Online judge MySQL for learning process of database practice course

IOP Conf. Series: Materials Science and Engineering **523** (2019) 012046 doi:10.1088/1757-899X/523/1/012046

Online judge MySQL for learning process of database practice course

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Abstract. Database course is the main courses in the department of informatics and computer science. This course aims to provide knowledge to students to build and manage data on Database Management Systems (DBMS) like MySQL. Therefore, the implementation of database processing practices in one of the DBMS such as MySQL is very important as basic skills in the field of informatics. With the growing number of informatics students, lectures cannot correct the results of student exercises quickly. For that, we need a system that can help lecturers to make corrections of query exercise on MySQL automatically, which is called Online Judge MySQL. This application was developed using NodeJS to execute queries that users input and ReactJS to build its interfaces. Testing is done by using this application for the online exam in several classes simultaneously. The results show that this application can correct the test results quickly and lightly.

1. Introduction

Database course is the main courses in the department of informatics and computer science. This course aims to provide knowledge to students to build and manage data on Database Management Systems (DBMS) like MySQL. Therefore, the implementation of database processing practices in one of the DBMS such as MySQL is very important as basic skills in the field of informatics. With the growing number of informatics students, lectures cannot correct the results of student exercises quickly. For that, we need a system that can help lecturers to make corrections of query exercise on MySQL automatically, which is called Online Judge MySQL.

The developed system should be able to assess whether the output generated from the student's query equals the output generated by the correct query. Because the same output can be obtained using different queries. A lot of research has been done to develop an online judge system. Among them is a system that has been created by Miguel A. Revilla [6] entitled "Competitive Learning in Informatics: UVA Online Judge." The system was built based on the needs of the online judge system for various programming languages, as well as referring to the concept of competitive learning that aims to provide lessons about programming through the competition. Some things that have been achieved from this system include discussion forums, a collection of problems, a system for program submission and leaderboard. But this system has a lack of feature; the system did not support query language on MySQL.

There is another system entitled "Rancang Bangun Sistem Basis Data Online Judge untuk Proses Pembelajaran Mata Kuliah Sistem Manajemen Basis Data di Departemen Teknik Informatika ITS." The system can overcome several things in the correction problem, by creating a grader system that can facilitate students to do the task. This is achieved by comparing the student's query with the query that acts as the answer key. The system, then, is using it as a determination of scoreboard scoring through the system. And then displayed it as an evaluation. But in the implementation, there are still some shortcomings such as query restrictions are allowed to run on the system, scoring system through the scoreboard and processing, and the speed of grader execution [8].

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To solve the problem of correction time, asynchronous javascript technology can be used. Asynchronous javascript is JavaScript that is executed as server-side. One of the advantages is the existence of non-blocking techniques. Using the technique, the execution process of an operation does not have to wait for the previous operation to be executed, resulting in a faster and more efficient web application [5]. The asynchronous javascript technology used in this research is NodeJS.

In this paper, the first section will describe concepts that support the research, such as an online judge, NodeJS and ReactJS, JSON, REST. In the second part of this paper will describe the research methodology. In the third section will describe the results and discussion of the research while the fourth section will contain conclusions.

2. Online Judge MySQL

Online Judge, in general, is a server that contains descriptions of problems in different context, as well as data that is set to assess whether a particular solution solves the problems residing on the server [6]. There are several online judge categories currently implemented: Problem Solving Online Judge, HTML & CSS Online Judge, and SQL Online Judge. In this research will be developed SQL Online judge. Just like an online judge for HTML and CSS, online judge for SQL is currently an online course, because there is no rating system in the application. Examples of online course applications for SQL are Codecademy and SqlCourse [6].

Online Judge is an online system that is often used to perform testing of the program in a programming contest. This system can compile, execute, and test on the source code submitted by the participants of the programming contest. The online judge can be used in various languages such as C++, Java, including SQL. In this MySQL database online judge, after the user enters the answer in SQL query form, the system does not compare query text but compares the result of answer query with the result of the key query. The online judge architecture runs entirely on the basis of text-based query execution, in accordance with the rules of the MySQL.

