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Implementation of PHPMailer with SMTP protocol in the development of web-based e-learning prototype

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Abstract. The usage of information technology has developed rapidly. At present, the information system has been widely used in various fields, including the education sector, through various web-based learning systems. Information system becomes an important factor in the process of decision making system, data management, document management, and performance efficiency. In the education sector, the development of information systems can be applied to the teaching and learning process. One of them is an e-learning as a new innovation in the learning process. The development of e-learning become a solution of learning to become more interactive and productive. This prototype use PHPMailer Library on the SMTP protocol which is an alternative tools in the e-learning development. The PHPMailer Library become an intermediary of e-learning in sending emails automatically. PHPMailer can provide information to users about the activities carried out. Teachers, students and parents can monitor the teaching and learning process and the learning outcomes through notifications that send from email. This study use a waterfall software research and development model, and Object Oriented Programming (OOP) programming concepts. The Tests show that this prototype is successfully with 100% accuracy with a good level of responsiveness. The system testing results indicate that e-learning can provide an email notification to teachers, students and parents during the learning process. The development of e-learning can also be accessed from various media or devices.

1. Introduction

E-learning is the practice of using information and communication technology to create learning experience that can be formulated, organized and created with ample freedom without any boundaries [1]. In higher education, e-learning is gaining more and more impact, especially in the format of blended learning and this new kind of traditional teaching and learning can be practiced in many ways [2]. In an era where educational and technological modernizations are redefining the standards of higher education, the converging point of interconnection is e-learning [3].

Management Information System (SIM) is a key factor to facilitate and assist in an efficient decision-making process in an organization [4]. System development using PHP is a very familiar programming language used to create a website. In addition, the PHP programming language is known to have convenience. So that it is easy to use by web programmers [5]. As an interaction into the database, the system will be developed with Structured Query Language (SQL) which is a collection of statements used by programmers and users to access data in the database [6].

E-mail is the most common mode of communication today. E-mail not only used for sending messages/text only but also to send audio, video and other files as attachment [7]. E-mail is one of the most widely used ways of written communication over the internet, and its traffic has increased exponentially with the advent of World Wide Web [8]. To send a E-mail message, this research used the PHPMailer library which can be used to send e-mail. PHPMailer is used in proposed system which is used to send emails [9]. The reason why PHP Mailer is used is that many steps are needed to pass if one is trying to make his/her own email sender and receiver application. At the same time, almost all email service providers had secured themselves by these kinds of email [10].

PHPMailer's implementation as a technology used to send certain information to users connected to the website is the focus of this research. PHPMailer works like sending emails automatically without using other users to send emails [11]. PHPMailer will run on SMTP (Simple Mail Transfer Protocol) which is an email transport protocol used to send electronic messages [12]. SMTP performance is also affected by the server response time used and the latency / time delay. This slot starts with the initiation of a TCP connection until sending an e-mail message to the e-mail SMTP server [13].

SMTP servers incorporate one or more security features using several add-on e-mail security protocols to make communications secure and private. These protocols use diverse technological means like encryption, symmetric and asymmetric cryptography and domain validation through IP address verification and digital signatures. Several varieties of anti-spam filter have been developed to ensure message integrity. The add-on security protocols provide a reasonable security but have several limitations. This section discusses chief security protocols and their limitations [14].

2. Method

The development and testing of the system are focused on the prototype model software development method. The prototype model is a software development that focuses to certain functions [15]. Using this model, the development process will be much faster and easier than any other method in the process of identifying problems [16]. Prototype Model place more effort in creating the actual software instead of concentrating on documentation [17].
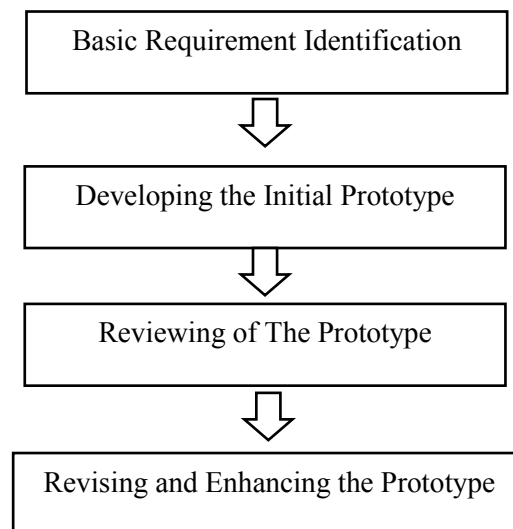

Figure 1. Prototype model

2.1. Basic requirement identification

Basic requirement identification aims to find out all the requirement data needed on the development of e-learning. This process is carried out by collecting the requirement of the variables needed including input variables, class sharing, task delivery, assessment input and access controll. The data requirement variable can be seen on table 1.

Table 1. Variabel Requirement

No	Variable
1	Full Name of student
2	Full Name of Teacher / Lecturer
3	Full Name of Parents
2	Class Data
3	Subject
4	Email Address
5	Parent Email Address
6	Assessment

Variable data is used to design database and system process. All requirements related to data can be obtained before the database design process begins. To develop the prototypes, this study only use the email address of students, teachers and parents for sending email notifications from the system.

