ONLINE DATA VISUALIZATION FOR UMP STRATEGIC PLAN DASHBOARD

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ABSTRACT

Measuring UMP Readiness to Implement Online Data Visualization

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Business Intelligence (BI) system is widely applied in many fields especially the business field which is for the purpose of producing a better decision in solving the problems and get more accurate analysis results with the visualization of graphical data. UMP is now currently using the traditional information system which is unable to represent the data or information with the suitable graphs or charts. This project is developed to build a prototype dashboard system for the purpose of monitoring the performance of each department in UMP according to the strategy plan which included the UKRA (University Key Area Result) and all of the KPI (Key Performance Index) by implementing online data visualization. Rapid Application Development (RAD) is the methodology implemented to develop this system. This dashboard system is believed can be helped in producing a better decision making solution for the problem faced through the effective graphical data form and also improving the quality of UMP.

Keywords: Business Intelligence (BI), Online Data Visualization, Readiness, Dashboard System

ABSTRAK

Mengukur Kesediaan UMP Melaksanakan Online Visualisasi Data

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Business Intelligence sistem (BI) digunakan secara meluas dalam pelbagai bidang terutamanya bidang perniagaan yang bertujuan untuk menghasilkan keputusan yang lebih baik dalam menyelesaikan masalah dan mendapatkan keputusan analisis yang lebih tepat dengan visualisasi data grafik. UMP kini masih menggunakan sistem maklumat tradisional yang tidak dapat mewakili data atau maklumat dengan graf atau carta yang sesuai. Projek ini dibangunkan untuk membina sistem dashboard prototaip bagi tujuan memantau prestasi setiap jabatan di UMP mengikut perancangan strategi yang termasuk UKRA (University Keputusan Kawasan Key) dan semua KPI (Key Performance Index) dengan melaksanakan visualisasi data secara online. Pembangunan Permohonan Rapid (RAD) adalah kaedah yang dilaksanakan untuk membangunkan sistem ini. Sistem dashboard tersebut dipercayai boleh membantu dalam menghasilkan penyelesaian yang lebih baik bagi membuat keputusan untuk masalah yang dihadapi melalui data grafik yang lebih berkesan dan juga meningkatkan kualiti UMP.

Kata Kunci: Business Intelligence (BI), Visualisai Data Secara Online, Kesediaan, Sistem Dashboard

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PART 1

INTRODUCTION

1.0 Introduction

In this era of information technology driven society, there are a lot of information around us at everywhere. In those information systems, there are huge amount of data inside and divided into different categories. Data is very important for every organization and they have to manage and analyze all of data accurately especially in the business field since they have to make a correct decision according to what have they analyzed. A good information or data management system will make or improve the quality of the whole organization since the solution of decision-makers is provided. Business Intelligence (BI) system is one of the suitable systems that can be used in any fields that need to manage the data properly and represent the data in the suitable graphical form. According to Ellis, S. D., & Morris, H. D. (2010), IDC Retails Insights had carried out a survey in implementing an analytics solution over 2,700 IT managers and the result shows that 91% of large enterprises (over 5,000 employees) have implemented an analytics solution, while 83% of medium-sized enterprises (500–5,000 employees) have done so too.

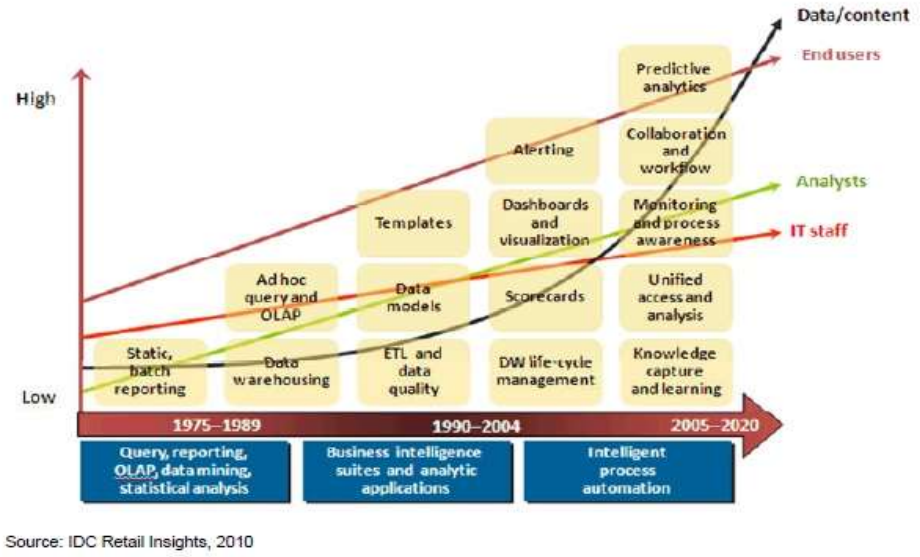


Figure 1.1: The Growing Influence of Business Intelligence (BI)

According to Ranjan, J. (2005 – 2009), Business Intelligence (BI) has two basic different meanings by the use of the term of intelligence. The first meaning is defined as the human intelligence capacity. This described that the capability of human intelligence applied in the business affairs or activities. This can be said as the investigation of human in order of to solve different business problems according to their management and decision support. The second meaning is related to the intelligence of information valued for its currency and relevance. This is means as the expert information, knowledge and technologies efficient in the management of an organizational or any individual business. Business intelligence is one of the applications or ways to help the enterprise users for gathering, providing access to and analyzing data in order to improve their business decisions. There are a lot of factors that can affect the enterprise users to produce a better business decision which are the customers, competitors, business partners, economic environment and internal operations.

Business Intelligence (BI) can be said to replace the decision support, executive information systems and management information systems as defined by Thomsen (2003). According to Negash, S. (2004), BI system is the combination of data gathering, data storage and management of knowledge by using the analytical tools to present complex internal and competitive information to the planners or decision makers. By using this system, the useful information or decision can be delivered to the decision makers at the right timing and this enable them to save the time in the decision making

process. In this BI system, both of the structured and semi-structured data will analyzed by the analysts. Both of these types of data will be the inputs of the system and the examples of structured data are like OLAP, DW and DM while for the semi-structured data are conversations, graphics and business processes. Besides, Langseth and Vivatrat (2003) have summarized that the components of the BI will be real-time data warehousing, data mining, automated anomaly and exception detection, proactive alerting with automatic recipient determination, seamless follow-through workflow, automatic learning and refinement, geographic information systems and data visualization. Figure 1.2 represents the basic understanding of Business Intelligence.

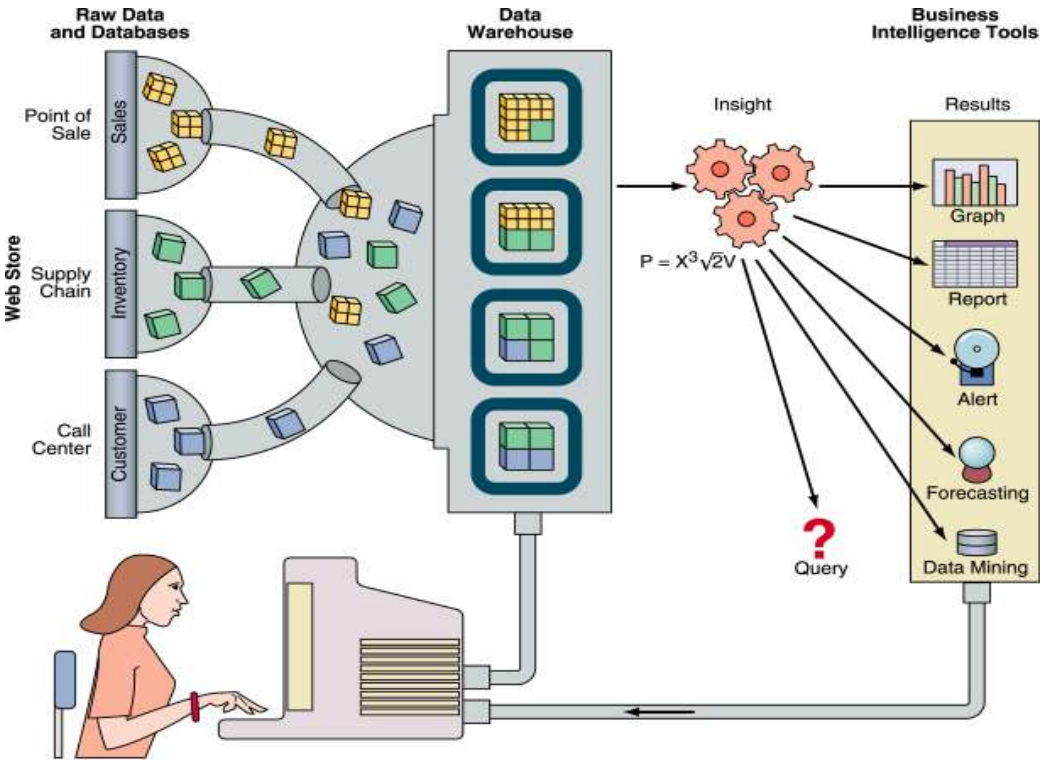


Figure 1.2: Basic Understanding of Business Intelligence (BI)

Apart from that, education field such as university can also implement BI system in term of managing the information and data of the whole university. University Malaysia Pahang (UMP) has to be aware with this since the management of data still not very well. By implementing the BI system, UMP can store all the data according to their categories accurately and will not mixing up the data since the data will be changed or increased year by year or anytime when the update is been made. Furthermore, UMP can also analyze the data that they needed and get the solutions from

the analytical tool which is the dashboard with those graphs and charts to improve the decision making skill based on the problem faced. Therefore, UMP dashboard system is designed in order to let the human resources which included the both of the staffs and top levels of every department in UMP to visualize the achievement based on the strategic plan and improve the quality of UMP.

1.1 Problem Statement

Nowadays, most of the offices or analysts are still using the traditional or conventional information system and analytical tools such as spread sheets, desktop databases, Google Analytics and others instead of using Business Intelligence (BI) system to store and analyze all of the data. First, some of the traditional information system cannot store huge amount of data and maybe will mixing all of the data at the end. University Malaysia Pahang maybe will face this kind of problem since the data are changing or updating time by time especially when the new semester is started. UMP can store and manage or arrange all of data accurately by using the dashboard system.

Besides, the traditional information system sometimes will lack of the information that the users needed. This will slow down the decision making process and there will be no sufficient time for waiting another process in this fast, interconnected and complex world nowadays. By using the analytical tools in the dashboard system, UMP can easily analyze all the data through the graphical form and get the accurate information about the problem that they faced. Then, planning for the decision will be started and the best solution of the decision will be produced at the end. This enable UMP to save a lot of time in thinking of the decision and can make sure the main cause of the problem can be detected correctly.

Apart from that, the traditional information system can only store some basic information but dashboard system can store more detailed information. UMP consists of many departments and there are huge amount of data. It is hard for the traditional information system to store the detailed information for each department. This maybe will cause the database of the information system overloaded. Then, this maybe will affect the quality of UMP to be decreased and cannot achieve the goals in the strategy plans.

Lastly, traditional information system only will display the specific data with some basic or familiar graphs or charts such as bar chart, pie chart, line graph and others or sometimes only will display all the data in a table form. Through this way, the users might not be able to digest the data in the table and the basic graph might not suitable to be used as visualizing the specific data. This will cause the information or message delivered to the user is wrong. But for the dashboard system, it will use different and the most suitable graph to display the specific data in order to make sure the users can easy to visualize the data and make the decision. So, there must be a right graph or chart for the right data in order to deliver the right information.

1.2 Objective of project

The objectives of this project are

i. to build a prototype of dashboard system to make the decision making process to be more effective and accurate in order to solve the problem after analyzed.
ii. to increase the readiness or awareness of UMP to implement the online data visualization.
iii. to improve or increase the knowledge, skills and experience in using the online data visualization among the UMP in term of analyzing and managing the data and information.

1.3 Scope of project

i. This project will included both of the staffs and students since the system will get the data according to the different types of UKRA (University Key Area Result) in University Malaysia Pahang (UMP).
ii. The decision making mostly will depend on the problem which is the data analysis of UKRA (University Key Area Results) and KPI (Key Performance Index) such as the academic achievement of the student, the satisfaction of the staffs and others.
iii. The data will be received from the Pusat Pembangunan Korporat & Pengurusan Kualiti (PPKPK) which is the client of this project.
iv. The techniques that will be used in this project are HTML5, JavaScript, XML, CSS, Data Visualization and some of the other related techniques.

1.4 Terminology

i. Business Intelligence (BI) is a process of taking large amount of data, analyzing the data and lastly condensing the valued data into a high-levels set of report to enable the management to take the basis business actions through the making of better business decisions, Stackowiak et al. (2007). It is the combination of data gathering, data storage and management of knowledge by using the analytical tools to present complex internal and competitive information to the planners or decision makers as defined by Negash, S. (2004).

ii. OLAP (On-line analytical processing) is the way in which business users can find their way through the data by using some complicated tools that allow for the navigation of dimensions such as time or hierarchies. It is also providing multidimensional, condensed views of data and also for the purpose of reporting, analysis, modeling and planning for optimizing the business.

iii. Advanced analytics is the process of data mining and forecasting or predictive analytics which is for the purpose of predict certainty measures on facts and also discover the trends and analyze the critical factors.

iv. Real time Business Intelligence (BI) is the distribution of metrics through email, messaging systems and/or interactive displays.

v. Data warehouse is the major component of business intelligence and it supports the physical propagation of data by handling the numerous enterprise records for integration, cleansing, aggregation and query tasks.

vi. Data sources mean the operational databases, historical data, external data, or information from the existing data warehouse environment, relational databases, structured information and unstructured information.

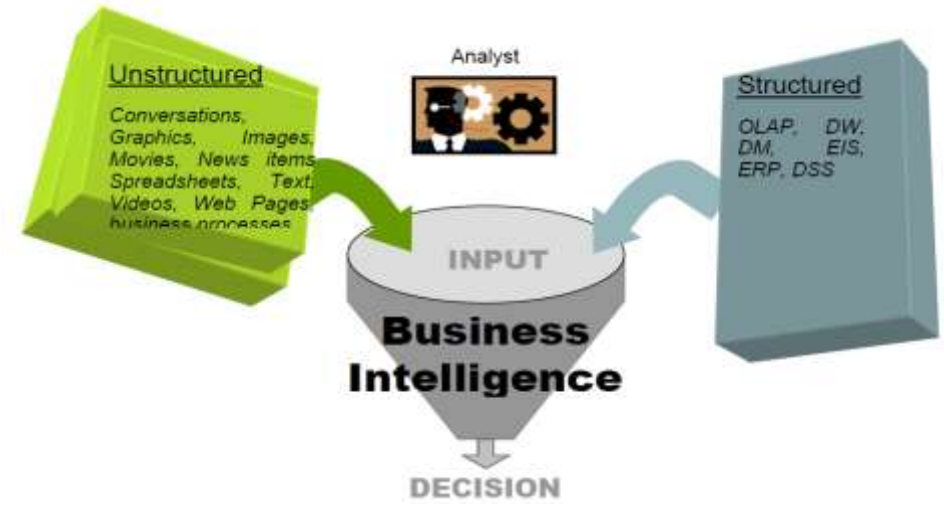


Figure 1.3: Inputs to Business Intelligence System

vii. Data visualization is a process of transforms data, information and knowledge in a visual form to enable us to observe, manipulate, search, navigate, explore, filter, discover, understand, and interact with the large volume of data. The data will be represented in graphical form instead of using a table. The information of the data will be revealed in a good display in order to let the viewers to see the structure of data correctly as defined by Chen, C. H., Härdle, W., & Unwin, A. (2008).

viii. Dashboard system is a system that collects, manages and present data and information which allow the users to make decision based on data from any number of sources. There will be three main layers for this system which the top layer is for designing and displaying the information. The middle layer is a data management layer for data propagation and aggregation. Then, the bottom layer is for data collection and processing (Ly, S., 2004).

1.5 Reasons for Business Intelligence (BI)

Most of the companies nowadays are choosing Business Intelligence is because BI enables their companies to make well informed business decisions and thus can be the source of competitive advantages. By using BI, the firms are able to extrapolate the information and make accurate forecasts or visualization about the trends or the current conditions of economic. They can make the accurate decisions through the analysis

from BI and this will benefit the firms at last. Besides, they can also improve the timeless and quality of information by investing BI. Through BI, it can reveal several things like the position of the firm as in comparison to its competitors, the changes in customer behaviors and spending patterns, market condition, future trends, demographic and economic information.

Apart from that, the companies have realized that the trend of business environment nowadays is very competitive, fast paced and changing so rapidly. So they have to respond and adapt to change in a short time or as fast as possible. This is another reason for them to choose Business Intelligence since it can help them to use the information gathered in order to respond to the changes quickly and constantly.

1.6 Existing System of Business Intelligence (BI)

Nowadays, Business Intelligence is used widely among the companies especially in the business field. Based on Kestelyn (2003), there are 12 firms of identified BI with the editors's choice award which included Adaytum, Brio Software, Cognos, Crystal Decisions, E.Intelligence, Fair Issac & Co., Hyperion Solutions, Information Builders, MicroStrategy, ProClarity, Siebel Systems, and Spotfire. Furthermore, Stodder (2003) has mentioned 12 vendors as most influential in the overall category which included Teradata, SAS, IBM, OutlookSoft, Business Objects, Microsoft, Manhattan Associates, PeopleSoft, Oracle, Ilog, Insight Software, and Open Source/Linux. There are a lot of BI tools or systems available in the market that can be used by the decision makers in the firms. There are many vendors for this BI suite and the most famous vendors which are IBM, Microsoft, Oracle and SAP. These four vendors are now known as the 'mega vendors' or Big Four. The top-tier or most widely used BI are such as Cognos, Business Objects and Hyperion Oracle Business Intelligence.

The frameworks of those existing systems are the important criteria or concept that I have to implement in the dashboard system for this project in order to make the process or functionality of the system runs properly. By implementing the dashboard system, then there will be a lot of benefits in order to monitor the performance of UMP.