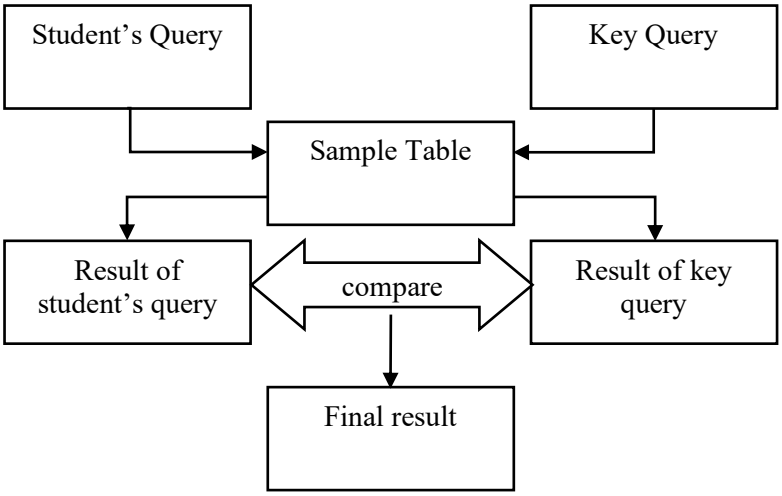

Figure 1. Judging Process Architecture

According to figure 1, the student's query is a query generated by input from the student. The key query is a query generated by input from the lecturer. The sample table is the table, which uploaded by the lecturer as a grading reference. The result of student's query is an object as the result of student's query execution. And the result of the key query is an object as the result of key query execution. The system is then comparing both of query results, and generate the final result. There are three possibilities of the final result Correct Answer, Wrong Answer and Query Error (if the result is an error due to incorrect syntax).

An object used as a comparison because the grading process cannot be done using text because it will produce inaccurate results. The inaccuracy of the results is caused by each query entered by the student may have different syntax and writing, but has the same logic as the expected execution result. By comparing objects, the results obtained are not based on text queries but rather query execution results, which can be more accurate.

The Online Judge MySQL in this research developed using asynchronous javascript technology using the Node.js platform for the backend and ReactJS for the frontend. Node.js is an event-based JavaScript and asynchronous I/O. Unlike most javascript languages that run on the browser. Node.js serves as a server application executed as server-side. One of the advantages of Node.js is the non-blocking technique in which Node.js will execute an operation without having to wait for the previous operation to be executed, resulting in a faster and more efficient web application. Node.js is capable of handling thousands of connections together with minimum resource usage for each process. In addition, another advantage of Node.js is an open source project, so anyone can see the code structure and can also contribute to its development [5].

ReactJS is an open source JavaScript library managed by world-renowned IT companies such as Facebook and Instagram along with developer communities from around the world. This framework is used extensively to develop an interface in a web application (Artemij 2015). When viewed from the architecture of user interface implementation, ReactJS can be said as a component of V (View) in MVC (Model View Controller). ReactJS can use CSS styling features and other CSS frameworks well. For element writing, we can use HTML script inside JavaScript (JSX). ReactJS excellence is when there are data changes, ReactJS will conceptually reload certain parts of the change [1]. This causes the application to be fast and lightly executed.

The system architecture used in this research is REST. REST is a web standards architecture that uses the HTTP protocol in data communications. In the REST architecture, servers that follow the REST architecture provide access to data sources and clients that retrieve data. Each data source is identified using a URI link. REST uses various formats to present data, such as text, JSON and XML. REST uses a stateless HTTP protocol. HTTP commands that can be used are GET, POST, PUT or DELETE functions. The results sent from the server are usually in the form of a simple XML or JSON format without any packet data protocol, so the received information is more readable and parsed on the client side [11].