In addition, the system need a library to send the e-mail from server. This is PHPMailer. To be able to use the PHPMailer library, the PHP code syntax must be included PHPMailer library in according with the directory location in the system design. To call the library, the syntax can be write the following code

```
required "PHPMailer/PHPMailerAutoload.php";
```

PHPMailer use SMTP as the transfer model protocol to send the email from the library. SMTP can be said as a post office, basically sending a letter will be taken to the post office for sorting. This warehouse is what is meant by SMTP. The concept of SMTP Transfer model can be seen on Figure 2.
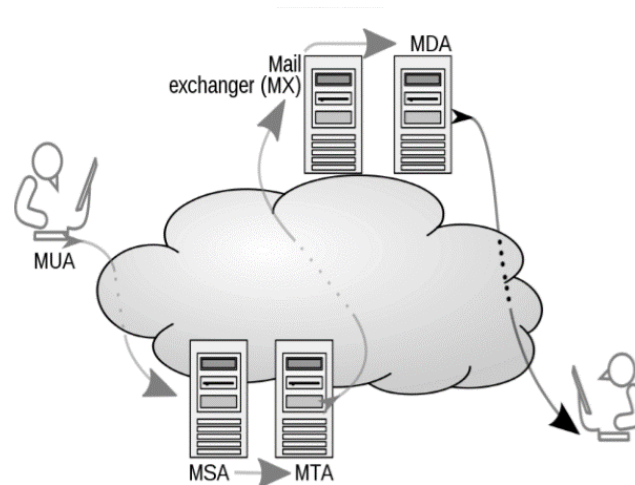
Figure 2. SMTP transfer model

On Figure 2, to send an e-mail, the e-learning server will sort the destination of e-mail address in according with the coding described in the prototype development process. After the email is successfully initialized by SMTP, e-mail will be sent from the internet network by encrypting network security to the destination of e-mail server. So the users including students, teachers and parents will receive the email as a notification when they open the email service provider.

2.2. Developing the initial prototype
This study focused on the implementation of PHPMailer library as a message sender and automatic notification on e-learning systems. The initial preparation is consentrated to preparing the PHPMailer

code and initiating the SMTP protocol as an email delivery traffic. After all the requirement variable and library are met, the next steps are encoding the prototype according to the PHPMailer library format that used in the SMTP protocol. The code can be seen on the following code fragment

```
$mail->Host = 'hostname';
$mail->SMTPAuth = true;
$mail->Username = 'username';
$mail->Password = 'password';
$mail->SMTPSecure = 'tls';
$mail->Port = 587;
$mail->setFrom('from');
$mail->addAddress('to');
$mail->isHTML(true);
$mail->Subject = 'Subject';
$mail->Body    = 'Message';
```

Based on the code, several variables are need to be able to connect between the client computer and the SMTP server. One of the most important variable is SMTP secure. It is a cryptographical protocol that provide a security communication from the internet network. These variables can be filled with "TLS / SSL" data, each of variable have different security [18]. To send an e-mail, traffic on the server requires PORT to identify the applications and services using a network connection on TCP / IP [19]. The default PORT is 25, 465 or 587 according to the e-mail service provider. In the early stages of the prototype development, all the variable and SMTP configuration had been defined through the code embedded in the prototype for testing.

2.3. Reviewing of the prorotype
After the prototype code has completed, the next stage are testing and implementating the prototype. The prototype will tested on a local server and cloud server. Testing on local server will be done before the prototype is applied to online integration system. While the test result can be used as a material for planning and developing the e-learning locally, the cloud server testing is used to test the success of prototypes in online conditions.

The prototype is tested on several different configuration variable of SMTP Secure, PORT and Host email service providers. After the basic prototype is running properly on the local server and cloud server, the prototype is tested on all modules needed to notify the users using email. This process only embed the base code and change the contents and subject of the email as a differentiator between one notification and another. To find out the prototype development is going well, the prototype is tested on each module that requires automatic email notification sent by the system to participants.

2.4. Revising and Enhancing the Prototype
The final process is improving and enhancing the prototype that the overall code can be embedded in an integration system. Some point of the improvements to the configuration and the addition of an email body are inserted in the HTML code (Hyper Text Markup Language) which is a programming language used in making the web. So the appearance of the email previously only display a plaintext, now it can be more interest and interactive using HTML display. This process carried out until all modules in the system providing automatic information to users/participants. In addition to the development of e-mail configuration and content, the improvements are made to add the attachment files that allow e-mail to send attachments in the form of specific files.

3. Result and Discussion
The results of this research are divided into two parts of testing, namely local servers testing and cloud servers testing. Each of test will be carried out on different SMTPSecure, PORT and HOST variables.

To find out the code has been successfully sending an e-mail, the code can use the debug function on the library code by activating the function as in the following code

```
$mail->SMTPDebug = 1;
```

Function number 1 will activate the debugging function to determine errors in the prototype coding. Thus, if the function contain 0, its mean that the debugging function will be disabled.