1.6.1 Cognos

First, Cognos is owned by IBM (International Business Machines Corporation) and the members of Cognos family are included Cognos Insight, Cognos Express and Cognos Enterprise. There are some benefits of Cognos for the users and one of them is explore all types of information. Cognos is a complete performance management system built from the ground on a single, purpose-prepared SOA (Service-Oriented Architecture) platform. Cognos allows business users to access to all the data accurately and in shorter period of time. It also allows them to consume a fact-based statistical evidence to support their decisions in order to let them take a suitable action. Besides, they can also more understand to the current business situation by exploring the patterns that exist in the data.

Next, the business users can analyze the facts and anticipate tactical and strategic implications is also one of the benefits. They need the analytical tools to help them evaluate and identify the impact on the business and also the bottom line based on the different scenarios. Besides, Cognos is also allows the business users to analyze the facts and anticipate strategic implications by simply shifting from viewing data to performing more advanced predictive or what-if analysis. When they can understand the scenarios which affected their business then they will make a suitable recommendations or decision support in order to improve the performance of their business.

Apart from that, the solution that the users get from Cognos can be transformed and published in different languages and formats such as HTML, PDF and others. Moreover, they can access the solutions from several locations through portal, e-mail, mobile and others. Lastly, the interface of Cognos is user-friendly and easy to be explored by the users. The features of Cognos are maturity, stability, and high-participation planning solution.

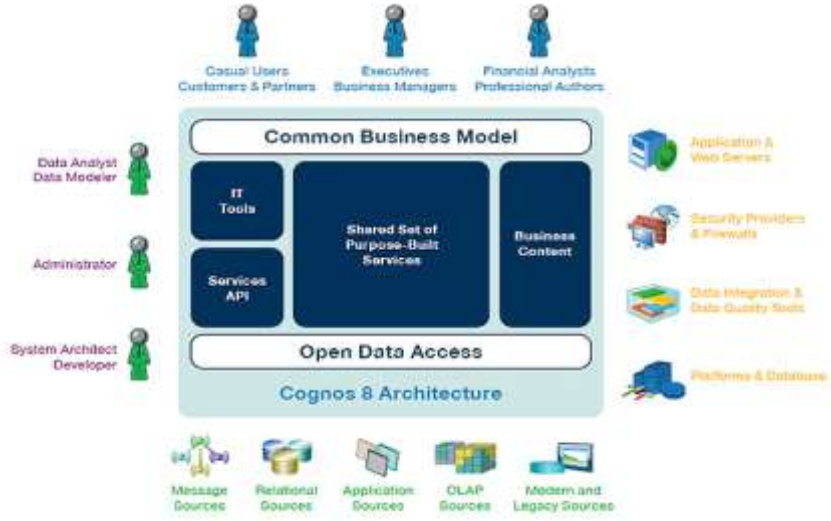


Figure 1.4: Architecture of IBM Cognos

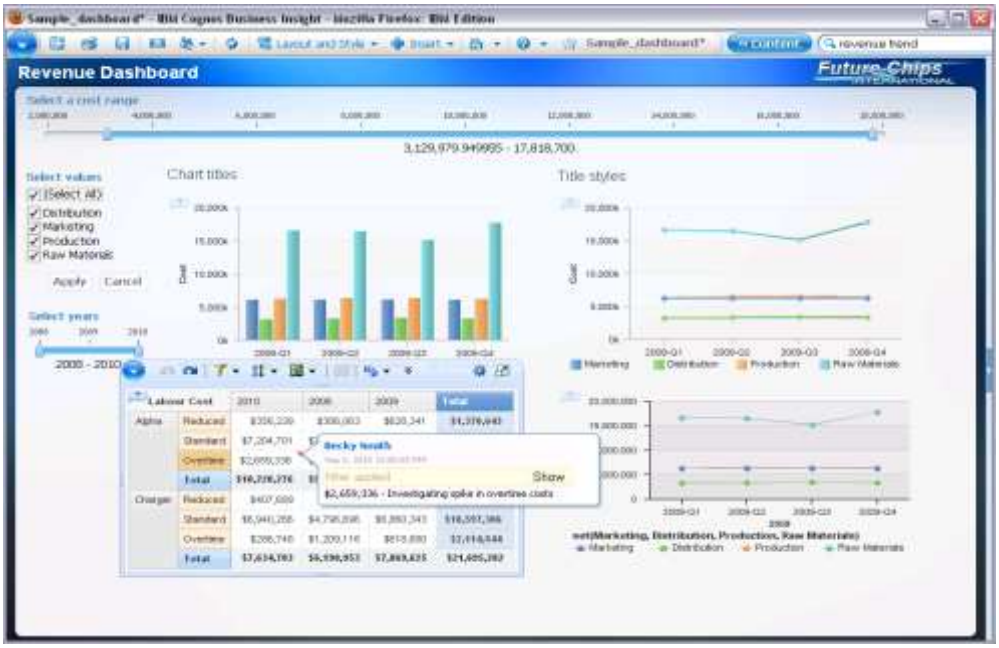


Figure 1.5: Interface of the Dashboard for Cognos

1.6.2 Business Objects (BO)

Second, Business Objects is now owned by the SAP (Systems Applications and Products in Data Processing) and is offers one of the broadest and most complete BI product sets. BO is a BI (Business Intelligence) tool which developed in the Adobe Flash Platform. This system has some benefits or strengths and one of them is allowed the users access to all the data that stored in the system easily and quickly to improve the growth of both productivity and performance. The retrieved data is very accurate

and according to the difficulty of the problems faced. Besides, consolidation and aggregation of data are also been applied in order to improve the efficiency.

Furthermore, the structure of the information in BO is flexible and good scalability. Although there are more receivers and more forwarded data but these will not slowing down the transfer rate and can also faster the decision making process. Next, all the information is unified what simplifies the access to all resources independently on their format or location diversification. BO platform is designed with a good interface where all the dashboards are designed to make the users easy to familiar with and also increase the service-intuitionism. Next, the software was created as a single intelligence platform in order to reduce the effort which is required for the cooperation of different users.

Apart from that, the structure of the platform enables an insight into the whole operations which enables the users to check every process within every stage on every level easily. This strength can make the decision making to be more accurate since the information is delivered time by time and it also shortened the time of reaction needed that leads to a better performance. Lastly, the deployment of BO is not complicated and this will increases the security and functionality of the platform that can be used by everyone.

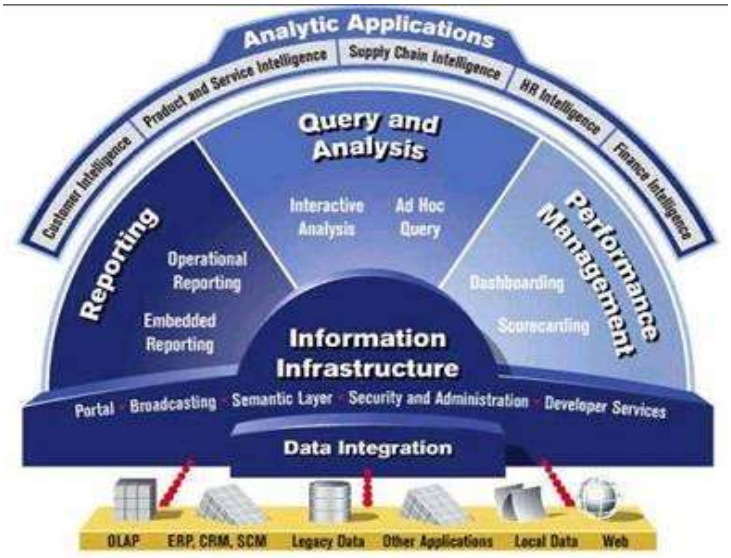


Figure 1.6: Architecture of SAP Business Objects

Figure 1.7: Interface of the Overview Dashboard for SAP Business Objects

1.6.3 Oracle Business Intelligence

Third, Oracle is now acquired Hyperion and offered a combination of BI platform and analytic applications such as Oracle Business Intelligence Enterprise Edition (OBIEE) and Oracle Analytic Applications. It is potential in delivering operational and strategic BI capabilities. The components of Oracle BI included Oracle BI Discoverer, Oracle BI Spreadsheet, Oracle BI Warehouse Builder, Oracle BI Beans and Oracle AS Reports Services.

Oracle BI Discoverer is an intuitive ad-hoc query, reporting, analysis, and Web-publishing tool that empowers business users at all levels to gain immediate access to information from data marts, data warehouses, online transaction processing systems, and Oracle E-Business Suite. Next, Oracle BI Spreadsheet provides OLAP data access from within Microsoft Excel worksheets and the users can also use the Oracle BI Beans Calculation and Query Builder Beans to analyze that data. Then Oracle BI Warehouse Builder enables rapid design, deployment, and management of data and metadata. Lastly, Oracle BI Beans builds powerful custom business intelligence applications while Oracle AS Reports Services provides enterprise reporting.

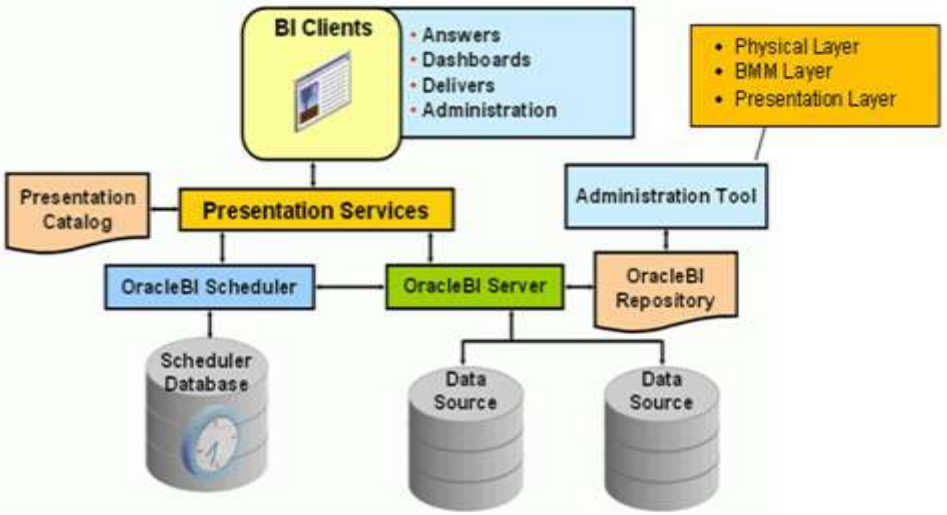


Figure 1.8: Architecture of Oracle Business Intelligence

Figure 1.9: Interface of the Dashboard for Hyperion Oracle Business Intelligence

1.6.4 Limitations of Existing System

i. IBM Cognos:

- Does not support its own ETL (Extraction, Transformation and Loading) and data quality software.
- Does not implement function of the offline reporting and analysis.

- Divided into more parts than it's necessary such as studios (Report Studio, Query Studio, and Analysis Studio) might be operated by one common tool.
- The documentation storing is difficult due to the lack of appropriate tool.
- Problem of visual analytics.

ii. SAP Business Objects

- Unclear Business Intelligence (BI) and Performance Management (PM) roadmap or strategy.
- Risk of gaining inconsistent data results since the data connections are inconsistence.
- The function of multiple locations options was inconsistent.
- The service of software is not satisfied by the users since they only can do some changes by themselves and most of them demand engaging the developers.
- Modifying the content requires complicated and labor-consuming IT lifting.

iii. Oracle Business Intelligence (Hyperion)

- Connectivity to heterogeneous sources requires DBA (database administrator) setup of database connectors.
- No access to non-relational legacy data sources.
- Scheduling of reports based on periodicity and events requires custom coding.
- No out-of-the-box security integration with non-Oracle solutions.

PART 2

REPORT BODY

2.0 Methodology

Software development methodology is an important framework used to structure, plan, and control the process of developing a software project or system. There are many different types of approach in the software development methodology such as Waterfall model, Rapid Application Development (RAD), Spiral model and others. The method of approach that will be implemented in this project development is the Rapid Application Development (RAD).

Rapid Application Development (RAD) consists of four phases which are the requirement planning, user design, construction and implementation (as shown in Figure 2.1). The reason to choose RAD as the method of approach in this project is because of the speed and quality as the primary advantages. By implementing RAD, we can increase the speed of the development and decrease the time to delivery. Then, the quality can be increased by meeting with the client frequently and show the progress of the development in order to make sure the system is achieving the requirements. Although RAD has such good advantages but there are still disadvantages existed which are the reduced of scalability and features. This is because RAD focuses on development of a prototype that is iteratively developed into a full system so the delivered solution may lack of scalability. Besides, RAD may produce applications that are fewer features since this approach is designed to deliver the full application in a short period of time.

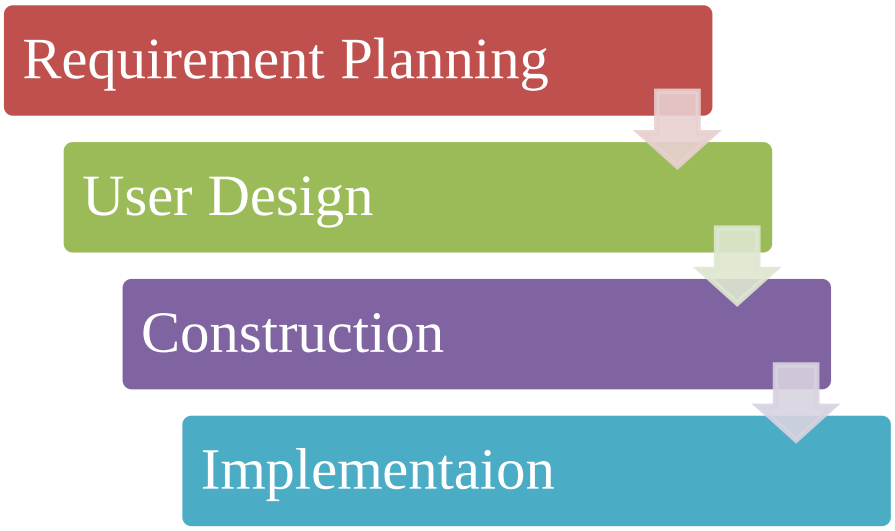


Figure 2.1: Rapid Application Development (RAD) Model Phases

2.1 Requirement Planning

Requirement planning is the first phase of Rapid Application Development (RAD). In this phase, requirement planning is also known as the concept definition stage which defines the requirements in order to support the scope of the system which is to measure the readiness of University Malaysia Pahang (UMP) to implement online data visualization. The requirements are gathered through the interview session with the client of this dashboard system which is Mr. Wan Azlee bin HJ. Wan Abdullah, the head of Bahagian Pengurusan Data & Kualiti for Pusat Pembangunan Korporat & Pengurusan Kualiti (PPKPK).

According to Mr. Wan Azlee, the first requirement of this project is to measure the awareness of the staffs from different departments in UMP towards the strategy plan in UMP and also in their own departments.

Next, the dashboard system should be designed in order to monitor and analyze the performance of UMP according to the requirement. The system will get the data according to the UKRA (University Key Result Area) which included all the KPI (Key Performance Index) in UMP. Each KPI will has different initiatives or activities that have to be measured in order to reach or achieve the goal or target that has been set at the beginning. By using this dashboard system, the staffs will be able to see the monitoring of UMP and also will motivate them to contribute more in improving the performance or quality of UMP.

2.2 User Design

User design will be the second phase of Rapid Application Development (RAD) and it is also known as functional design stage. In this phase, there will be three types of design which are visual design, data design and process design. First, the visual design will be the design of the interface of the dashboard system. Next, the data design will be the data structure or schema and process design is the design of the data flow process.

2.2.1 Visual Design

Visual design will be discussed about the graphical user interface (GUI) of the dashboard system. There are some main GUIs in this dashboard system such as the login interface, staff view of dashboard, top level view of dashboard and others.

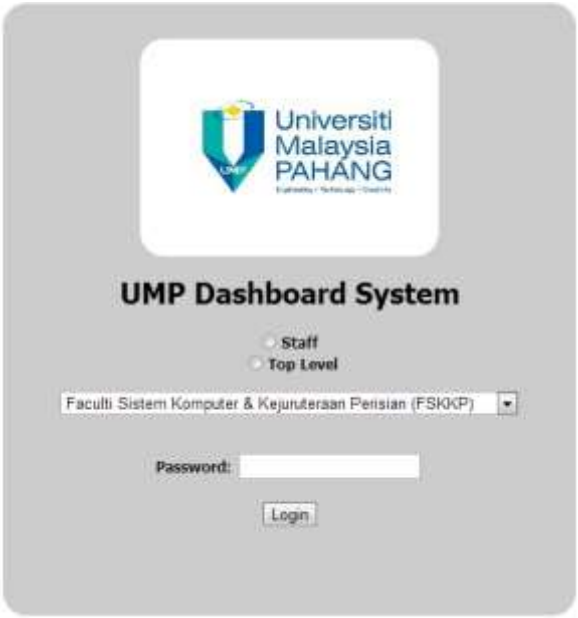


Figure 2.2: Login Interface

Figure 2.2 shows the login interface of the system. The users of this system are only the staffs and top level in UMP since the data displayed is confidential. The users have to choose the category of users which either staff or top level. If the user is staff then has to choose the department and enter the password while for the top level can direct enter the password to enter the system.