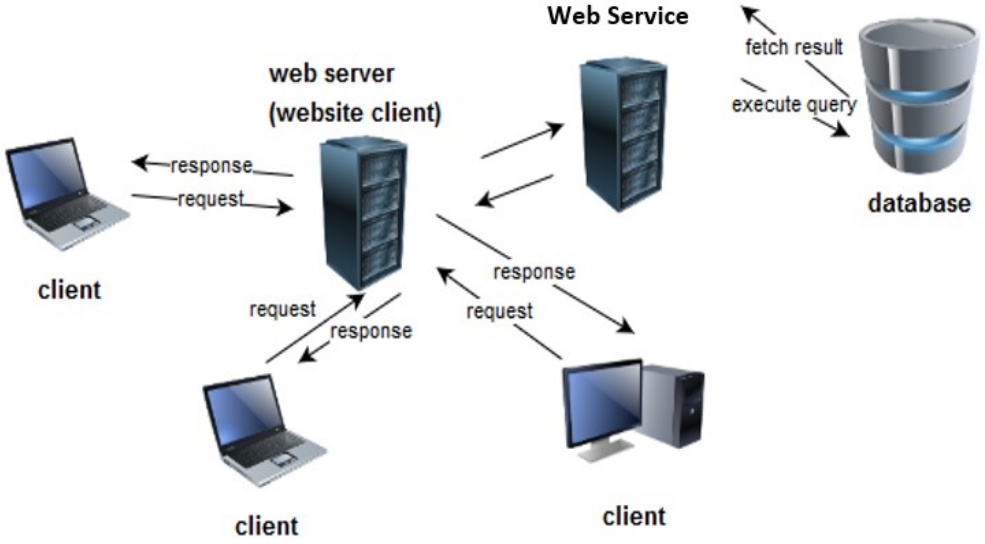

Figure 2. System Architecture

Javascript Object Notation (JSON) is a popular general-purpose data encoding format. Application of JSON has been widely used in database and web service. JSON document structure can optionally

be limited by a scheme consisting of two things namely the map (mapping of value based on the classification structure type) and lists (grouping value based on the classification of the type). JSON is a lightweight, easy-to-read, and human-written data exchange format, and is easily translated and created by computers. JSON is a text format that does not depend on any programming language because it uses common language styles like C, C ++, C #, Java, JavaScript, Perl, and Python. Because of these traits, making JSON ideal as a language of data exchange.

In this part, will be explained about the system architecture, as shown in figure 2. Client access the website via a browser on laptop or PC connected to the internet. The client computer sends the request, and the webserver sends a response. Through the webserver, data entered by the client is stored into the database. The system is built using Node.js as the backend. Node.js plays a role in the routing process, using the express framework help. Node.js also plays a role in the creation and management of databases and queries, on the MySQL server. While the frontend used ReactJS as a library. ReactJS also play a role to send data received from view to routing express on node.js while the online judge architecture is fully run on the basis of text-based query execution code on the MySQL database.

This research develops Online Judge MySQL which aims to simplify the assessment of database practice, especially on SQL Select command material. In this application, there are features such as managing users, managing the lab and exam schedules, manage classes and class participants, manage a collection of questions and problems, manage assessment. In every practicum activity, there is a scoreboard to see the recapitulation of values from students. In this application, there are three users, namely lecturers, students, and super admin. The data used in this application is managed in MySQL database management system. The structure of the database in this application can be seen in figure 3.

