figure 5 below:
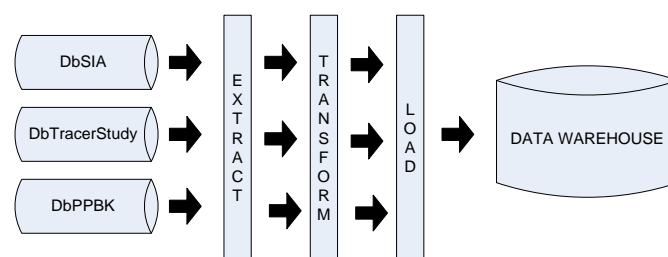

Figure 4. ETL Process Flow Diagram ofBI System Student Performance Monitoring

The ETL process begins with an ETL machine performing the process of extracts, cleanses and transforms on operational data. Then the middleware will help bring data to the BI database. Finally, when the data requested by the user will be mapped by the application by running queries and printing reports. After the ETL process is implemented, the next step is to design the BI system architecture that will be developed. The system architecture that will be built is as follows:
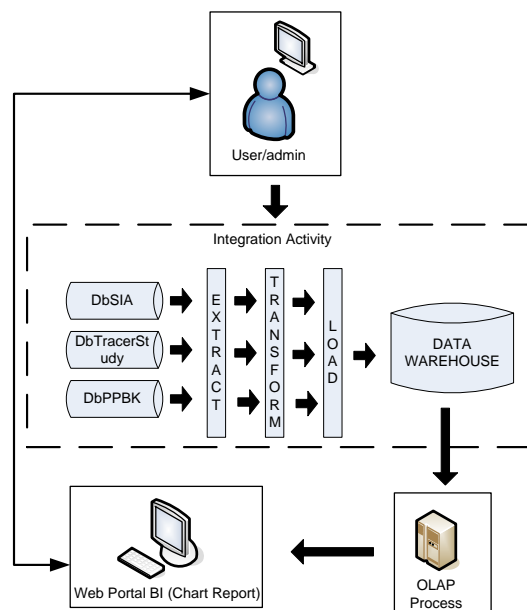
Figure 5. BI System Architecture

In Figure 6, the admin or user processes the ETL data source from the database that has been built. In the integration process, the admin will update the data that will be stored in the data warehouse according to the analysis needs. The next step after the integration activity is logging into the BI portal web system to select the desired data in the form of graphical reports or statistics. The data entered will be processed by the system in the process of On-Line Analytical Processing (OLAP).

In the BI system that will be built after the process of integration and data analysis, the system will print output in the form of reports in the form of graphs and tables in the form of student performance data. With the display of this report, the decision makers in the study program will be easier to evaluate the quality of student performance and then be reported in the preparation of accreditation forms.

5. Conclusion

Based on the results of the analysis of system requirements and design that has been carried out, this study succeeded in making the design of the Business Intelligence information system architecture design of student performance monitoring according to the needs of accreditation. The limitations of the results of this study are still limited to the design concept as a form of recommendation for the future system development process.

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