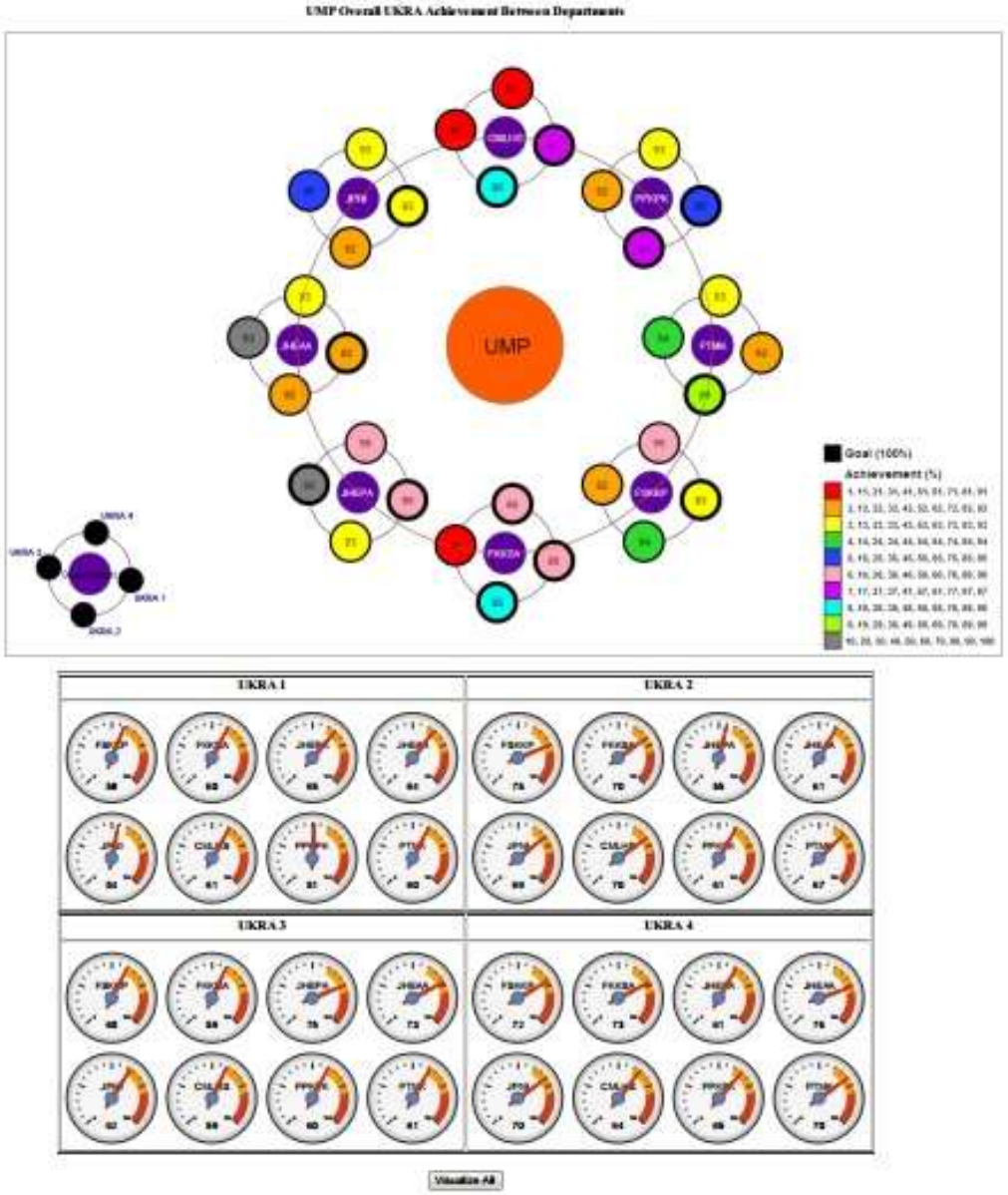


Figure 2.3: Top Level View

Figure 2.3 shows the interface of the view for the top level in UMP such as Naib Canselor, dean and others. In this interface, the user can see the summarized achievement or performance for each department in UMP.

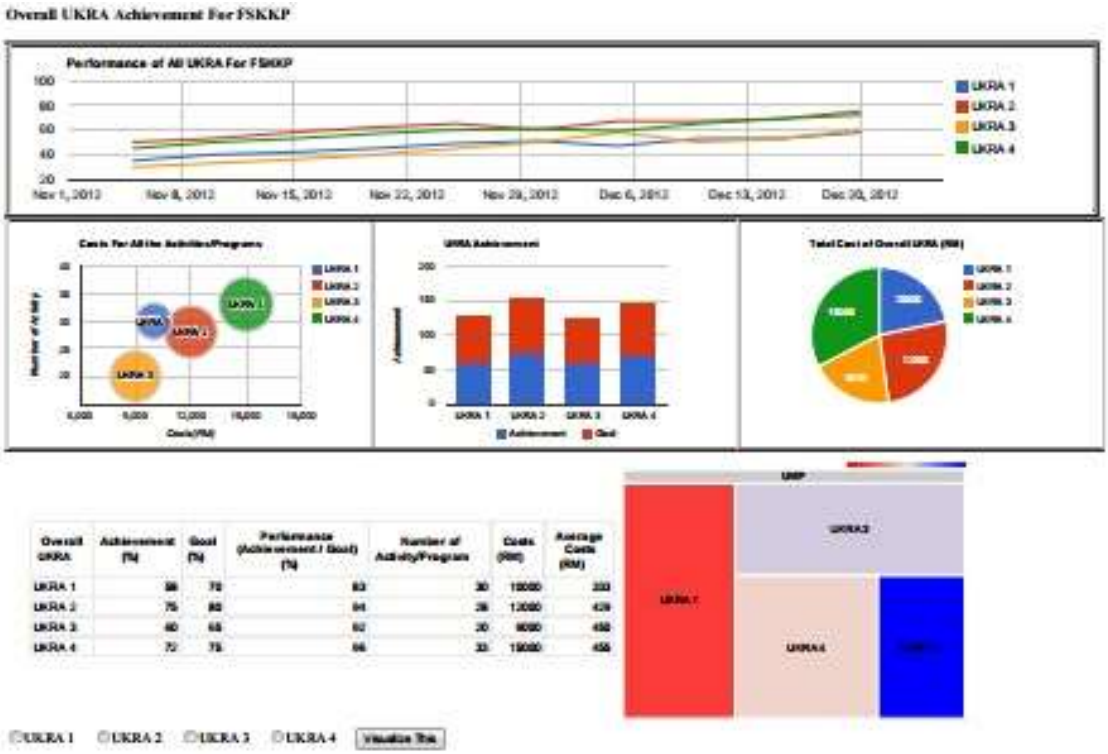


Figure 2.4: Staff View

Figure 2.4 shows the interface of the view for only the staffs of each department. In this interface, the users are able to see the overall achievement or performance for own department. The detailed information about function of the system will be further discussed in section 2.5 Technical Results.

2.2.2 Data Design

In this dashboard system, the strategy plan of University Malaysia Pahang (UMP) will be the main criteria and there will be four different types of UKRA (University Key Result Area) for the plan which is the UKRA 1, UKRA 2, UKRA 3 and UKRA 4. Each UKRA will consist of one or more sub-division which is the KPI (Key Performance Index). Besides, there will be one or more than one initiatives which are divided from the KPI. The data structure of UKRA will be shown in Figure 2.5 while the data structure of KPI will be shown in Figure 2.6.

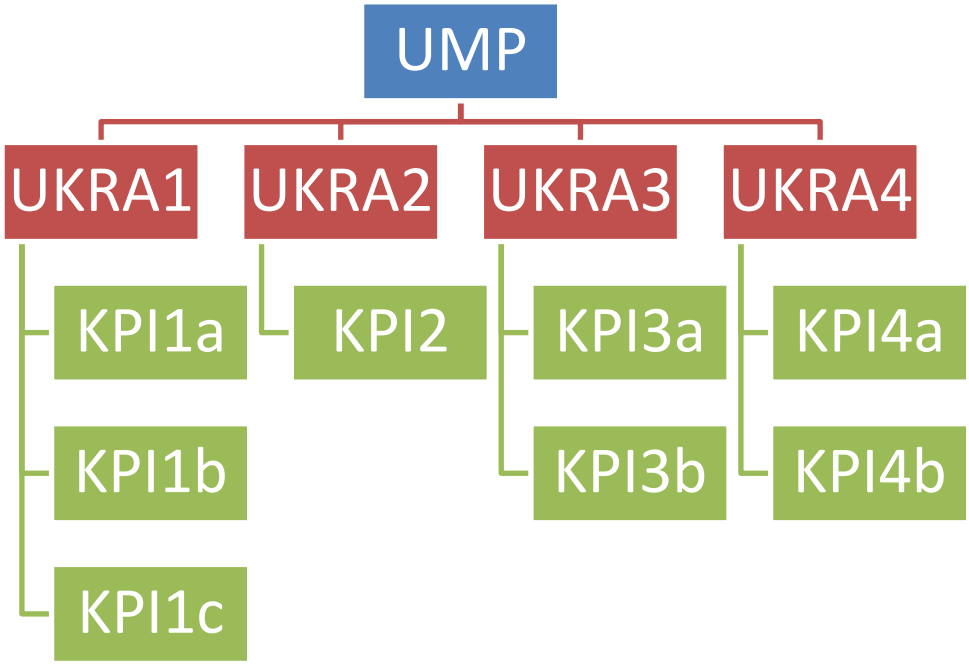


Figure 2.5: Structure of the Data Flow

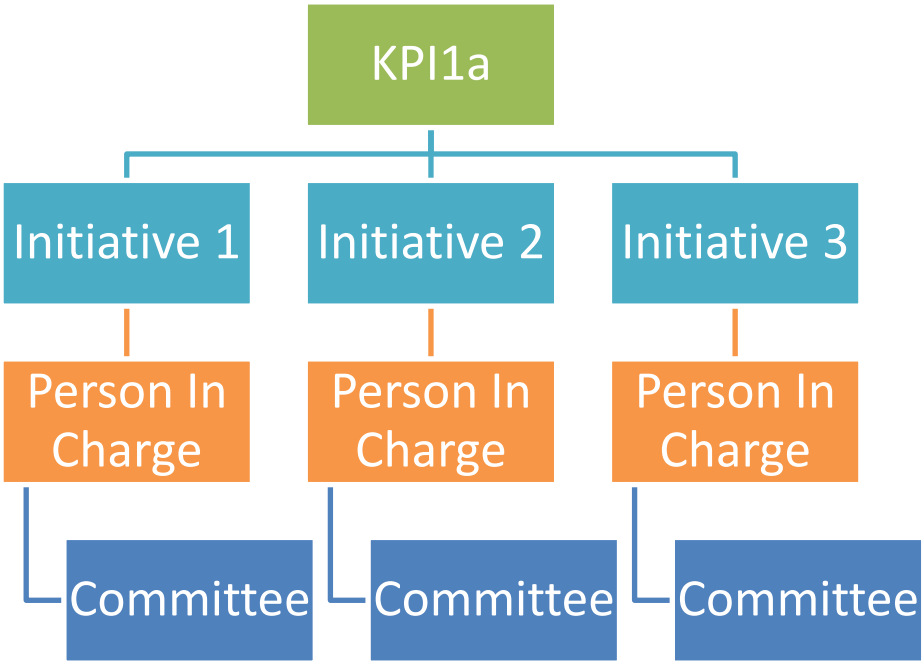


Figure 2.6: Data Structure of KPI (Key Performance Index)

Therefore, there will be eight DFD (Data Flow Diagram) as shown in Figure 2.7 until Figure 2.14 according to the KPI in this data design phase. The description of each KPI is shown in Table 2.1. In each DFD, there will have some calculations involved which are to calculate the percentage of each initiative whether has achieve the KPI or not.

KPI1a	Quality Student Intake
KPI1b	Competent Staff
KPI1c	Proficient Graduates
KPI2	Operational Sustainability
KPI3a	Professional Development of Human Capital
KPI3b	Company Incorporation
KPI4a	Staff Satisfaction
KPI4b	Brand Equity