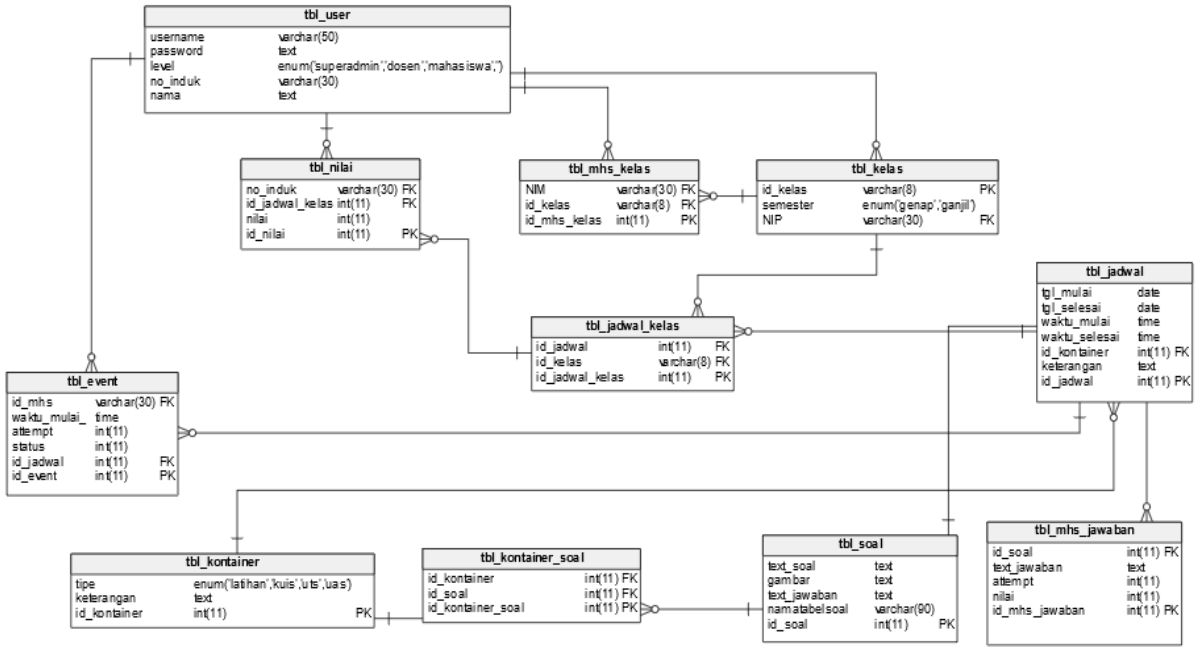

Figure 3. Database Design of Online Judge MySQL

3. Implementation

In order to build this application, we use several support tools consisting of software and hardware. The software that we use in building this application can be seen in table 1, while the hardware that we use to build the application can be seen in table 2.

Table 1. Software Requirement

Name	Function
Visual Studio Code	As a tool for writing program code
Node.js	As a tool for web-based application development
Apache	As a web server
MySQL	As an application for data storage
Web Browser (Mozilla / Chrome)	As a browser to run web-based applications

Table 2. Hardware Requirement

Hardware	Specification
Processor	Processor Intel Core i 3 2.00GHz
Memory	RAM 4 GB
Harddisk	500 GB

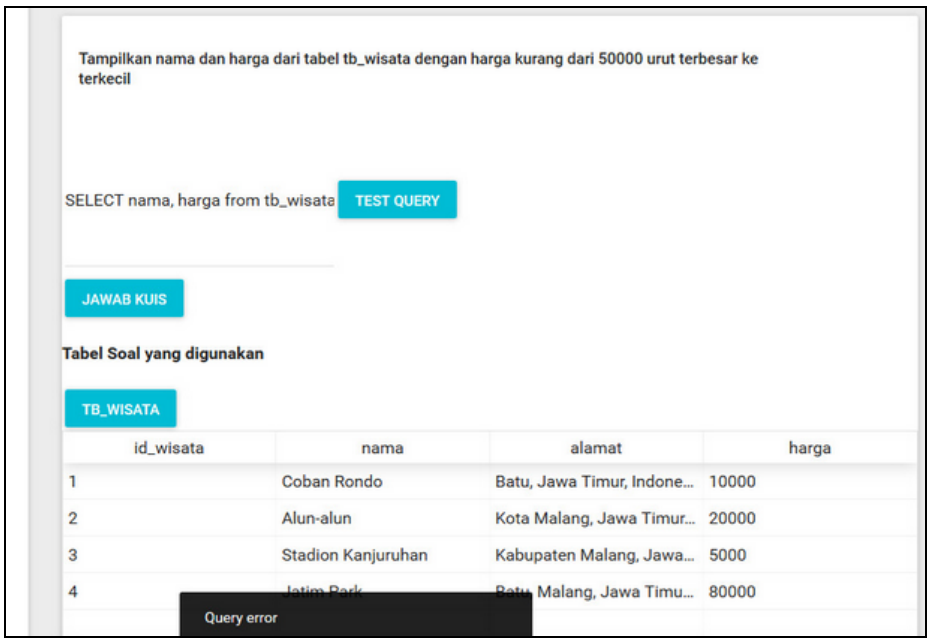

Figure 4. Query Page

4. Experiment results and discussion

To test Online Judge MySQL done two kinds of testing, User Acceptance Test (UAT) and system testing. UAT Testing aims to determine the level of need for online applications MySQL judge and the level of compatibility with the needs of the database practicum especially DML query SELECT material in the Department of Information Technology, Politeknik Negeri Malang. The number of respondents as many as 10 students and database lecturers of as many as 3 people. While for testing the system is focused on the level of success graders in handling the judgment process of the query that allows the occurrence of errors on the system. Grader testing is done by testing two grader versions.

After testing is done, it can be seen that online judge. MySQL application meets the requirement of database material about DML, especially query SELECT. It also can save lecturers time to assess student's work about query SELECT. Then for the grader test, it can be seen that the grader has been able to perform the judgment process appropriately.

5. Conclusion

During the process of design, implementation, and testing can be concluded that online judge application can handle the assessment procedure. It checks whether the student's query equals the key query from the lecturer. Online judge application already met the functional requirements. Grader already meets the needs of the judgment process. In accordance with the User Acceptance Test, the lecturer requires online judge for database practicum material about DML, especially query SELECT.

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