3.1. Local server testing

The results of this test are carried out on the prototype while still on the local server. This test is intended to determine the configuration that can be used on a local server. To find the appropriate configuration, the prorotipe must be tested with several different variable combinations for the SMTPSecure, PORT, and Host email service providers. Test results data on the local server can be seen in Table 2.

Table 2. Local server testing

Host	Secure	Port	Status
Domain Host	TLS	25	Failed
Domain Host	TLS	465	Failed
Domain Host	TLS	587	Failed
Domain Host	SSL	25	Failed
Domain Host	SSL	465	Failed
Domain Host	SSL	587	Failed
http://smtp.gmail.com	TLS	25	Failed
http://smtp.gmail.com	TLS	465	Failed
http://smtp.gmail.com	TLS	587	Success
http://smtp.gmail.com	SSL	25	Failed
http://smtp.gmail.com	SSL	465	Failed
http://smtp.gmail.com	SSL	587	Failed

3.2. Cloud server testing

Subsequent testing is carried out to determine whether the combination of SMTPSecure, PORT and HOST variables can also be used when the prototype is online or in a cloud server. The results of this test will be the configuration used for all modules in the application of the prototype. Testing on the cloud server can be seen in table 3.

Table 3. Cloud server testing

Host	Secure	Port	Status
Domain Host	TLS	25	Failed
Domain Host	TLS	465	Failed
Domain Host	TLS	587	Failed
Domain Host	SSL	25	Failed
Domain Host	SSL	465	Failed
Domain Host	SSL	587	Failed
http://smtp.gmail.com	TLS	25	Failed
http://smtp.gmail.com	TLS	465	Failed
http://smtp.gmail.com	TLS	587	Success
http://smtp.gmail.com	SSL	25	Failed
http://smtp.gmail.com	SSL	465	Failed
http://smtp.gmail.com	SSL	587	Failed

In the table 2 and table 3 it can be concluded that prototype testing shows the same results. Based on the 12 combinations of configuration variables used, there is only one combination that

successfully sends email through the system. This is related to the conditions on a server that has a different module. So that the application of the prototype for the next operation can use a combination of SMTPSecure, Port and Host that successfully sends an email.

3.3. Module testing
After the PHPMailer variable configuration has been found and can send the e-mail, then the prototype will be developed and implemented in several modules that require e-mail notification when the user registers and used the e-learning. At this stage, the configuration of the SMTPSecure variable will be installed with the value "TLS", the PORT variable will be set to the value "587" with the HOST name "smtp.gmail.com". After that, the configuration will be tested into several modules according to table 4.

Table 4. Module testing prototype

Modul	Local Server	Cloud Server
Member Registration	Success	Success
Lecture / Teacher Registration	Success	Success
Upload Coursework	Success	Success
Assesment	Success	Success
Project Report	Success	Success
Quis Notification	Success	Success
Test Assesment	Success	Success

The modules testing that require email notification shows that the 100% prototype works well. From the results of these tests, it can be concluded that the implementation of the PHPMailer library on the system can run well and successfully send automatic notifications to students, parents and teachers. Figures 3 is the result of system notifications via e-mails that sent automatically by e-learning system.
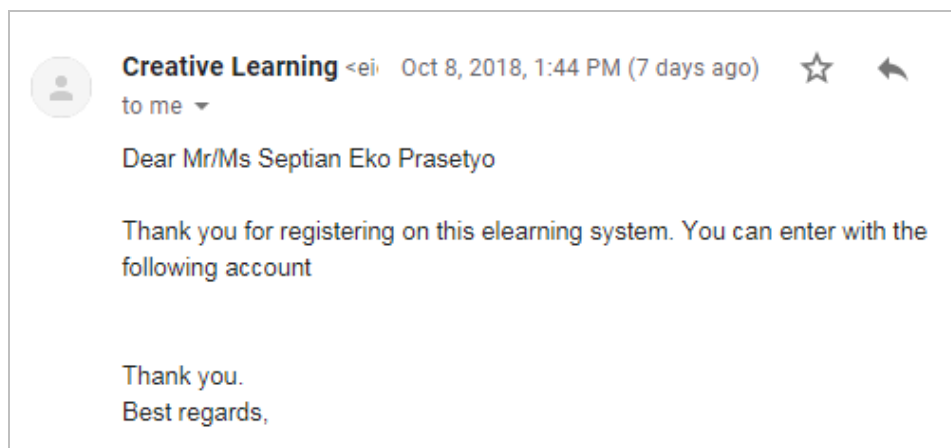

Figure 3. Registration notification

Figure 3 is an answer that provides feedback to discussion participants who have registered in the e-learning system. Email will be sent automatically through a process that the SMTP server responds.

4. Conclusion
PHPMailer library implementation to send an emails using the SMTP protocol can be applied to the development of the E-Learning prototype. The prototype model software development can focused on a problem point, so the development process will be much faster and easier in the identification process. From the results of testing all modules that are applied to the system, it shows that the prototype 100% works well.

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