Table 2.1: Description of KPI

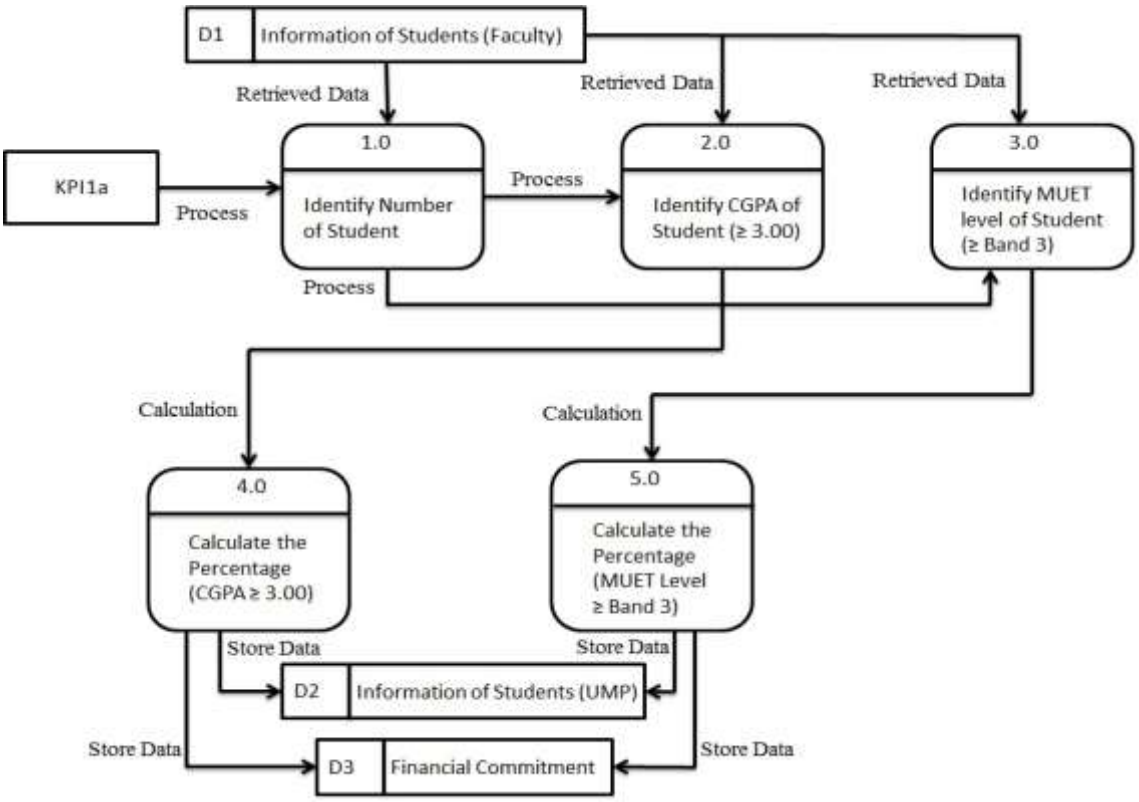


Figure 2.7: Data Flow Diagram (DFD) for KPI1a

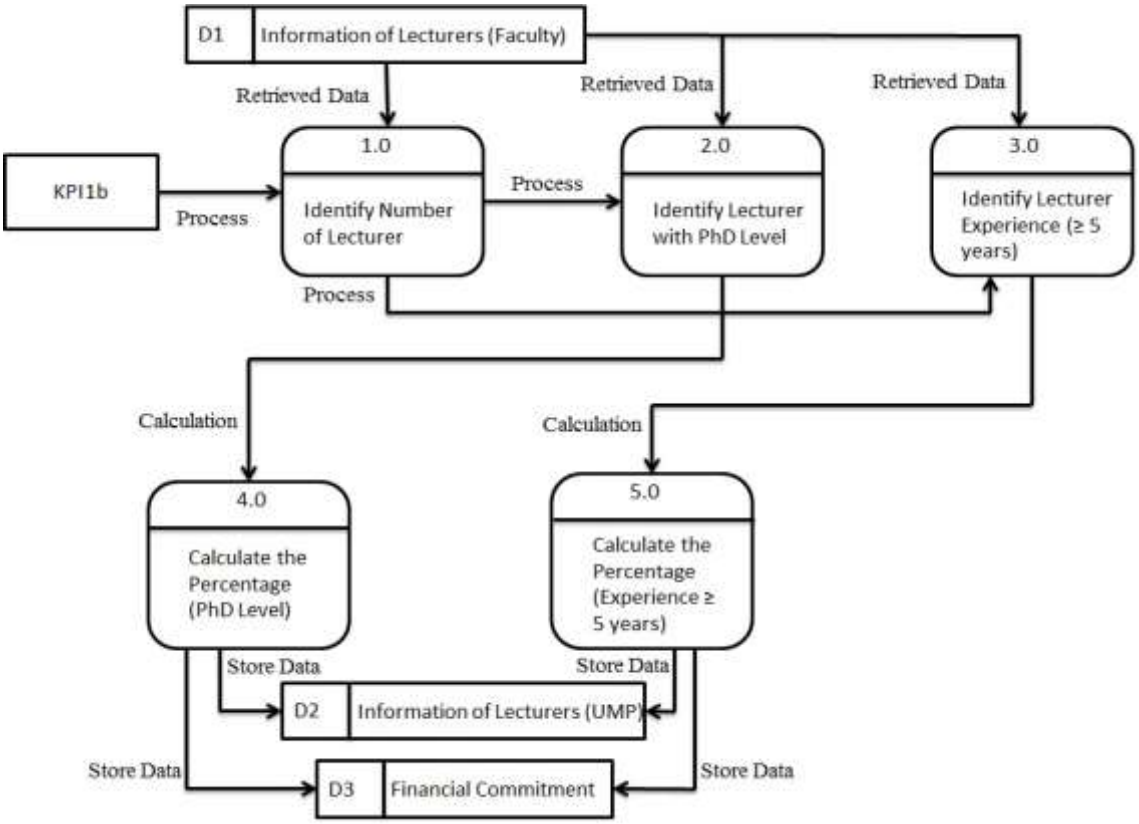


Figure 2.8: Data Flow Diagram (DFD) for KPI1b

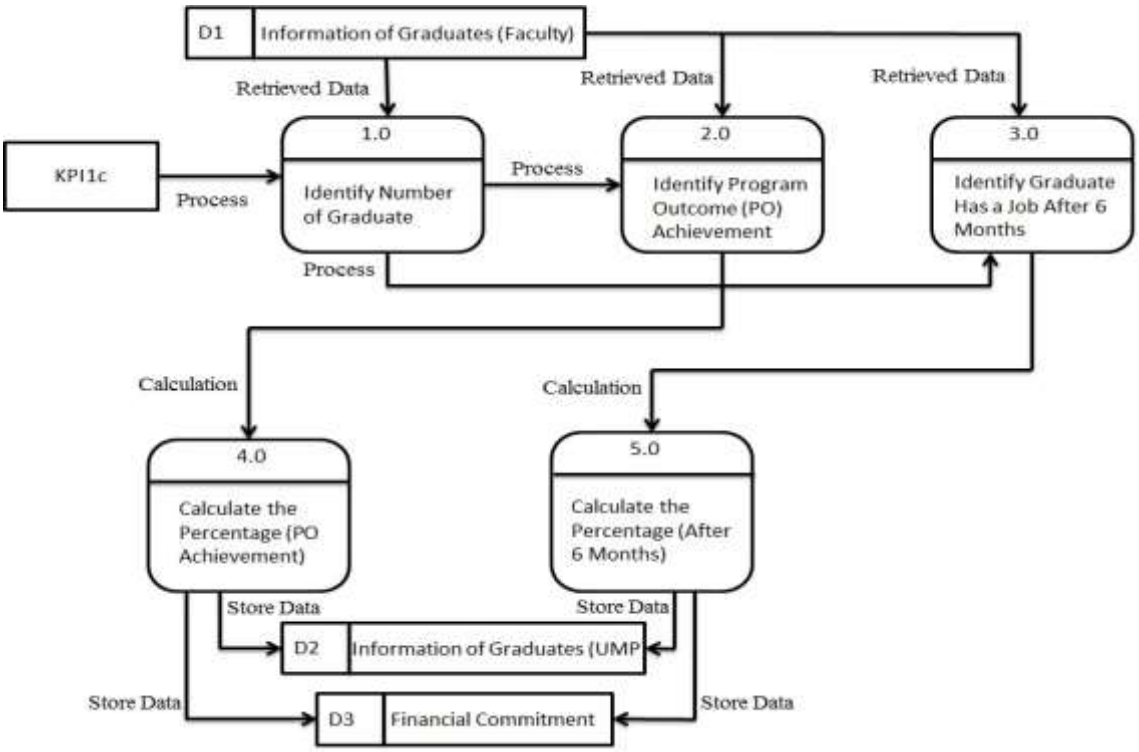


Figure 2.9: Data Flow Diagram (DFD) for KPI1c

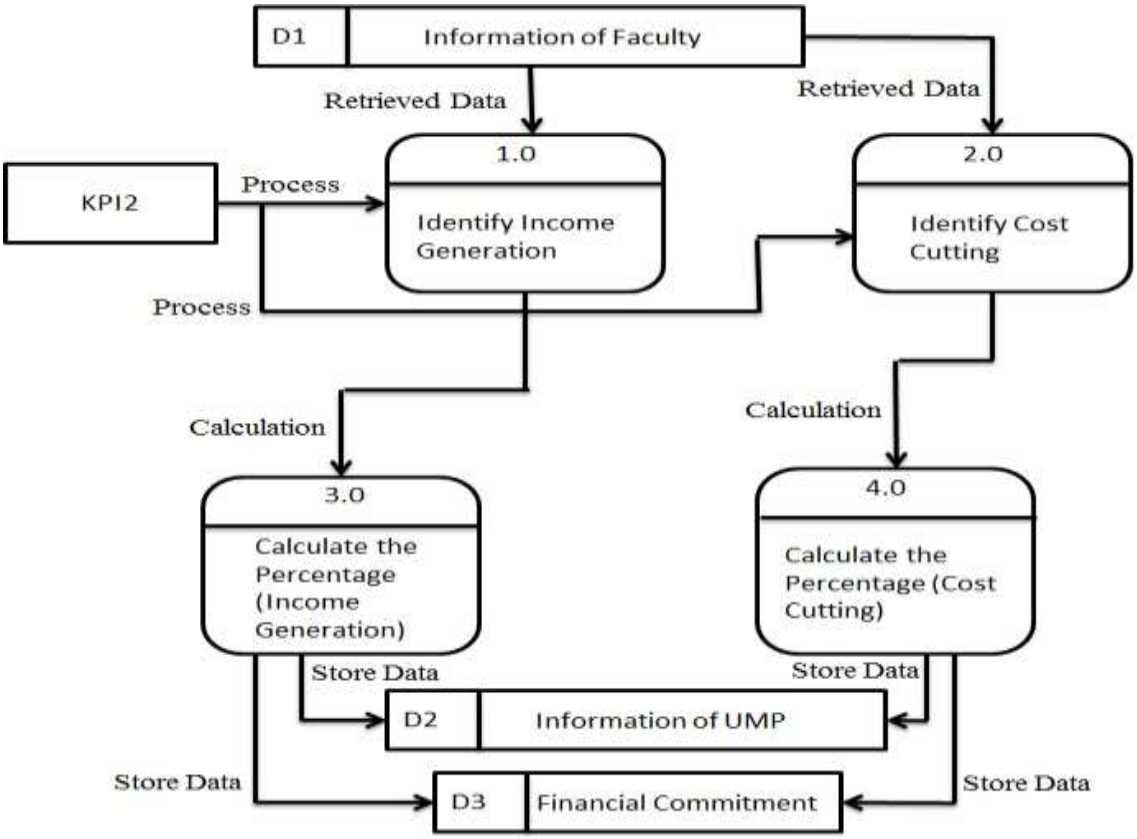


Figure 2.10: Data Flow Diagram (DFD) for KPI2

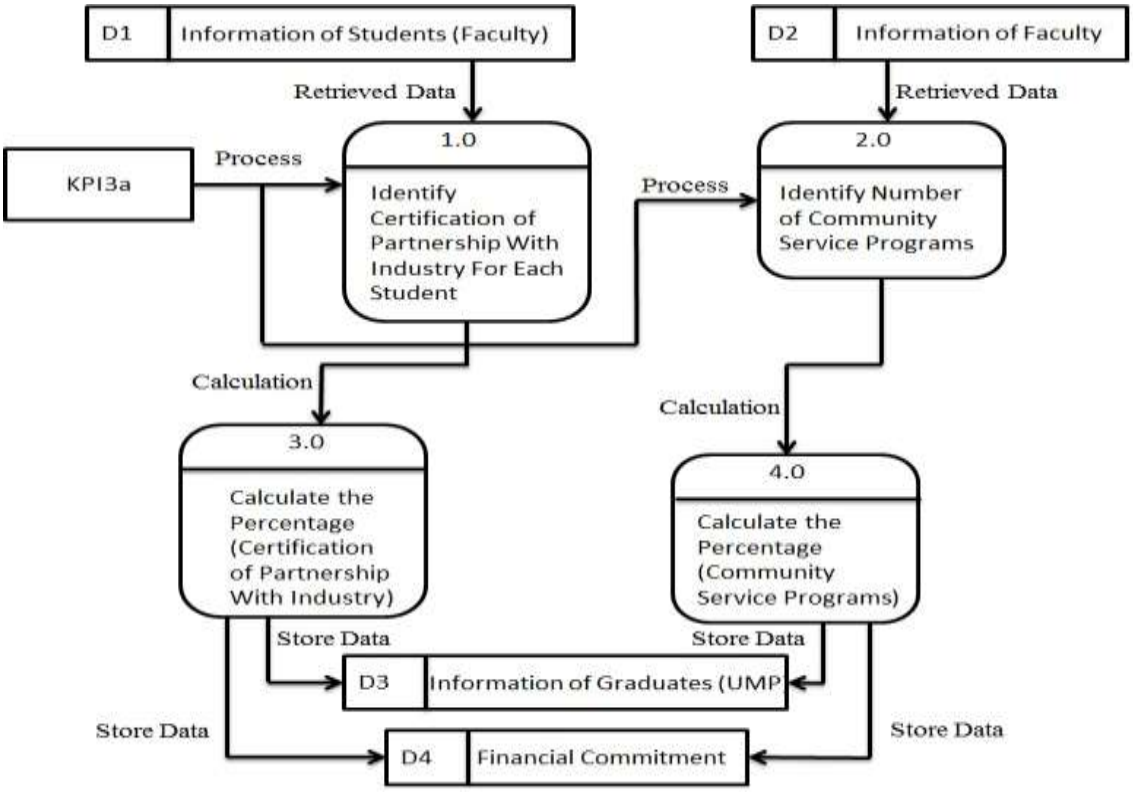


Figure 2.11: Data Flow Diagram (DFD) for KPI3a

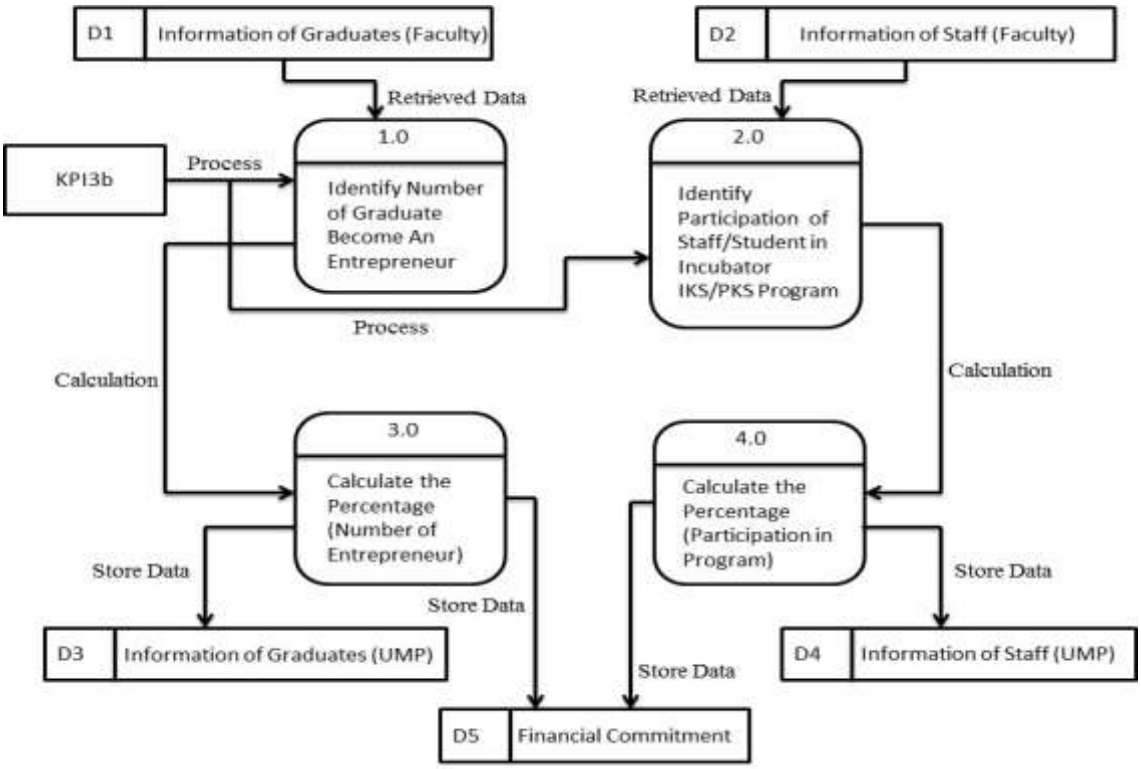


Figure 2.12: Data Flow Diagram (DFD) for KPI3b

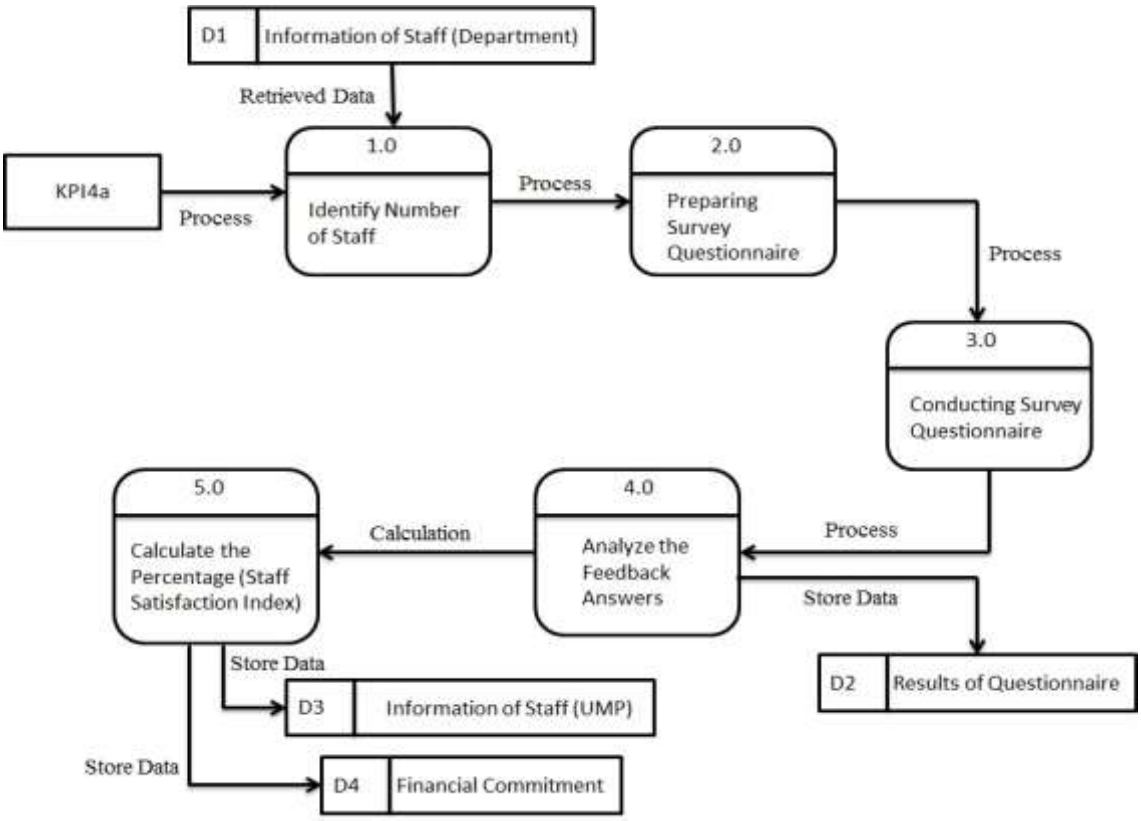


Figure 2.13: Data Flow Diagram (DFD) for KPI4a

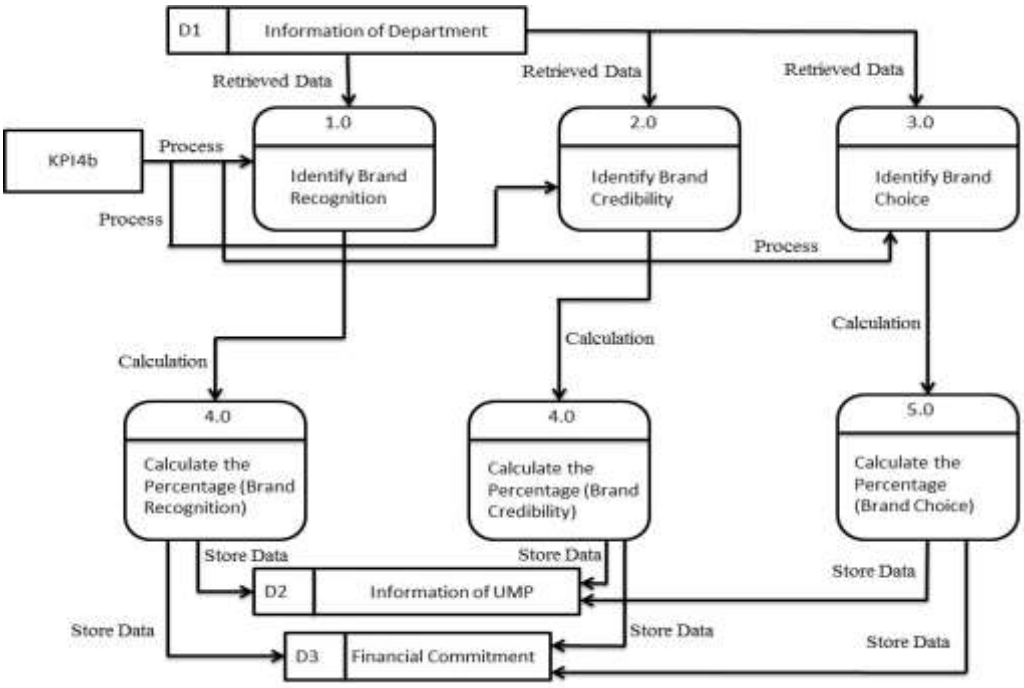


Figure 2.14: Data Flow Diagram (DFD) for KPI4b

Field Name	Description	Data Type
UKRA_type	Type of UKRA (University Key Result Area)	Varchar
KPI_type	Type of KPI (Key Performance Index)	Varchar
KPI_desc	Description of KPI (Key Performance Index)	Char
KPI_target	Target of KPI (Key Performance Index)	Integer
Initiative_desc	Description of initiative	Char
PIC_name	Name of PIC (Person In Charge)	Char

Table 2.2: Data Dictionary of the Database

In Table 2.2, there are some main data there must consisted in the database of this dashboard system.

2.2.3 Process Design

In this stage, a flow chart of the system will be shown in Figure 2.15. In this dashboard system, the user has to choose the department at first. Then select the type of the UKRA to be viewed. After getting the data from the XML database, then the data will process according to the data visualization in graphical form in order to produce an analysis report. Lastly, the user can make a decision after visualized the results.

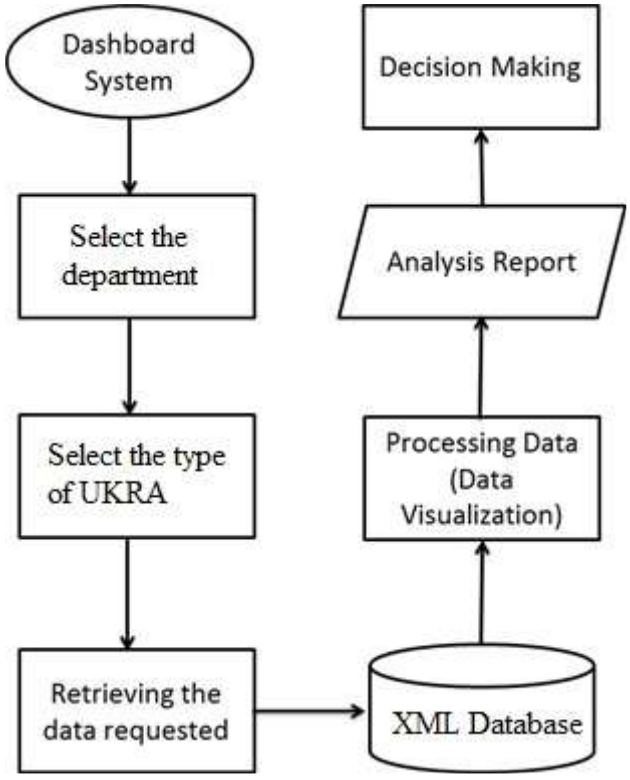


Figure 2.15: Flow Chart of the Dashboard System

2.3 Construction

Construction will be the third phase of Rapid Application Development (RAD) which also known as development stage. In this phase, the dashboard system will be developed completely by implementing the work plans in the second phase. In order to complete the dashboard system, there are several techniques needed in this development phase such as HTML5, XML, JavaScript, CSS, data visualization technique, statistical analysis and others.

