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Integrated Architecture of Moodle (LMS) with Student Information System to Improve the E-Learning System

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Abstract:
Information communication technology is rapidly changing. Education system has been shifted from bricks to click. E-Learning system is replacing the traditional education system and engaging the learners through ICT based learning. Parr and Fung, (2005) stated that E-learning can be defined as a "the use of new multimedia technologies and the internet to improve the quality of learning by facilitating access to resources and services as well as remote exchanges and collaboration. The word Moodle is an acronym for Modular Object-Oriented Dynamic Learning Environment. Moodle is one of the systems that have been increasingly gaining worldwide popularity in e-learning system as a standard Learning Management System (LMS). Reuben et. al (2005) and Chouris et. al. stated that it is a free and open-source software written in PHP and distributed under the GNU General Public License. Developed on the basis of pedagogical principles and educational domains. The systems which involved with e-Learning also called as Learning Management System (LMS) or Virtual Learning Environment (VLE). Moodle is designed to help educators and content experts to create online courseware with opportunities for rich interaction. This paper is mainly focused on the integrated 3-layer system architecture of Learning Management System (LMS) with external Student Information System (SIS) using Authentication method to improve the e-Learning System.

Keywords: LMS, Moodle, Database, E-Learning, Apache, Web Server etc

1. Introduction

Sachan and Singh (2015) explained the Moodle and Blackboard which are the best learning platforms for virtual learning platform and Blackboard learning platform is best for commercial platform Kumar, Gankotiya et al. (2011) focused on the Moodle Architecture and comparative study of Moodle. Whereas, Andersson and ÅkeGrönlund (2009) proposed a conceptual Framework on challenges for e-learning in developed and developing countries. The framework was useful to guide both practice and research but they don't provide any suggestion how to overcome these challenges. Chouris et. al. explored the implementation of effective e-learning through moodle and also present the various facilities of Moodle.

Reuben et. al. Bryant Bremer, Dave (2005) presented an evaluation of open source e-learning platforms with the aim of finding the most suitable platform for extending to an adaptive, customized as local context of any one of the platform like Moodle or Blackboard. Whereas, DwiSurjono (2014) discussed the evaluation of an adaptive e-learning system based on student's learning styles that had been developed using Moodle(LMS).

However, above researchers does not suggest any framework or architecture that integrated with student information system to improve the e-learning system because Moodle has no student information system. That's why we have implemented an integrated system architecture that will improve the e-learning system.

2. Objectives of the Study

The overall objectives of the proposed system architecture are analysis, planning and implementation of an integrated solution between student information system and Moodle in order to solve the problems of Moodle user creation and access to the LMS. Specific Objectives are as follows:

a) To improve the E-learning system using integrated student information system
b) To provide a greater degree of flexibility and increased security.
c) To ensure data integrity, privacy and data consistency.
d) To reduce the time for access to the LMS.

2.1. Outcomes of this Study
a) Data transferred quickly and efficiently from SIS to LMS.
b) Synchronization of user data from SIS and LMS platform.
c) Learning environments quickly established

3. Framework/Methodology

This paper designed a 3-layerintegrated System architecture of Moodle with Student information system using authentication method to improve the e-Learning system. This system design consists of user interface layer, application layer and data layer. The design is clearly described in the Figure 1:
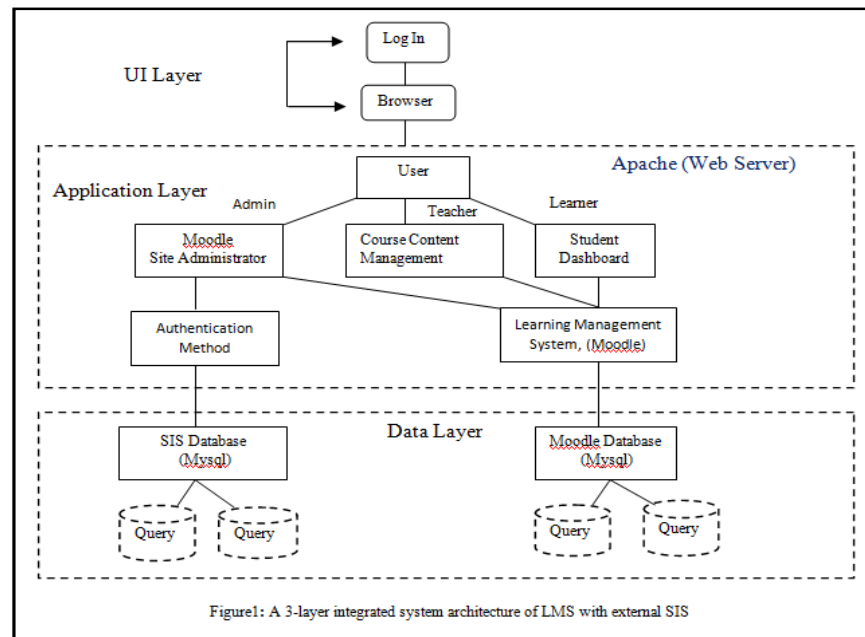

Figure1: A 3-layer integrated system architecture of LMS with external SIS

Figure 1

1) User Interface Layer: It is the top-level tier. At this stage user inputs, the necessary data to the system using the browser and the output is displayed on his browser.

2) Application Layer: This layer controls application functionality by performing detailed processing.
    a)   Site Administrator: Administrator has the full permission to do anything in Moodle.
    b)   Course Management: Can do anything within a course, including changing activities and grading students.
    c)   Student profile: Students can see available course, which program of study they are on, and hence which course need to complete and courses they have completed.
    d)   External database authentication: It uses an external database to authenticate and populate user's information and access to the LMS.

