Google Chart Integration for Constructing Business Intelligence Dashboard

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Abstract. This study aims to develop a business intelligence information system dashboard by integrating google charts into the system to present information in graphic as data visualization. The information presented can be in the form of graphs with percentage values, summary values, and other aggregation values that can represent complex data distributions if presented in the form of detailed information. The data as a source of information in this study comes from a database that comes from a server-side database, and comes from a RESTful web service request. The information presented can later be easily understood and can help higher education management for decision making in order to improve management in higher education.

Keywords: Google Chart · RESTful Web Service · Business Intelligence

1 Introduction

Data visualization is an alternative in presenting data when information tends to be complex and difficult to understand. Data visualization is an integral aspect of the business world. Data visualization can help present data in real-time and see data trends from various data sources. Spreadsheet software is an example of a tool that can assist in visually presenting data. However, with the development of technology and challenges in presenting visual data, various technologies have emerged that can be used in presenting data visualization. Various tools that can be used in visualization include Google Charts, D3.js, FusionCharts, and so on [9].

Data originating from various sources in data visualization can maintain the sustainability of the data presented in an up to date, real-time manner, facilitate data analysis, and decision making [1]. Research on data visualization has been widely studied, including being implemented in monitoring and evaluating patient health [7]. This study presents a variety of charts that provide information about patient health which is implemented in a mobile application. Likewise, research conducted by [10] implements visualization in e-commerce applications to present product sales information.

This study aims to implement one of the tools that can present data visually, namely google chart. Data as a source of information in the presentation of visualizations is obtained by integrating data from server-side databases and RESTful web services by

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running the WEB API provided by the Web Service architecture to obtain data in JSON data format.

2 Literature Review

2.1 Data Visualization

Data visualization is the process of presenting information in the form of graphs and images [2]. Furthermore, Zhang provides a definition that data visualization is a theory, method, and technology that transforms data into graphics and processing mechanisms using computer graphics, virtual reality, and the like [3]. The same thing was also conveyed by [4] that visualization converts information into visual form and utilizes human natural abilities that can quickly identify visual patterns to observe, search, distinguish, and understand information. Sources of data in the visualization process can be obtained from various sources, and in general this is done by integrating various data sources [5]. From the aspect of the term Data visualization has several equivalent terms such as information visualization, data visualization, visual analytics, or just using the term visualization [6].

2.2 Google Chart

By utilizing Google Chart users can create various kinds of charts to present information from various data sources. Then the chart can be easily integrated in web pages and can be displayed in various browsers and platforms. Like other Google products, Google Charts is also free. There are approximately 12 types of charts supported by Google charts, namely pie, scatter, gauge, geochart, table, treemaps, combo, line, bar, bar, column, area, and candlestick [6]. The data presented in google charts can come from a web service, server-side database, or from google spreadsheet or google fusion table.

2.3 RESTful Web Service

RESTful web service is a client/server communication protocol using HTTP methods such as GET, PUT, POST, and DELETE [11]. In general, in the development of web services there are 2 protocols, namely the SOAP and REST protocols [12]. In its implementation, Restful web services can be accessed through desktop applications, web applications and mobile applications [13].

3 Implementation and Results

The function of the google chart in the development of this business intelligence information system is to display data and information in graphic form so that it is easily understood by decision makers. The main role performed by Google charts is the visualization of information on web pages.

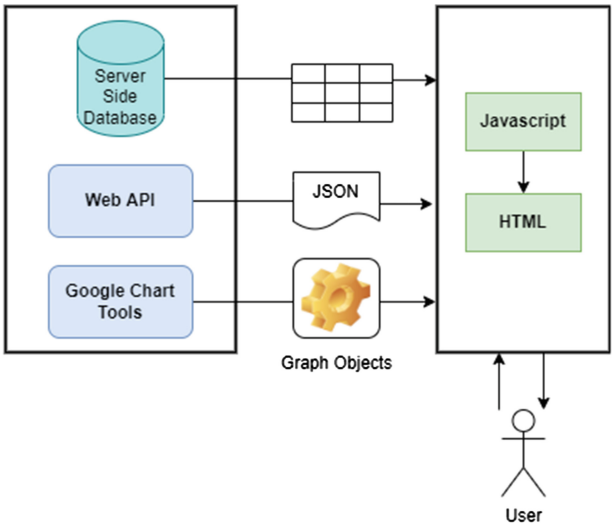

Fig. 1. Application Architecture. Adapted from [8].

3.1 Application Architecture

Figure 1 is the application architecture of the developed system. Google chart tools will be embedded into web pages through javascript code, then return various charts in graph objects. As a source of data for this business intelligence application, it is obtained from 2 data sources, namely a RESTful web service which returns documents in JSON format, and from a server side database which returns data in the form of a recordset.

3.2 Dashboard Page

Figure 2 shows a web page display of a business intelligence application that displays information on the Top 5 of the distribution of research productivity from each study program and the most widely absorbed funding schema. This graph is generated from google charts in the form of pie charts and donuts. Graphic display can be packaged in 2D or 3D as shown in Fig. 2.