This dashboard system is a web-based system so it required HTML5, JavaScript and CSS programming language in order to design the web page or GUI. For the

database system, XML is required in order to store the data and retrieved the data to be displayed accurately. In this dashboard system, the analysis results or output will be presented by using the charts such as histogram, pie chart and others. This will be involved the statistical calculation in order to produce an accurate result or output. Lastly, data visualization technique is required for producing a suitable visualization for the result so that the users can see the pattern of the data clearly and get the information accurately. This will enable the users to make the right decision for the strategy.

2.4 Implementation

Implementation is the last phase in Rapid Application Development (RAD) and is also known as deployment stage. In this phase, the testing for the system will be carried out for both developer and users in order to make sure the dashboard system is completely fulfilled the requirements of the client and fully functions without any errors. The testing phase will be discussed further in section 2.7 Testing Plan and Results.

2.5 Technical Results

UMP (Universiti Malaysia Pahang) dashboard system, an analytic system is designed by combining different of charts or graphs and tables. The charts are developed by using HTML5 Canvas and also Google Chart Library. This system is developed for only two types of user which are the staffs of each department and the top level such as Naib Canselor, dean and others. Both of the users will have different view of dashboard.

In this system, there will be four main dashboards which are divided into two for top level and two for the staffs. For the top level, there will be two main views of dashboard which are the summarized UKRA (University Key Area Result) achievement between departments and overall UKRA achievement between departments as shown in Figure 2.16 and Figure 2.19 respectively. While for the staffs, the two main views of dashboard are overall UKRA achievement for own department and detailed view of each UKRA achievement which will divide into four since there are four types of UKRA as shown in Figure 2.23 and Figure 2.30 respectively.

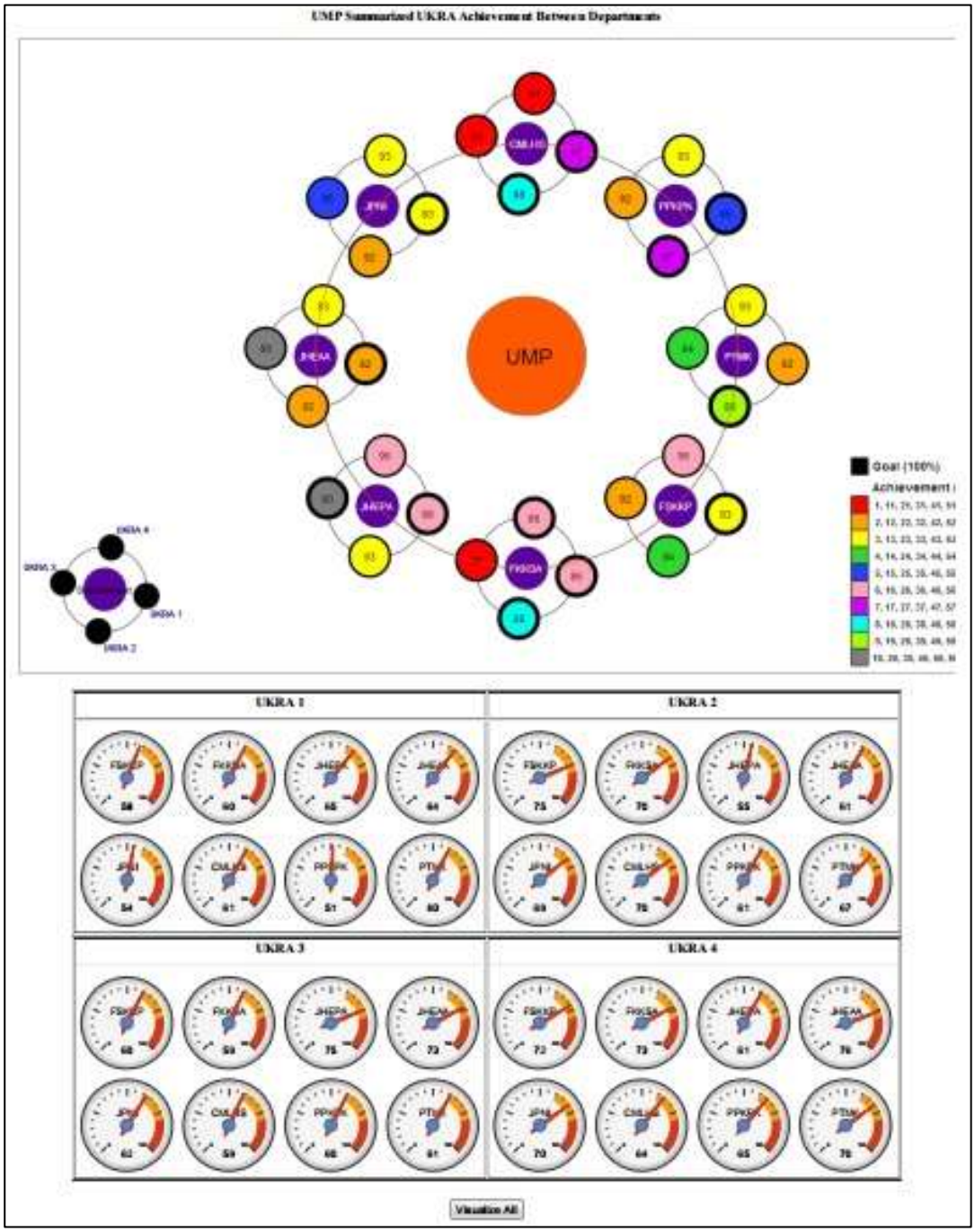


Figure 2.16: Summarized UKRA Achievement between Departments

In Figure 2.16, this will be the first dashboard or first view when top level login to the system. Top level is able to visualize the overall achievement or performance of each department for four types of UKRA respectively. There are only two charts in this dashboard which are the universe chart and gauge chart.

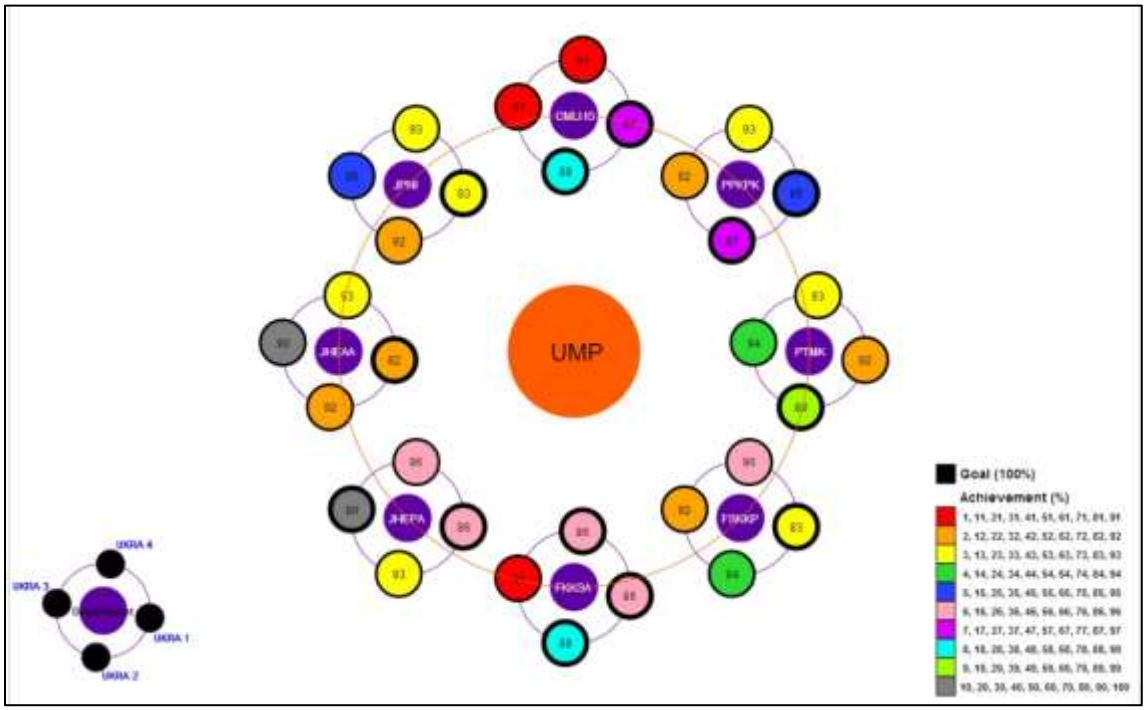


Figure 2.17: Universe Chart

Universe chart is a chart that is fully developed by using HTML5 Canvas. This chart is developed based on the idea of the universe which included the Sun and those planets. In this chart, the centre circle which is the UMP will be the core just like the Sun and then the circles on the second orbit will be the departments in UMP just like the planets surrounded the Sun. Next, the four types of UKRA will surround each department since every department has these UKRAs as the strategy plan. In this chart, the user is able to visualize performance of each department for each UKRA. The circle in black colour will be represented as UKRA and all are in the same size since the goal will be normalized to 100%. Then, the achievement will be increase the size from the inside of black circle based on the value. For the size, there will be 10 different sizes since the value is divided into 10 ranges such as 1 to 10, 11 to 20 and continuously until 91 to 100. For the colour, there will be 10 colours and are the same for each range such as 1, 11, 21, 31, 41, 51, 61, 71, 81 and 91 will have the same colour but different in size. The user is able to visualize the performance through the changing of the circle's size and get the information clearly.

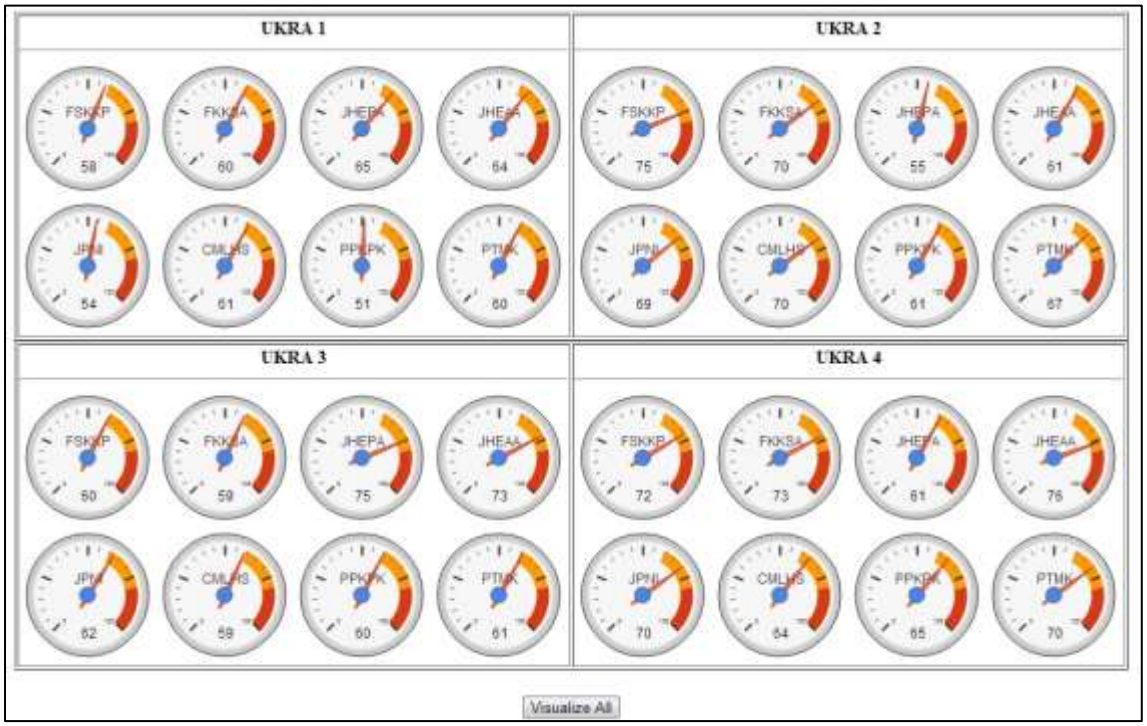


Figure 2.18: Gauge Chart

In Figure 2.18 shown the gauge chart which is designed to show the current achievement of UKRA for each department. In this gauge meter, the minimum goal or target is set to be 60% starting from the area with orange colour and the red colour part is for the goal with 80% and above. Through this chart, the user is able to visualize the overall performance for each UKRA based on the departments.

Figure 2.19: Overall UKRA Achievement between Departments

Figure 2.19 shows the second view for the top level which is the overall UKRA achievement between departments. In this dashboard, the user is able to visualize which department has achieved the UMP's target goal. There are bar charts, pie charts and a table in this dashboard as shown in Figure 2.20, Figure 2.21 and Figure 2.22 respectively. In Figure 2.20, the bar charts are represented for each department in UMP and show the achievement of the UKRA. Through this chart, the user is able to visualize which department has achieved the highest achievement and also the lowest. There will be four bar charts which represented four types of UKRA achievement between departments.

Besides, the user is able to visualize the ratio of departments achieved the target or goal for each UKRA as shown in Figure 2.21 and there will be also four pie charts to represent each UKRA. The user is able to get the information about how many departments have achieve the goal and how many still left behind.

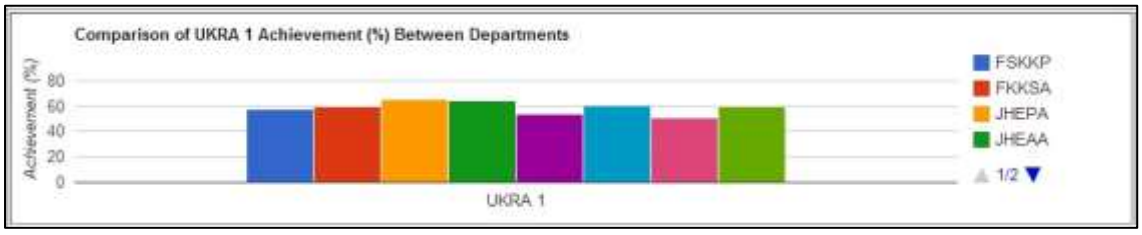


Figure 2.20: Comparison of UKRA Achievement between Departments

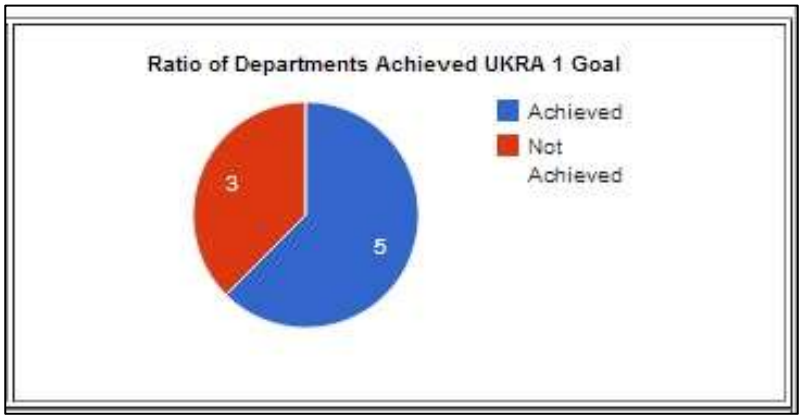


Figure 2.21: Ratio of Departments Achieve UKRA Goal

Departments	UKRA 1	Goal (60%)	UKRA 2	Goal (60%)	UKRA 3	Goal (60%)	UKRA 4	Goal (60%)
FSKKP	58	Not Achieved	75	Achieved	60	Achieved	72	Achieved
FKKSA	60	Achieved	70	Achieved	59	Not Achieved	73	Achieved
JHEPA	65	Achieved	55	Not Achieved	75	Achieved	61	Achieved
JHEAA	64	Achieved	61	Achieved	73	Achieved	76	Achieved
JPNI	54	Not Achieved	69	Achieved	62	Achieved	70	Achieved
CMLHS	61	Achieved	70	Achieved	59	Not Achieved	64	Achieved
PPKPK	51	Not Achieved	61	Achieved	60	Achieved	65	Achieved
PTMK	60	Achieved	67	Achieved	61	Achieved	70	Achieved

Figure 2.22: Table of UKRA Achievement between Departments

In Figure 2.22, the detailed information for each UKRA achievement of each department will be shown in a table form. In this table, the user is able to visualize which departments still not achieve the goal easily since the value which is under the goal's value will be highlighted with red colour.

Besides, the top level is able to click the name of each department in order to enter the department selected to view the detailed information about the performance for each UKRA.

