Web based Application Quality from End User Perspective: Case Study - Assignment Letter LPPM ITS

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Abstract: Lembaga Penelitian dan Pengabdian Masyarakat (LPPM) is the unit to manage research and community service activities in Institut Teknologi Sepuluh Nopember (ITS) institution. The researcher must request an assignment letter to the LPPM for official travel needs (such as data collection, seminars, and surveys). LPPM staff creates an assignment letter file manually and store it in the computer folder. LPPM staff should check the latest identity number of assignment letter in the Excel file, and write down the number on the document. After the document has been printed and approved by the Chair of LPPM, the document is scanned and archived in the computer folder. But it also not properly archived since different staff has different computer folder. We create a web-based application using Laravel and MySQL database to manage the assignment letter in LPPM ITS. The application quality then measured to ensure it has good performance and to ensure it meets user expectation. Application is measured by checking application functionality, calculating response time for database access and time to upload, download, or export files. Functional evaluation shows that all the application features have no error. Performance evaluation shows that the application could serves 100 user requirements in less than 1.5 second. It can download, upload, and export files in less than 1 second. The quality of the web based application is measured by comparing the independent variables of reliability, responsiveness, assurance, emphaty, and tangible as well as user aspects divided into a variety of factors, such as age, work experience, and education. The survey analysis shows that the application meets respondent expectation and the user quite satisfied with it (the average gap between expectation and reality is -0.096).

1 INTRODUCTION

Lembaga Penelitian dan Pengabdian Masyarakat (LPPM) is the unit for managing research and community service activities in the Institut Teknologi Sepuluh Nopember (ITS) institution based on ITS Chancellor Regulation (Peraturan Rektor ITS) Number 10 Year 2016 about ITS Organization and Governance (Organisasi dan Tata Kelola ITS or OTK ITS) Chapter X Article 106 (Perek ITS Nomor 10, 2016). One of its tasks is organizing and monitoring research programs and community service conducted by ITS lecturers.

In conducting out research and community service activities, a lecturer sometimes has to leave their job in ITS for a few days e.g. to collecting data, training, attending conference, presenting article. For administrative purpose (the lecturer doesn't considered as absent), the lecturer must have an Assignment Letter issued by LPPM.

The researcher must request an assignment letter to the LPPM by sending cover letter from the department. LPPM staff creates an assignment letter file manually and store it in the computer folder. LPPM staff should check the latest identity number of assignment letter in the Excel file, then write down the number on the document. After the document has been printed and approved by the Chair of LPPM, the document is scanned and archived in the computer folder. But it also not properly archived since different staff has different computer folder. To monitor the assignment letter process, lecturer should contact LPPM staff by phone, then the LPPM staff tracking the assignment letter document manually in Window Explorer using search box. Those processes are inefficient. So we

create a secure web-based application to manage the assignment letter in LPPM ITS and calculate the quality of the application based on end-user perspective.

The rest of the paper is organized as follows. In Section 2, we discuss the theoretical background and related work. Section 3 describes our web based application developed for LPPM ITS and method to calculate web application quality. Section 4 shows the experimental result of the web based application and the questionnaire result. Finally in Section 5, conclusions and possible future work are discussed.

2 THEORITICAL BACKGROUND

2.1 Assignment Letter – LPPM ITS

Assignment Letter is a document with which an assignor assigns a specific portion of his/her rights to an assignee (USLegal, 2018) LPPM-ITS creates the assignment letter for academia (lecturer, student, or department staff) based on lecturer request as the lead researcher or lead of community service. The assignment letter should follow ISO 15489-1:2016 standard. ISO 15489-1:2016 applies to the creation, capture and management of records regardless of structure or form, in all types of business and technological environments (ISO 15489-1:2016, 2016). But the standard has not been followed yet since the management of assignment letter was done semi-manually. To meet the standard, the assignment letter document needs to be managed in an electronic management system. Electronic Document Management System (EDMS) is a management system to prepare documents in computers, to save the document header information, to make changes on the document, to share with other user, and to archive the document (M. Başıbüyük and A. Ergüzen, 2015). Examples of common EDMS are Napersoft (Napersoft, 2016), Message Point (Letters and Correspondence,2018), OpenDocMan(Document Management Software, 2018), OpenKM (Document Management System, 2018). Example of custom EDMS for university is Electronic Document Management System for Kırıkkale University (M. Başıbüyük and A. Ergüzen, 2015).

In this research, we develop a custom EDMS for managing assignment letter which is generated by LPPM-ITS. Example of an assignment letter LPPM ITS can be seen in Figure 1.

Figure 1: Assignment Letter LPPM ITS.

2.2 Web Based Application

Web based application is a computer program that allows you to go to a web address in order to submit and retrieve data to or from a database over the internet which use HTTP as its primary communication protocol, developed using web technologies (e.g. HTML, CSS, JS), and can be accessed using web browser (e.g. Google Chrome, Firefox) (WebFinance Inc, 2018) (Evergreen, 2018). The advantages of web based application are improved efficiency, accessibility, higher levels of security, easy customization and scalable, easy installation and maintenance [10]. The assignment letter management system in LPPM ITS is built as web based application.

MySQL is an open-source relational database management system (Why MySQL, 2018). Laravel is a web application framework with elegant syntax, easing common tasks used in the majority of web projects (e.g. authentication, routing, sessions, caching), and providing powerful tools for developing robust applications. It has control container, migration system, and tightly integrated unit testing support (T. Otwell, 2018). Laravel use Apache web server (Apache Software Foundation, 2018), to serve the files that form web pages to users

in response to their requests. Laravel has better performance for business since data abstraction and other inbuilt libraries help reduce development time and also performance (execution time, response time and throughput) is enhanced at larger loads (U. Ibrahim, et. al. , 2018)(R. Das and L. P. Saikia, 2016).