Furthermore, Fig. 3 displays information in the form of a Linechart that displays information on the distribution of lecturers from each study program at the Sriwijaya State Polytechnic. The information generated in this graph is obtained using requests to Restful Web Services provided in different systems from business intelligence applications. Data in JSON format transmitted from Restful Web Service and from business intelligence applications is parsed to be displayed in the form of line charts using google charts.

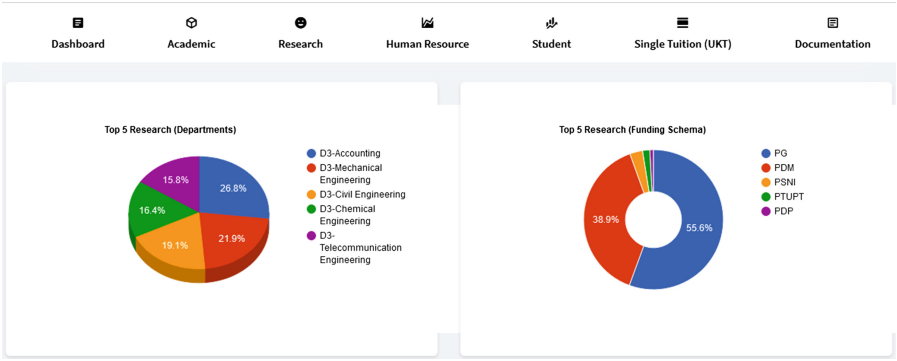

Fig. 2. Piechart and Donut View from Google Chart

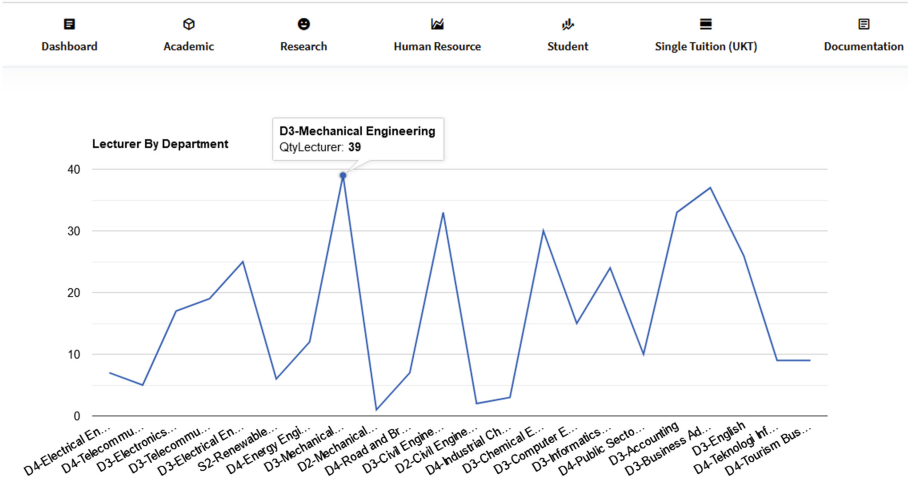

Fig. 3. Display of Lecturer Distribution in Line Graph Form.

3.3 Performance of Application

Figure 4 is the performance of a RESTful web service in terms of network traffic which is the communication between the client/server. Processing requests to the server using Postman software, so that the response from the server can be presented in the form of response time and the amount of the payload of the data transmitted from the server to the client. The information obtained from Fig. 4 shows that the total time required to process the graphic display as shown in Fig. 3 to provide information on the distribution of the number of lecturers in each study program takes 290.93 ms. It starts with several steps such as socket initialization, DNS lookup, TCP handshake, transfer start, and download. While the amount of payload transmitted is 2.25 KB with 1.64 KB is the body segment information, and 628 B is the information from the header.

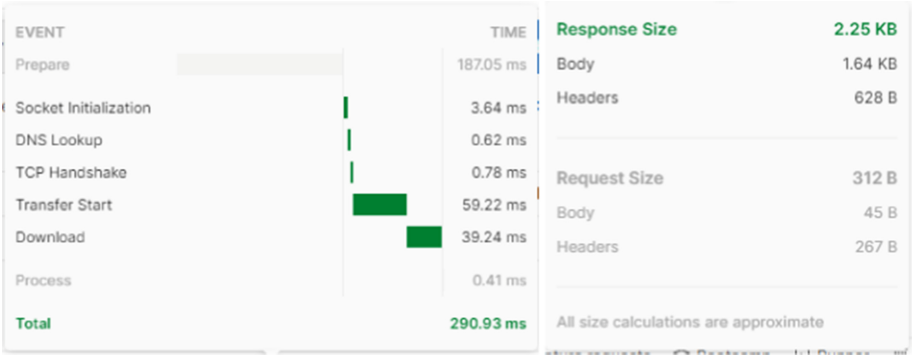

Fig. 4. Monitoring Request Restful Web Service using Postman software

4 Conclusion

This research has implemented google charts as part of the data visualization process to present information in graphic form in business intelligence information systems in universities. Presentation of information in the form of graphs can facilitate the legibility of information presented in visual form for upper management in higher education. By packaging the application in a web-based environment, it can increase accessibility, because it can be accessed from anywhere and anytime as long as it is connected to the internet.

The focus of this research is to present data visualization information in one direction only. There are no interactive facilities in the developed system. As further research, interactive features can be added, where the viewer of the data presented can interact with the system, such as filtering, sorting, and customizing the data to be presented in the system.

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