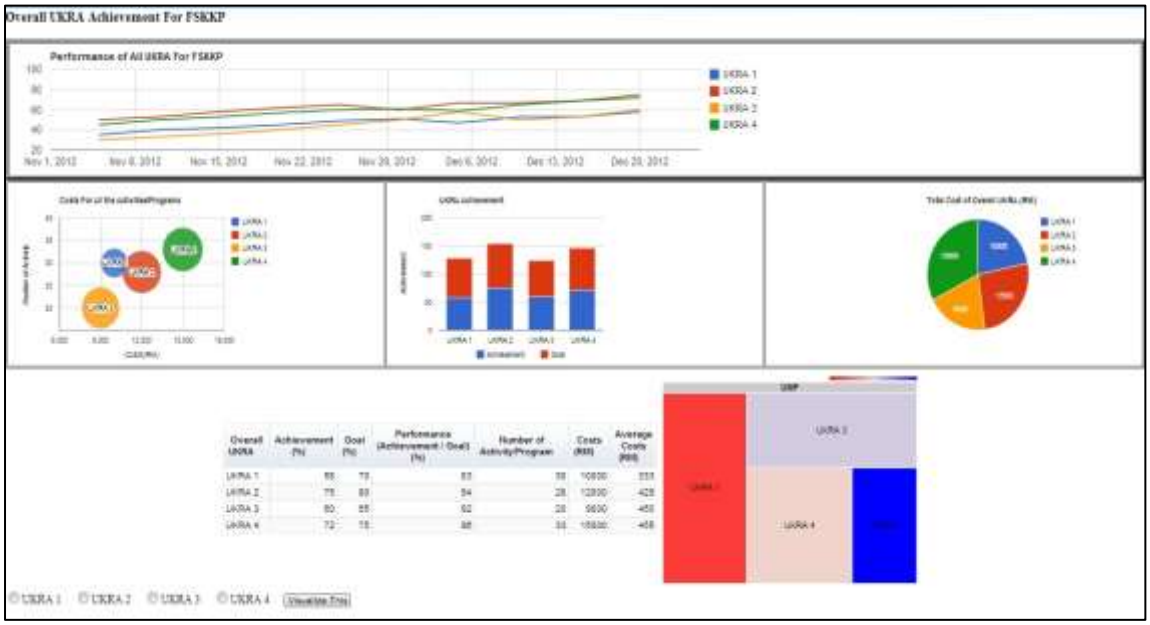


Figure 2.23: Overall UKRA Achievement for Specific Department

Figure 2.23 shows the main dashboard view for each department when the users (staffs) login to the system. In this dashboard, the user is able to visualize the overall performance of every UKRA for own department only. This dashboard included line chart, bubble chart, bar chart, pie chart, table and also tree map.

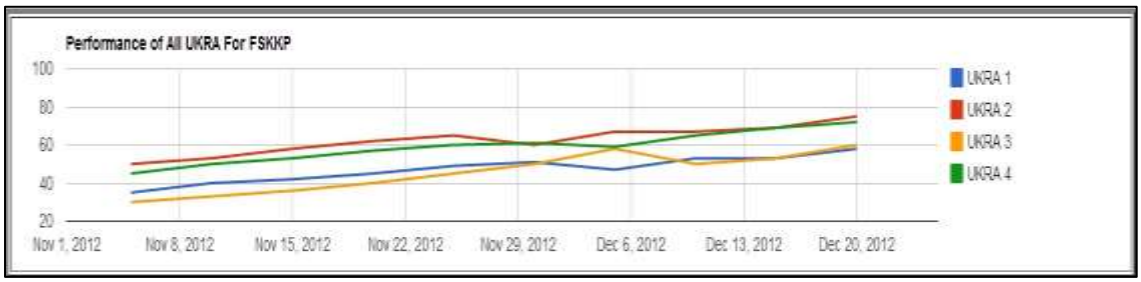


Figure 2.24: Performance of All UKRA for Specific Department

In Figure 2.24 shows the line chart which is represented as timeline graph for the purpose of showing the performance of every UKRA time by time. The user is able to visualize the trend of each UKRA whether the performance is drop or increase at the specific time.

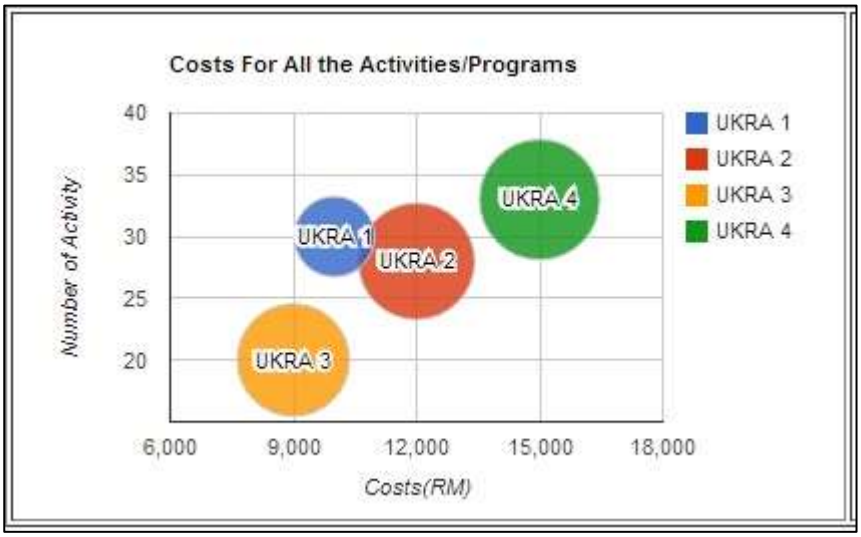


Figure 2.25: Costs for All the Activities/Programs

Figure 2.25 shows the bubble chart which allows the user to visualize the correlation between the costs and number of activity. The bubbles are represented each UKRA respectively. The position of the bubble will depend on the value of number of activity and also the cost. The lower the number of activity, the lower the position of the bubble and the higher the cost, the position of the bubble will shift to the right side. Furthermore, the size of the bubble is depending on the value of the cost which is the higher the cost, the bigger the size of the bubble.

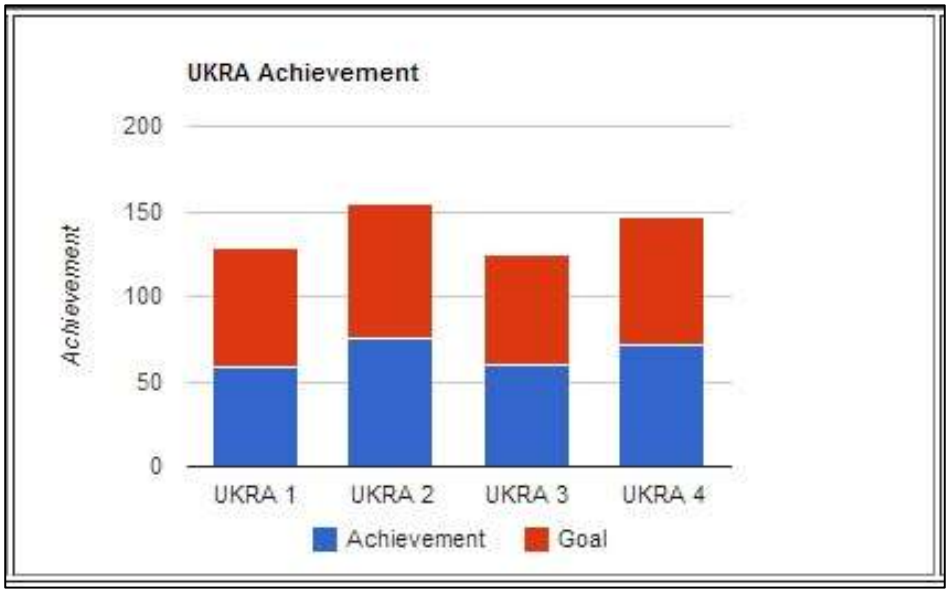


Figure 2.26: UKRA Achievement

From Figure 2.26, the user can visualize the achievement and the goal for each UKRA through the stacked bar chart which the red bar represented the goal while the blue bar represented the achievement.

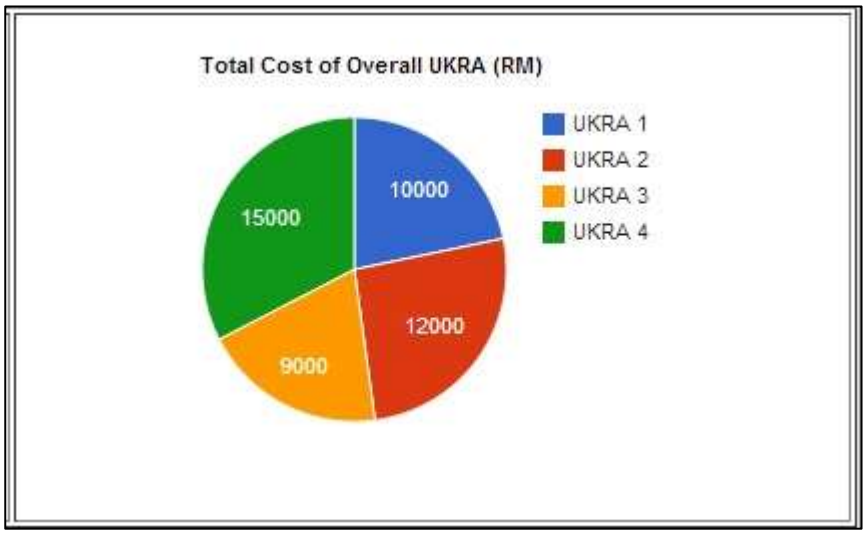


Figure 2.27: Total Cost of Overall UKRA

Figure 2.27 shows the pie chart which delivered the information about the ratio for the total cost of all UKRA to the user. The user is able to visualize which UKRA spend more cost if compared with others.

Overall UKRA	Achievement (%)	Goal (%)	Performance (Achievement / Goal) (%)	Number of Activity/Program	Costs (RM)	Average Costs (RM)
UKRA 1	58	70	83	30	10000	333
UKRA 2	75	80	94	28	12000	429
UKRA 3	60	65	92	20	9000	450
UKRA 4	72	75	96	33	15000	455

Figure 2.28: Table of Overall UKRA Achievement

Besides from viewing the data in the graphical form, the user can also view the detailed information as shown in Figure 2.28. From the table, the user can view all the parameters of the information for UKRA.

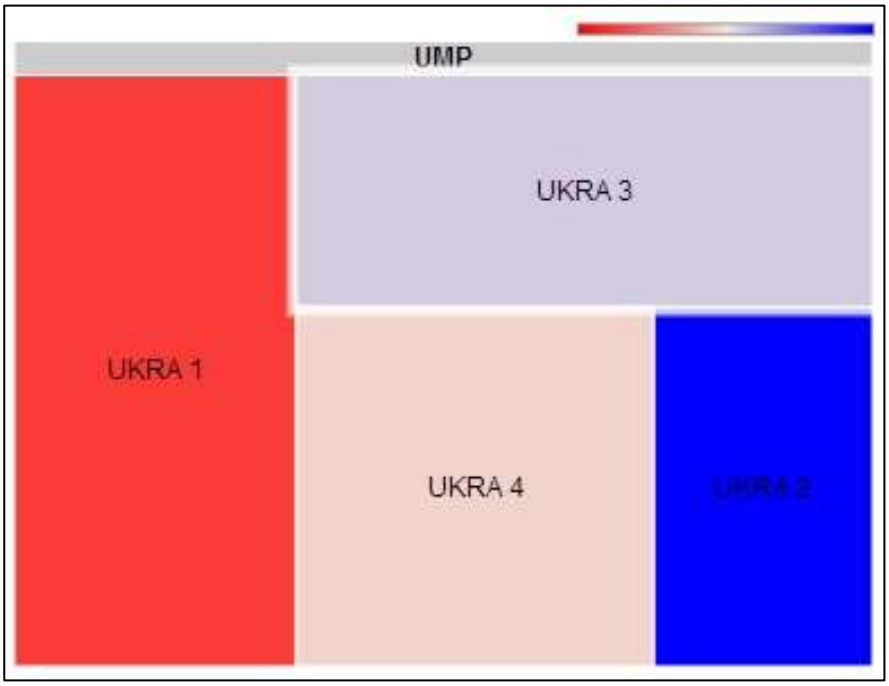
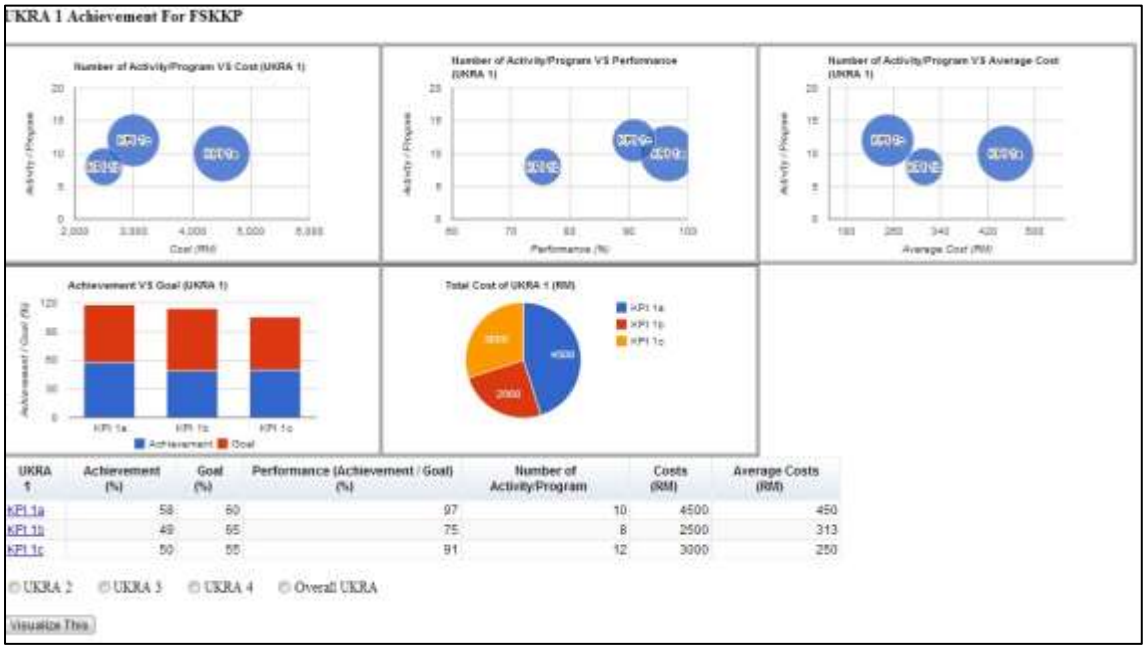


Figure 2.29: Tree Map for All UKRA

Apart from that, the user is able to view the structure of each UKRA through the tree map as shown in Figure 2.29. In this tree map, the user can see the number of KPI (Key Performance Index) under each UKRA before go through the detailed information of each UKRA in other dashboards.

Figure 2.30: Selection of UKRA

Figure 2.30 shows the radio buttons provided for the purpose to enable the user to visualize another dashboard with more detailed information of each UKRA.



UKRA 1	Achievement (%)	Goal (%)	Performance (Achievement / Goal) (%)	Number of Activity/Program	Costs (RM)	Average Costs (RM)
KPI 1a	58	60	97	10	4500	450
KPI 1b	49	65	75	8	2500	313
KPI 1c	50	55	91	12	3000	250

Figure 2.31: Specific UKRA Achievement of the Department

Figure 2.31 shows the second dashboard for the staffs which is the detailed information for the UKRA selected. The design of the dashboard for each UKRA is the same since the type of information to be displayed is the same.

In this dashboard, there will be three bubble charts which represented different types of parameter, bar chart, bubble chart and also a table.

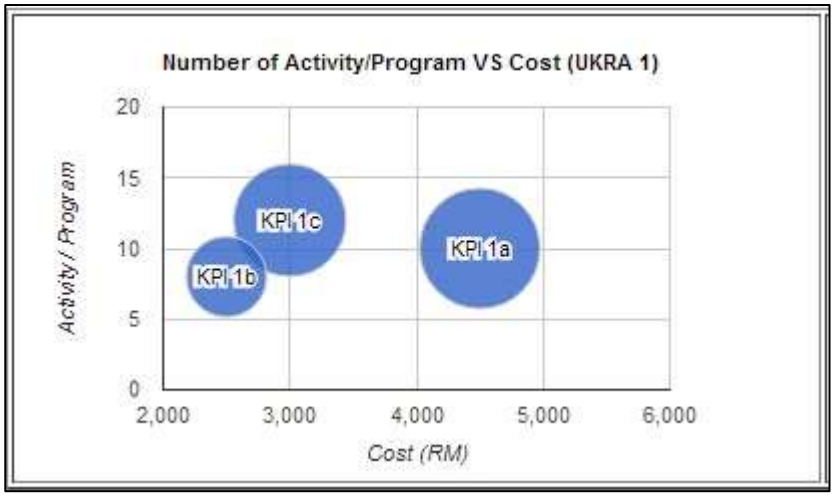


Figure 2.32: Number of Activity/Program against Cost

Figure 2.32 shows the first bubble chart in this dashboard which displayed the information about the correlation between number of activity or program and cost. The

bubbles are represented as the KPI respectively. This size of the bubbles is depending on the value of the performance of KPI.

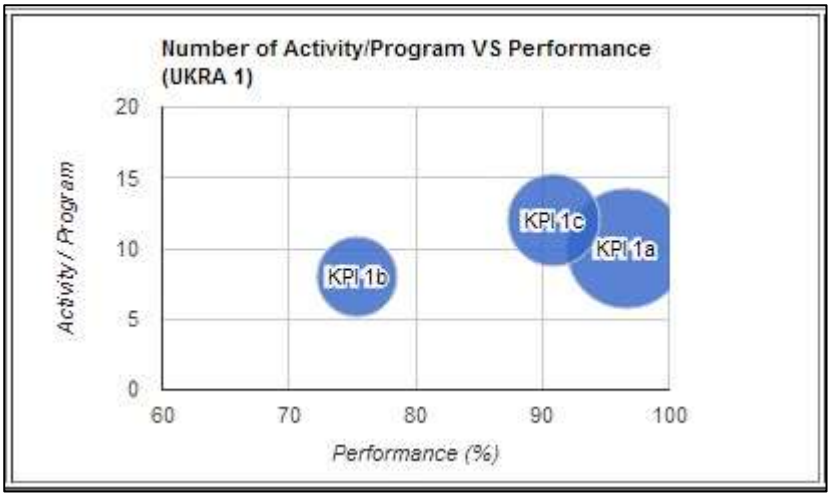


Figure 2.33: Number of Activity/Program against Performance

Figure 2.33 shows the second bubble chart which displayed the information about the correlation between number of activity or program and the performance. The user is able to visualize the relationship between these two parameters and clearly see the position of the bubble based on the performance. The higher the performance, the bubble will shift to the right.