3) **Data Layer:** It will get the data from the Application layer and send it to the database or get the data from the database and send it to the Application layer.

4. Flowchart of the System

The following flowchart represents the sequence of steps and decisions needed to perform a process of our proposed system architecture.
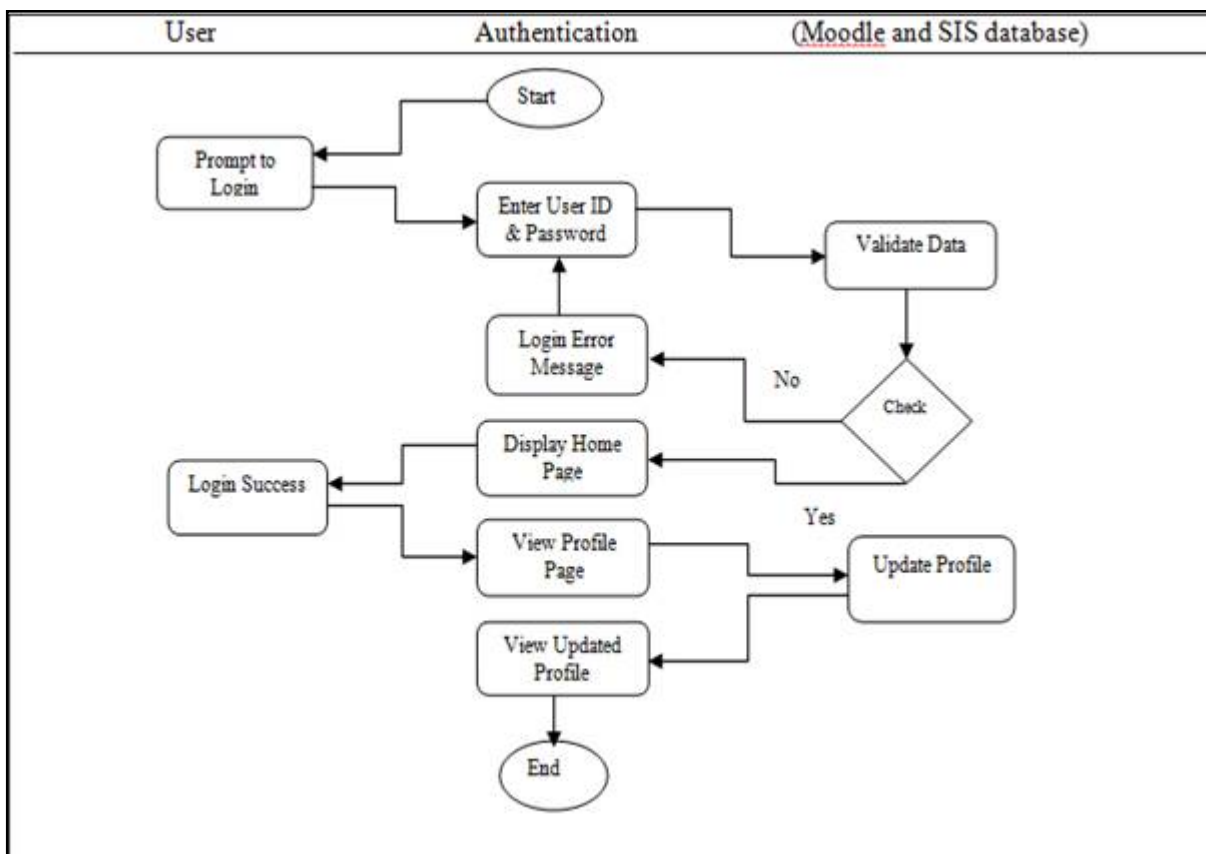
Figure 2: Flow Chart of System Architecture

5. Implementation of the System

In order to implement the system, it is essentials to consider the following steps:

a) External Database of Student Information System: Create an external student information system database (student_info). Here is table of users includes the following fields and data type:

Figure 3: users table of SIS database

b) LMS (Moodle) Configuration: We have successfully configured the moodle in our web server according to system architecture. It requires:
- Apache on Windows platforms.
- PHP Scripting language (version 5.1 or +)
- MySql database

The moodle user table stores the data from SIS database. The structure of user table is as follows-

Figure 4: Moodle user table

c) Integrate Moodle with external SIS database: Then we integrated LMS with Student information system database (student_info) using external database method. See the following figure 5.

Figure 5: Integration of SIS database

d) Implementation output: Finally, we have successfully integrated moodle with external student information database. After login into Moodle, the users from SIS database appear in LMS platform. See figure 6.
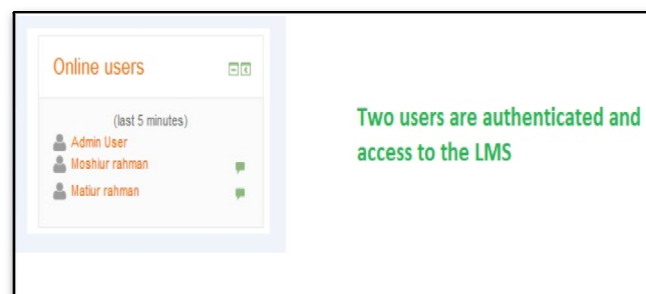

Figure 6: Online user of LMS platform

6. Result Analysis

To evaluate the performance of our proposed system architecture we have taken 50 students for user creation and access to the LMS. First, we have created account manually by LMS administrator and required time is calculated as:

= (Time/User creation * Total No of Users) Minutes

= (3 * 50) Minutes

= 150 Minutes

On the other hand, no required time is needed for access to the LMS when integrated from SIS database. So, this study can express that LMS system architecture will increase the efficiency and effectiveness of e-Learning system.

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