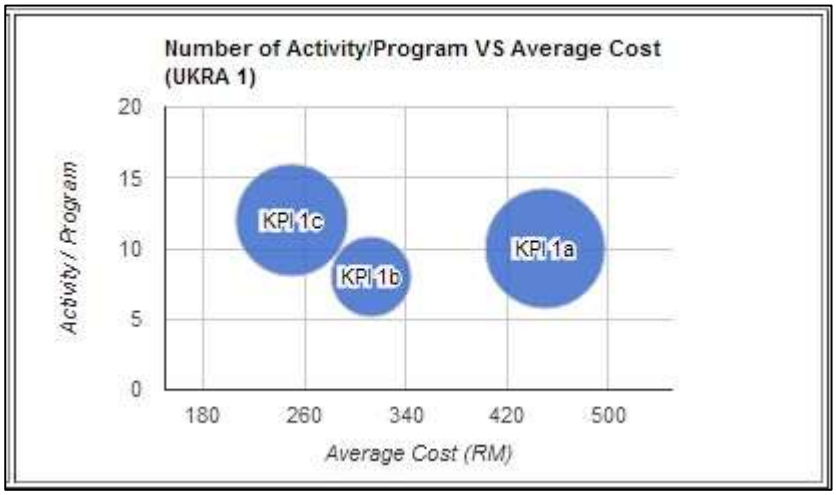


Figure 2.34: Number of Activity/Program against Average Cost

Figure 2.34 shows the third bubble chart which displayed the information about the correlation between number of activity or program and average cost. The average

cost is calculated by dividing the total cost with total number of activity of a KPI. The user is able to visualize the estimated cost needed for an activity through this chart.

UKRA 1	Achievement (%)	Goal (%)	Performance (Achievement / Goal) (%)	Number of Activity/Program	Costs (RM)	Average Costs (RM)
KPI 1a	58	60	97	10	4500	450
KPI 1b	49	65	75	8	2500	313
KPI 1c	50	55	91	12	3000	250

Figure 2.35: Table of UKRA Achievement According to KPI

Apart from that, the user is able to view the information through the table form as shown in Figure 2.35. In this table, the types of KPI will be listed out together with the information about all those parameters. Besides, the user can click on each KPI in order to view more detailed information.

KPI 1a: Quality Student Intake

Bil	Initiative / Activity	Commitment		Achievement (%)	Goal (%)	Performance (%)	Measurement
		Human Resource	Monetary (RM)				
	Petunjuk Utama						
A	Pencapaian PNGK Calon - pengambilan Pelajar mencapai PNGK 3.00			55	65	85	Based on the number of students
B	Tahap Kemahiran Berbahasa Inggeris - Pelajar MUET Band 3/ TOEFL 550/IELTS 5.5 dan ke atas			50	60	83	Based on the number of students
	Inisiatif 1 : Perkongsian Pintar (Partnership Program)						
1.	Matrikulasi / Matrikulasi Teknikal	15	600	50	60	83	
	(i) Menyertai aktiviti promosi di semua kolej matrikulasi	12	750	52	60	87	
	(ii) Menyertai aktiviti promosi di Karnival Pengajian Tinggi (KPT)	18	850	49	60	82	
	(iii) Menyertai aktiviti promosi di Karnival Pendidikan MARA	15	650	50	60	83	
	(iv) Menyertai Minggu ICT KMPhg (Februari 2012) - include alumni involvement						
2.	Kolej di bawah KPTM / KYPM	15	700	52	65	80	
3.	SBP, SBT, SKK,Sekolah Teknik, Sekolah Harian Cemerlang (Dalam & Luar Pahang)	12	450	51	60	85	
	(i) SMS Labuan (April) - include alumni involvement	14	650	54	65	83	
	(ii) SEMSAS@ SBPI Pahang (Ogos)						

Figure 2.36: Information of KPI

Moreover, the user is able to see the detailed information about each KPI as shown in Figure 2.36 in a table form. In this table, the user can see the list of activities or programs held by the department and other parameters such as number of human resources, monetary, measurement and others. Then, the user can make a decision on which activity affected the most for the performance.

2.6 Comparisons with Theory and/or Previous Work

Based on the theory or concept of Business Intelligence (BI), the components or techniques it used are such as OLAP (On-line analytical processing), data mining, data warehouse, real time and others. OLAP is a technique that enables the users to see through the data from the navigation of dimensions such as time or hierarchies. It also provides multidimensional, summarized views of data and is used for reporting, analysis, modelling and planning for optimizing the business. In the dashboard system that developed in this project, it also consists of timeline graph which enables the users to see the trends of data from time by time.

Besides, the data source of BI can be operational databases, historical data and external data. In this dashboard system, it is using the external data which is the XML file. The results of the dashboard system will change when the data in the XML file is updated. But, BI concept is available for the real time distribution and the dashboard system in this project is still not yet develops with the real time function.

The proposed dashboard system aims to produce a better way to visualize the performance of the strategy plan which is the UKRA (University Key Area Result) and KPI (Key Performance Index) for all the departments in UMP (Universiti Malaysia Pahang). Although UMP currently has an analytical system but it is still not developed by using the concept of a dashboard system. The system only provided some basic graphs such as bar graph and line graph which only display some basic information. Through the UMP dashboard system, the users are able to visualize the data in a better way and better graphical form with detailed information that needed in order to make the decision making process become easier.

2.7 Testing Plan and Results

In the testing phase, there will be two stages of testing which the first stage will be tested by developer while the second stage will be tested by the testers.

For the developer's stage, there will be some main criteria that should be pay attention which are the design of the dashboard, the suitability of the graph to represent the data and the interaction between the system and users.

First, the criteria for the design of the dashboard that need to be pay more attention is the position of the graphs, table and also the buttons. All of these must be set on the right position in order to make sure the user can view in a comfortable way and will not get the wrong message from the dashboard. At the beginning of the development, the size of each chart or table is set by default size. But after designed a full single dashboard, the size of each chart is resize according to a suitable size in order to make sure the overall view is not weird and fully occupied the window size. Besides, the window size must be set to auto so that the size of the dashboard will resize based on the window size of the device.

Second, the developer must choose the right graph to represent the data this is because if the data is represented with a not suitable graph then the users or viewers maybe will get the wrong message delivered from the dashboard. For example, bubble chart is for the purpose of displaying the correlation between two parameters and both parameters must consist of data that only in number form else the chart will not work or false to display the data. Furthermore, if these two parameters have no relationship at all then must not display the data by using the bubble chart in order to avoid the confusion happened in the users or viewers. This is same goes to other types of chart and is very important to choose the right chart to display the data.

Third, the interaction between the users and system is also very important especially for the beginner typed of user. Since the dashboard system is still considered a new system that been used so the interaction must be user friendly. In this dashboard system, the interaction of the user only is choosing the department and type of UKRA to be viewed. Apart from that, the dashboard system also consists of mouse over function on each graph in order to display the value of the data.

For the tester's stage, this system is only tested by three testers which included the client of the system, Mr Wan Azlee bin Hj. Wan Abdullah and the other two testers are Mr Ahmad Fadly bin Ibrahim and Mr Azrizulazmi bin Bustan both with position of assistant registrar for Faculty of Industrial Sciences & Technology and Faculty of Computer Systems and Software Engineering respectively. In this testing stage, the demonstration of the system is shown to the testers in order to make the flow of the system clear. Then, interview session is held between each tester in order to get the feedback about the system.

From Mr Wan Azlee's feedback, the layout and design of the dashboard system is user friendly and the information displayed is very detailed. Besides, the flow of the UKRA's process is fulfilled and the criteria of the dashboard are also fulfilled. Then, Mr Wan also suggested that the users of the system should be more specified according to the role and responsibilities and also must be authorized by departments or level. Next, the skills or programming languages for this system must not only consist of XML as a data source but also integrated with database in order to provide the edit and update function. Apart from that, the system hosting site must be defined and must not run through the local computer since at the beginning is not yet upload to the UMP server. Mr Wan Azlee thinks that the system is at moderate level in visualizing data and should be implemented in UMP.

From Mr Ahmad Fadly's feedback, the system is good and should be implemented in UMP since currently still do not have this kind of online data visualization system. Besides, the system is also user friendly and easy to be used without any user manual. For the improvement part, Mr Ahmad suggested that the menu has to be split into two which is for academic staff and also non-academic staff. Furthermore, the system has to restrict other PTJ to see the other PTJ performance.

From Mr Azri's feedback, this dashboard system is good in showing the performance of the UKRA in the institutions. Besides, the system is also a helpful system which is able to help the management staff to make a better decision for the problem occurred. But in term of design, Mr Azri suggested that the system should be provided more graphics design in order to attract the users. Then, the result of the achievement with the lower value than the target should be highlighted in order to let the users easier to see the differences. Next, the legend should be shown in each bar for the bar chart for each UKRA.

As the final step of the testing, when the system is completed without any errors then it is uploaded to the UMP server which to ensure the dashboard system can be accessed via internal UMP network as shown in Figure 2.37 and Figure 2.38. Lastly, the system can be run or displayed on any devices such as laptop or mobile device since the system is a web-based system.

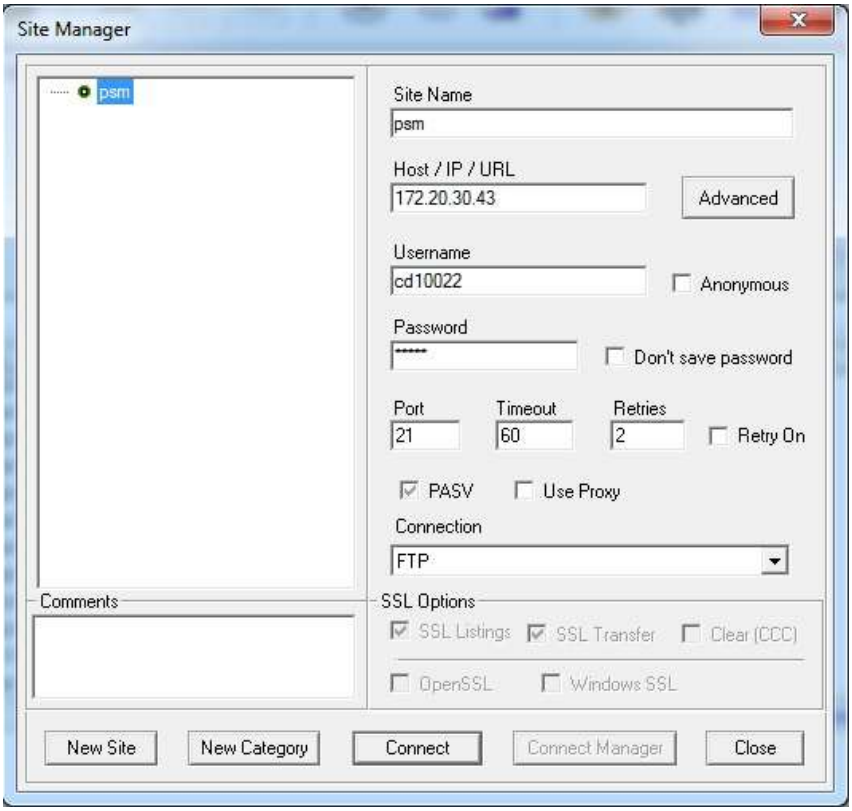


Figure 2.37: Using the Core FTP LE Software to Upload Files

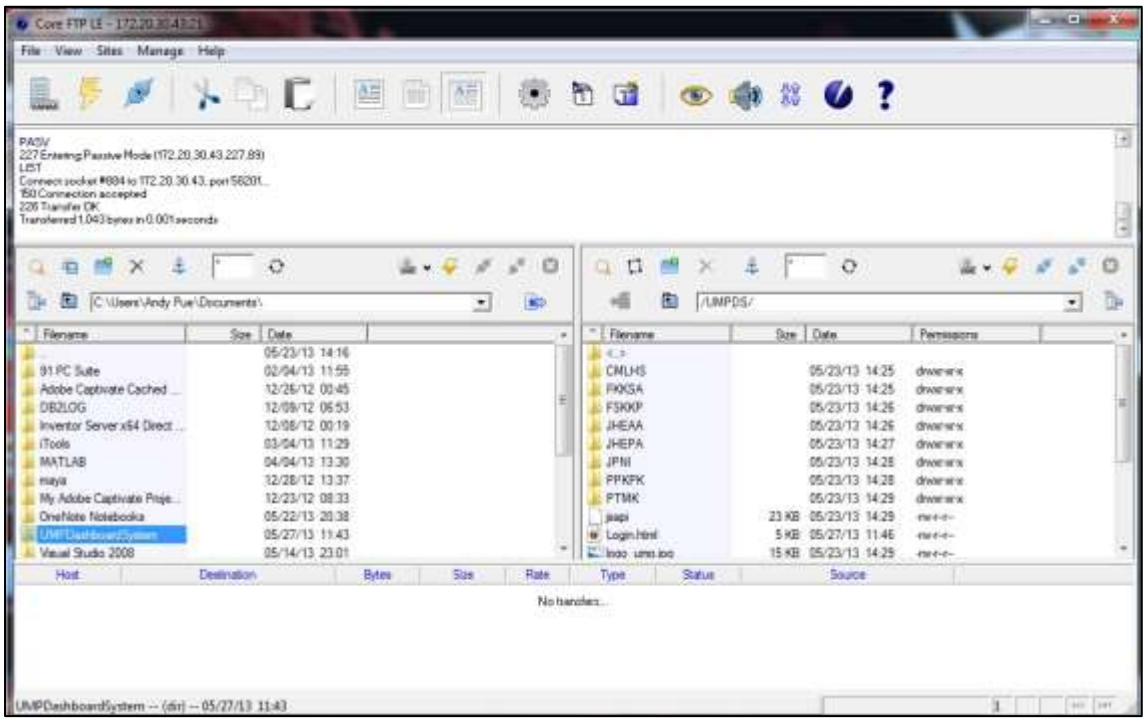


Figure 2.38: Uploading the System Files to UMP Server

2.8 Discussion and Analysis of Materials

In this UMP dashboard system, the techniques used or implemented is HTML5, XML (Extensible Markup Language), JavaScript and also CSS (Cascading Style Sheet).

Pilgrim, M. (2010) has defined that HTML5 is a new generation of HTML which provides many features that is suitable for modern web application. HTML5 is designed to be a cross-platform. It can be run on any type of operation systems such as Windows, Mac OS, Linux and others. Besides, HTML5 is also supported by any web browser such as Google Chrome, Firefox, Safari, Internet Explorer and others. Furthermore, HTML5 can also run on any mobile device platform. In this dashboard system, all the web pages are applying HTML5 language and the universe chart as shown in Figure 2.17 is developed by using the HTML5 Canvas.

Bray, T., Paoli, J., Sperberg-McQueen, C. M., Maler, E., & Yergeau, F. (1997) defined that XML describes a class of data objects called XML documents and the behaviour of computer programs which process them. XML document is made up of storage units which called as entities that consist of either parsed or unparsed data. In this dashboard system, the data is fully stored in only XML documents and the type of structure for the XML is hierarchical. In retrieving data process, the data will be called out based on its own declaration in the XML.

Flanagan, D. (2002) stated that JavaScript is a lightweight, interpreted programming language with object-oriented capabilities and will be embedded in the web browser. In this dashboard system, the JavaScript files for those charts are mostly loaded from the library of Google API library. The advantage of using this JavaScript is the JavaScript is an open source and ready to use the functions provided.

Sklar, J. (2001) stated that CSS is a dynamic style language that allows the user to design appealing and innovative web pages. CSS enables the user to add styles like fonts, colours, and spacing very easily to HTML. In this dashboard system, applying CSS is for the purpose of attracting the users with stylish web page instead of a dull page.

2.9 Project Limitation

The most concerned limitation for this dashboard system is only served as an output segment and lacking of input segments which are the editing and updating features since according to the Business Intelligence (BI) concept that a dashboard system must able to let the user to key in the dataset as the data will be updated time by time.

Besides, based on Mr Wan Azlee's suggestion, this system should not only using XML but must integrated with database since database is more suitable in storing dynamic data and the data will be stored in more proper way and easy to let the user to understand the structure.

2.10 Future Enhancement

In the future development, the dashboard system will come with a proper or standard login interface which is integrated with a database consists of information of each user and categorized in a correct group.

Besides, the dashboard system for sure will add in the edit and update features since these criteria are very important to make the system to be perfect. This also will enable the users to update the latest achievement of UKRA and KPI for own departments. The data will be stored in the database and extract the data to XML format when retrieving the data to the dashboard system and displays in the graphical form.

Furthermore, the dashboard system will add in more interesting design of the chart with unique idea of design in order to attract the users. This will help to increase the readiness of UMP to implement the online data visualization.

PART 3

CONCLUSION

Business Intelligence (BI) system is a system that is good in helping the people to store huge amount of data in a correct structure and displaying the output through the analytical tool which is the dashboard system in the form of graphical form. This kind of system is really useful in term of making the decision becomes more accurate and effective in solving the problem faced if compared with other methods.

In this project, UMP (Universiti Malaysia Pahang) dashboard system has achieved the established objectives. The flow of the UKRA (University Key Area Result) is fulfilled correctly in this dashboard system and the data is represented in a suitable graphical form that is able to deliver the correct message or information to the user. Then, the user is able to make a better decision based on the achievement of UKRA and also the KPI (Key Performance Index) for each department. Through this way, the strength and weakness of each department can be determined and a better solution can be produced in order to solve the weakness and also increase the strength.

In the nutshell, the dashboard system is able to improve the quality of each department since the system has the potential to be an effective analytic tool if this system is implemented in the future. This system is really helpful in term of helping the management team of each department to analyze the achievement of each UKRA and KPI in a better and convenient way with the suitable graphical form. Besides, this system is believed that able to increase the readiness of UMP in implementing online data visualization and also learn more knowledge or skill about this kind of technique in the future.

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Appendices

Appendices A

The letter shows as below is to prove the interview session with the client in PSM 1.

Universiti Malaysia PAHANG
Engineering • Technology • Creativity

Sekilas Ikram Kecemerlangan 10 tahun 2002-2012

07th DECEMBER 2012

TUAN/PUAN,

TAJUK	**: Measuring UMP Readiness to Implement Business Intelligence Using IBM Business Intelligence Strategy Framework**
NAMA PELAJAR	**: Andy Pue ZenFoong**
MATRIX NUMBER	**: CD10022**
TAHUN/PROGRAM	**: 3/Ijazah Sarjana Muda Sains Komputer (Teknologi Grafik & Multimedia)**

Saya ingin mengucapkan ribuan terima kasih atas bantuan dan kerjasama tuan/puan kerana memberi kebenaran kepada saya untuk mengadakan sesi temu duga dengan tuan/puan di samping memberi maklumat yang berkaitan kepada saya untuk menyiapkan projeck berkenaan.

Surat ini akan menjadi sebagai bukti bahawa saya pernah mengadakan sesi temu duga dengan tuan/puan.

Sekian, terima kasih.

Yang benar,

Andy

Nama: Andy Pue ZenFoong
Tarikh: 07 December 2012

Disahkan oleh,

WAN AZLEE BIN HJ. WAN ABDULLAH
KETUA BAHAGIAN PENGURUSAN DATA & KUALITI
PUSAT PEMBANGUNAN KORPORAT & PENGURUSAN KUALITI
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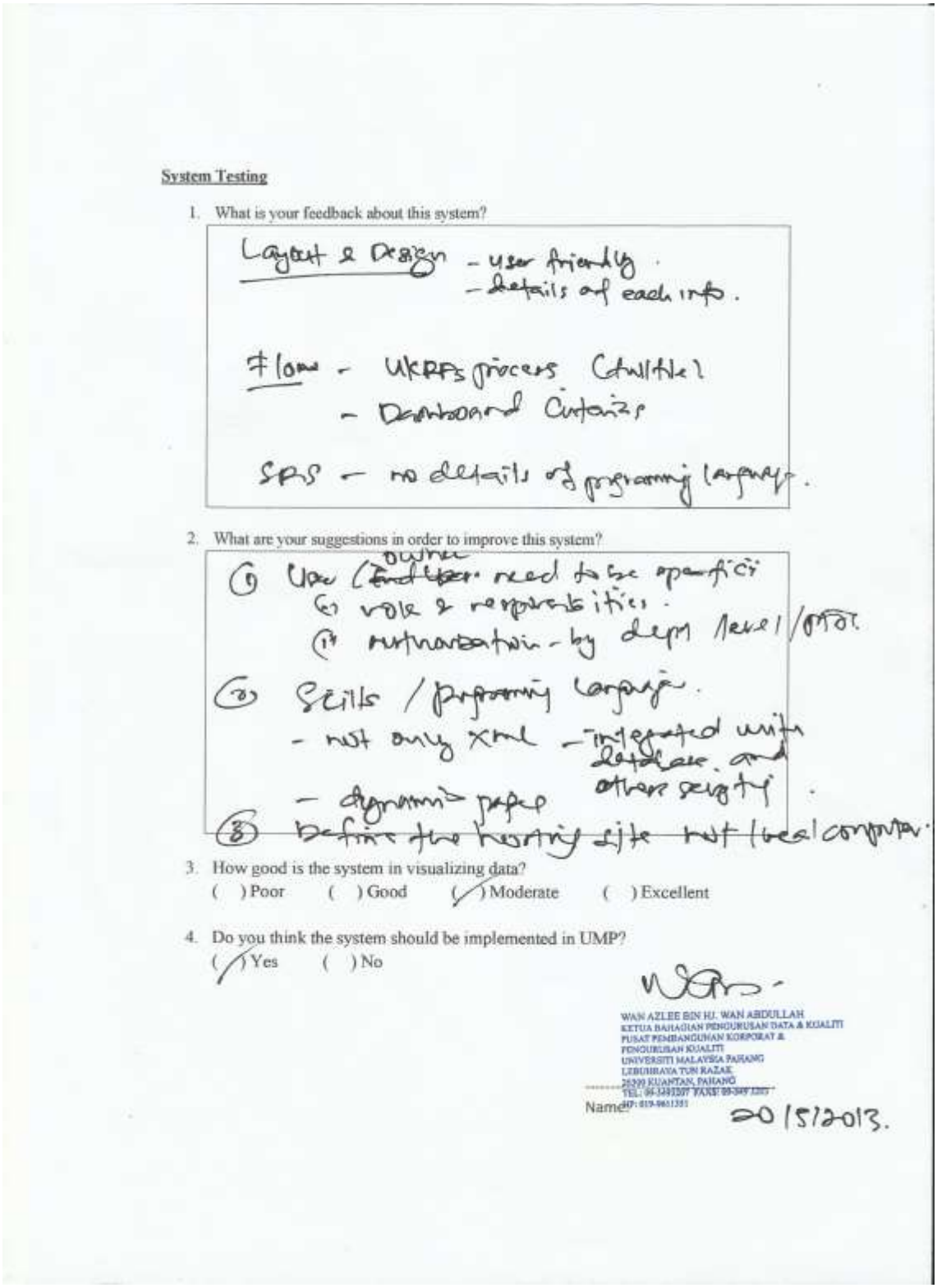
LEBUHRAYA TUN RAZAK
26300 KUANTAN, PAHANG
TEL: 09-5493207 FAXS: 09-549 3203
HP: 019-9611351

Nama:
Tarikh:

The letters below are to prove the feedback from the testers during the testing phase.



System Testing

1. What is your feedback about this system?

Layout & Design - user friendly
- details of each info.

Flow - UKRFs process (shuffle)
- Dashboard (interface)

SRS - no details of programming language.

2. What are your suggestions in order to improve this system?

(1) User (end user/owner) need to be specific
(a) role & responsibilities.
(b) authorization - by dept level/post.

(2) Skills / programming language.
- not only xml - integrated with database and other security.
- diagram> page

(3) Define the hosting site not local computer.

3. How good is the system in visualizing data?
( ) Poor ( ) Good (/) Moderate ( ) Excellent

4. Do you think the system should be implemented in UMP?
(/) Yes ( ) No

WAN AZLEE BIN HJ. WAN ABDULLAH
KETUA BAHAGIAN PENGURUSAN DATA & KUALITI
PUSAT PEMBANGUNAN KORPORAT &
PENGURUSAN KUALITI
UNIVERSITI MALAYSIA PAHANG
LEBUHRAYA TUN RAZAK
26300 KUANTAN, PAHANG
TEL: 09-5492207 FAKS: 09-549 2202

Name: HP: 019-9611351

20/5/2013.

System Testing

1. What is your feedback about this system?

- Good and can be implement to UMP.

2. What are your suggestions in order to improve this system?

- Split into two menus:
  - Academic Staff
  - Non Academic Staff.
- Restrict other PTJ to see the other PTJ performance.

3. How good is the system in visualizing data?
( ) Poor (✓) Good ( ) Moderate ( ) Excellent

4. Do you think the system should be implemented in UMP?
(✓) Yes ( ) No

AHMAD FADLY BIN IBRAHIM
Pelajar Pendaftar
Fakulti Sains & Teknologi Industri
Universiti Malaysia Pahang
Tel: 09-549 2781 Fax: 09-549 2788
Email: fadly@ump.edu.my

System Testing

1. What is your feedback about this system?

- It is a good system to show performance of the UKRA in it the institutions.
- It is really a helpful to the management to make a some decisions.

2. What are your suggestions in order to improve this system?

- Show or highlight result that above minimum achieve from target that have been set.
- Show legend in each bar that been shown in the UKRA.
- → Provide ~~more~~ graphics ~~more~~ graphics design to attract the user.

3. How good is the system in visualizing data?
( ) Poor (✓) Good ( ) Moderate ( ) Excellent

4. Do you think the system should be implemented in UMP?
( ) Yes (✓) No

Name: AZRUL AZMI BIN BUSTAN

AZRUL AZMI BIN BUSTAN
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Universiti Malaysia Pahang
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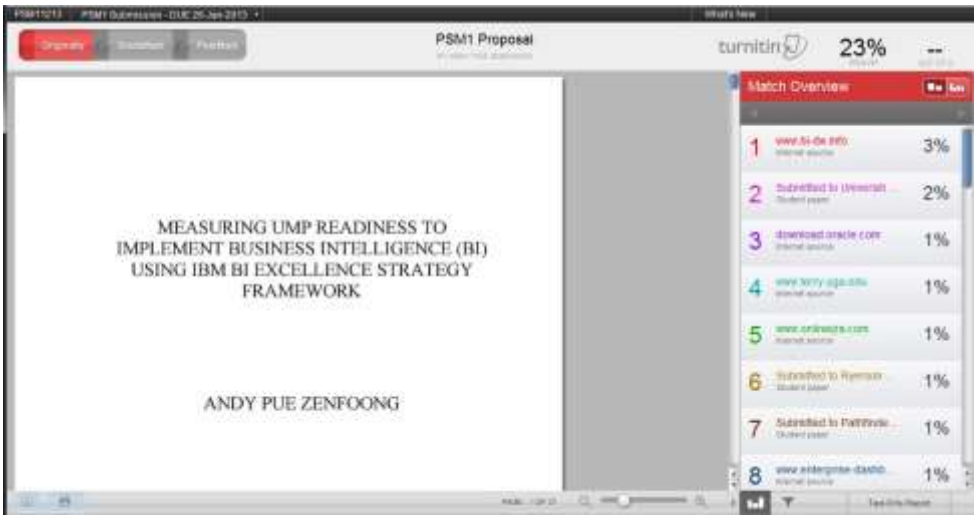
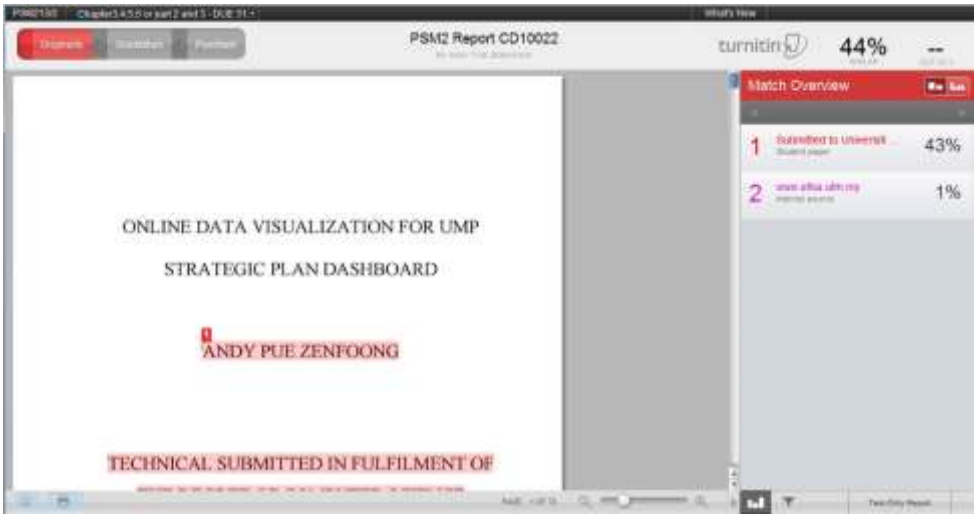
Appendices B

PSM 1 Turnitin similarity check: 23%

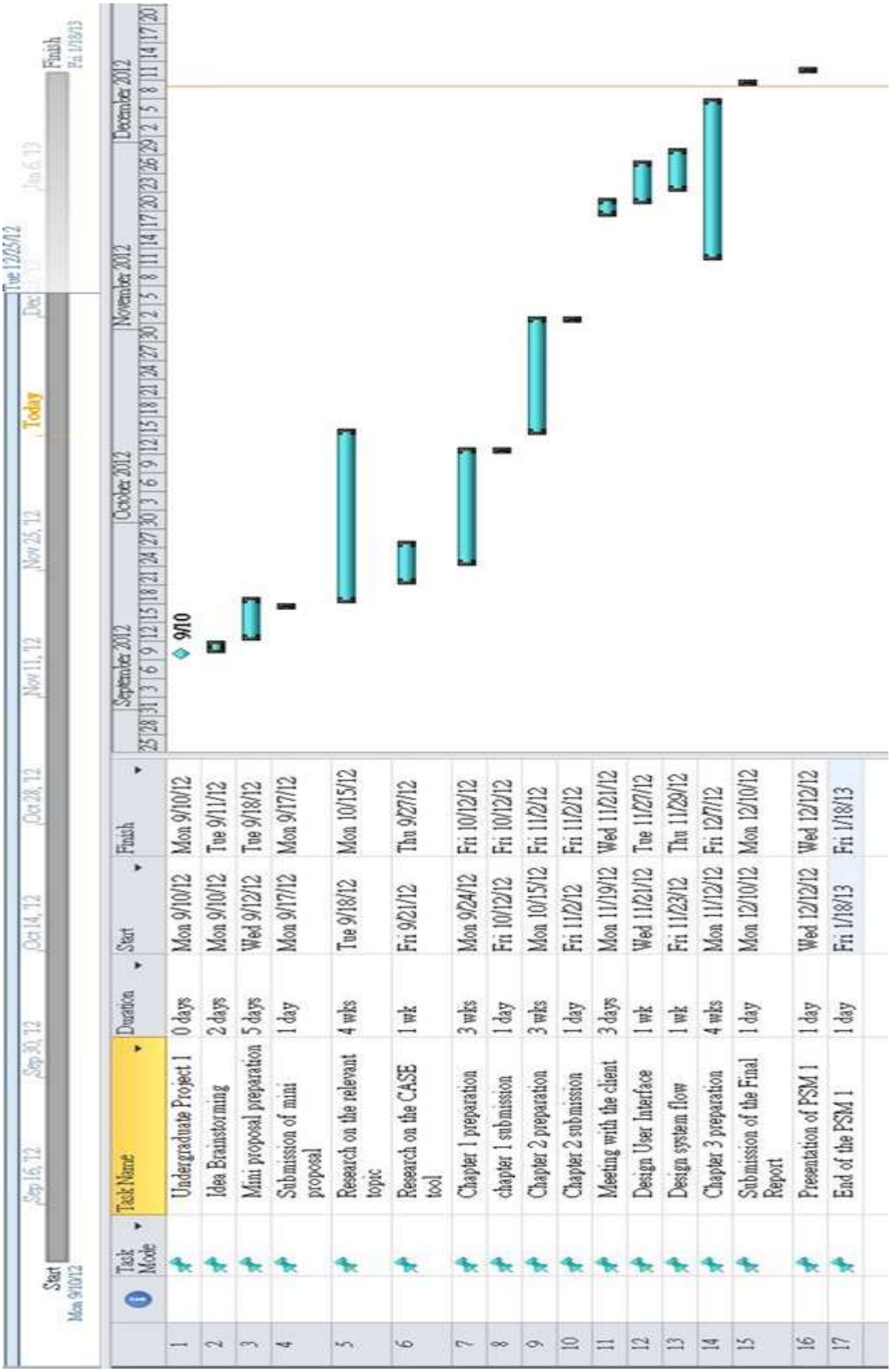


PSM 2 Turnitin similarity check: 44 – 23 = 21%



Appendices C

Gantt chart: PSM 1



	Task Mode	Task Name	Duration	Start	Finish
1		Undergraduate Project 1	0 days	Mon 9/10/12	Mon 9/10/12
2		Idea Brainstorming	2 days	Mon 9/10/12	Tue 9/11/12
3		Mini proposal preparation	5 days	Wed 9/12/12	Tue 9/18/12
4		Submission of mini proposal	1 day	Mon 9/17/12	Mon 9/17/12
5		Research on the relevant topic	4 wks	Tue 9/18/12	Mon 10/15/12
6		Research on the CASE tool	1 wk	Fri 9/21/12	Thu 9/27/12
7		Chapter 1 preparation	3 wks	Mon 9/24/12	Fri 10/12/12
8		chapter 1 submission	1 day	Fri 10/12/12	Fri 10/12/12
9		Chapter 2 preparation	3 wks	Mon 10/15/12	Fri 11/2/12
10		Chapter 2 submission	1 day	Fri 11/2/12	Fri 11/2/12
11		Meeting with the client	3 days	Mon 11/19/12	Wed 11/21/12
12		Design User Interface	1 wk	Wed 11/21/12	Tue 11/27/12
13		Design system flow	1 wk	Fri 11/23/12	Thu 11/29/12
14		Chapter 3 preparation	4 wks	Mon 11/12/12	Fri 12/7/12
15		Submission of the Final Report	1 day	Mon 12/10/12	Mon 12/10/12
16		Presentation of PSM 1	1 day	Wed 12/12/12	Wed 12/12/12
17		End of the PSM 1	1 day	Fri 1/18/13	Fri 1/18/13

Gantt chart: PSM 2

	Task Name	Duration	Start	Finish	Predecessors
1	**Planning**	10 days	Mon 9/10/12	Fri 9/21/12	
2	Discuss project progress	5 days	Mon 9/10/12	Fri 9/14/12	
3	Research findings (Journal, Article, Website)	5 days	Mon 9/17/12	Fri 9/21/12	
4	**Analysis**	12 days	Mon 9/24/12	Tue 10/9/12	1
5	Obtain user requirement	5 days	Mon 9/24/12	Fri 9/28/12	
6	Brainstorm on system planning	7 days	Mon 10/1/12	Tue 10/9/12	
7	**Design**	30 days	Wed 10/10/12	Tue 11/20/12	4
8	Design data flow diagram	10 days	Wed 10/10/12	Tue 10/23/12	
9	Flow Chart	5 days	Wed 10/10/12	Tue 10/16/12	
10	Design interface and database	14 days	Thu 11/1/12	Tue 11/20/12	
11	**Methodology**	6 days	Wed 11/21/12	Wed 11/28/12	
12	Choose the suitable methodology	6 days	Wed 11/21/12	Wed 11/28/12	
13	**Implementation and Testing**	107 days	Thu 11/29/12	Fri 4/26/13	
14	Design dashboard layout	20 days	Thu 11/29/12	Wed 12/26/12	
15	Design the structure of XML	15 days	Wed 12/26/12	Tue 1/15/13	
16	Develop the dashboard	73 days	Wed 1/16/13	Fri 4/26/13	
17	**Result and Discussion**	18 days	Wed 5/1/13	Fri 5/24/13	
18	Obtain result	14 days	Wed 5/1/13	Mon 5/20/13	
19	Writing report	4 days	Tue 5/21/13	Fri 5/24/13	
20	**Finalization**	3 days	Sat 5/25/13	Tue 5/28/13	
21	Preparation for presentation	2 days	Sat 5/25/13	Mon 5/27/13	
22	Presentation day	1 day	Tue 5/28/13	Tue 5/28/13