In this research, to build assignment letter management system we use Laravel Framework and Apache web server, to store the assignment letter data we use My SQL database server.

2.3 Web Based Application Quality

Usability is one of web based applications quality requirement. Usability can be measured from end-user viewpoint (P. Lew, et. al., 2009). The quantitative methods focus on the performance measurement of the website whereas the qualitative methods estimate the user's opinion of a website (H. Banati, et. al., 2006).

Web based application performance is measured by checking application functionality, calculating response time for database access and time to upload, download, or export files.

User opinion on satisfaction level can be measured based on content, speed, interactivity and appearance variable (N. K. Sumiari and I. N. Y. A. Wijaya, 2014). User satisfaction can also be measured by tangible (user will use the sense of sight for assess a quality of service), reliability (company's ability to provide services as promised and how far a company is able to provide accurate or no error service), responsiveness (speed of service), assurance (the ability of employees to knowledge of the product appropriately), and emphaty (the service providers know them personally) which can be detailed into 14 aspects (A. Gui, 2009).

In this research, we do the functionality evaluation using black box test, performance evaluation using JMeter, and user opinion using questionnaire method.

2.4 System Design

General system design can be seen in Figure 2. The application users are LPPM staffs who are in charge of managing Assignment Letters and academica (lecturer, department staff, or student) who request the assignment letter. Printer is used to print the draft of the assignment letter. Scanner is used to digitize the assignment letter that has been approved by the Chairman of LPPM. File server is to store the scanned assignment letter. Database server is to store the assignment letter data. Web server is to serve the user request.

This system has features as follows:
1. Create, update and delete data on assignment letter request as long as it has not been approved by the head of LPPM yet.
2. Download draft of the assignment letter in Microsoft Word (.doc) format.
3. Print the assignment letter draft using the printer.
4. Change the status of the assignment letter that has been legalized to a "valid" status.
5. Digitize the assignment letter that has been approved by LPPM management using a scanner.
6. Upload assignment letter that has been authorized to the File Server.

The activity diagram of assignment letter applicant can be seen in Figure 3, while activity of LPPM staff can be seen in Figure 4.

Figure 2: General System Design.
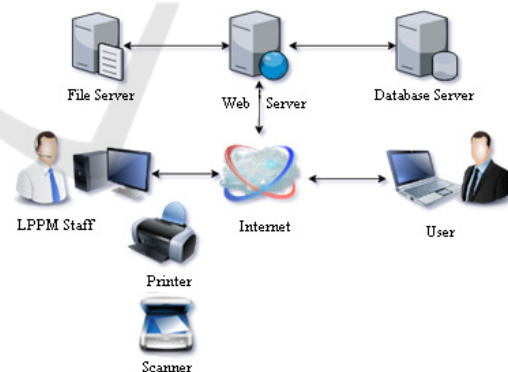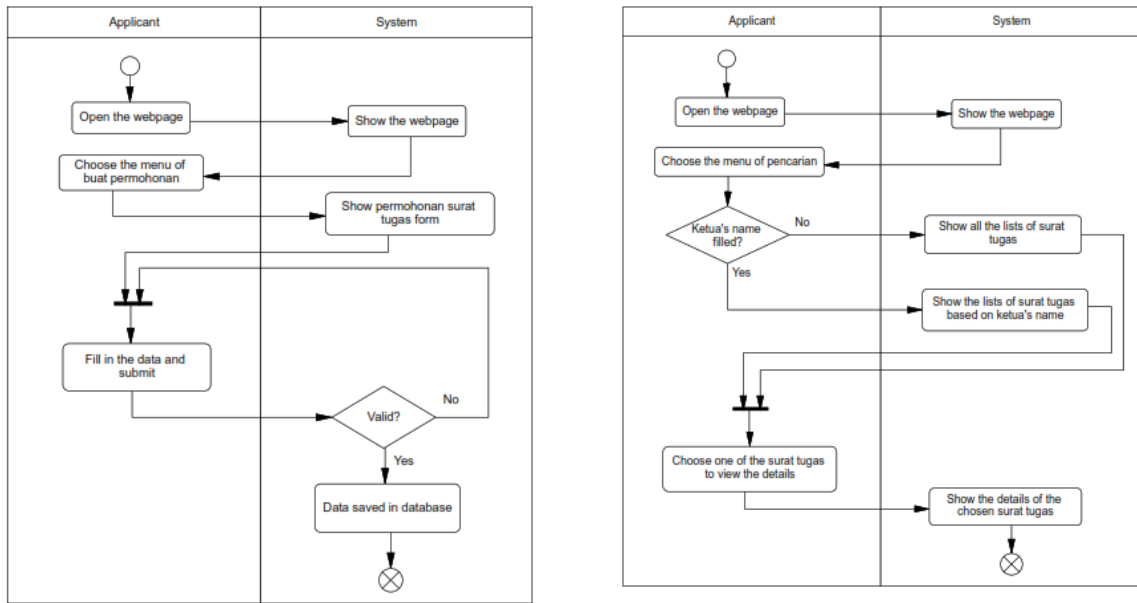
Figure 3: Applicant Activity Diagram: (a) Create (b) Search Assignment Letter.
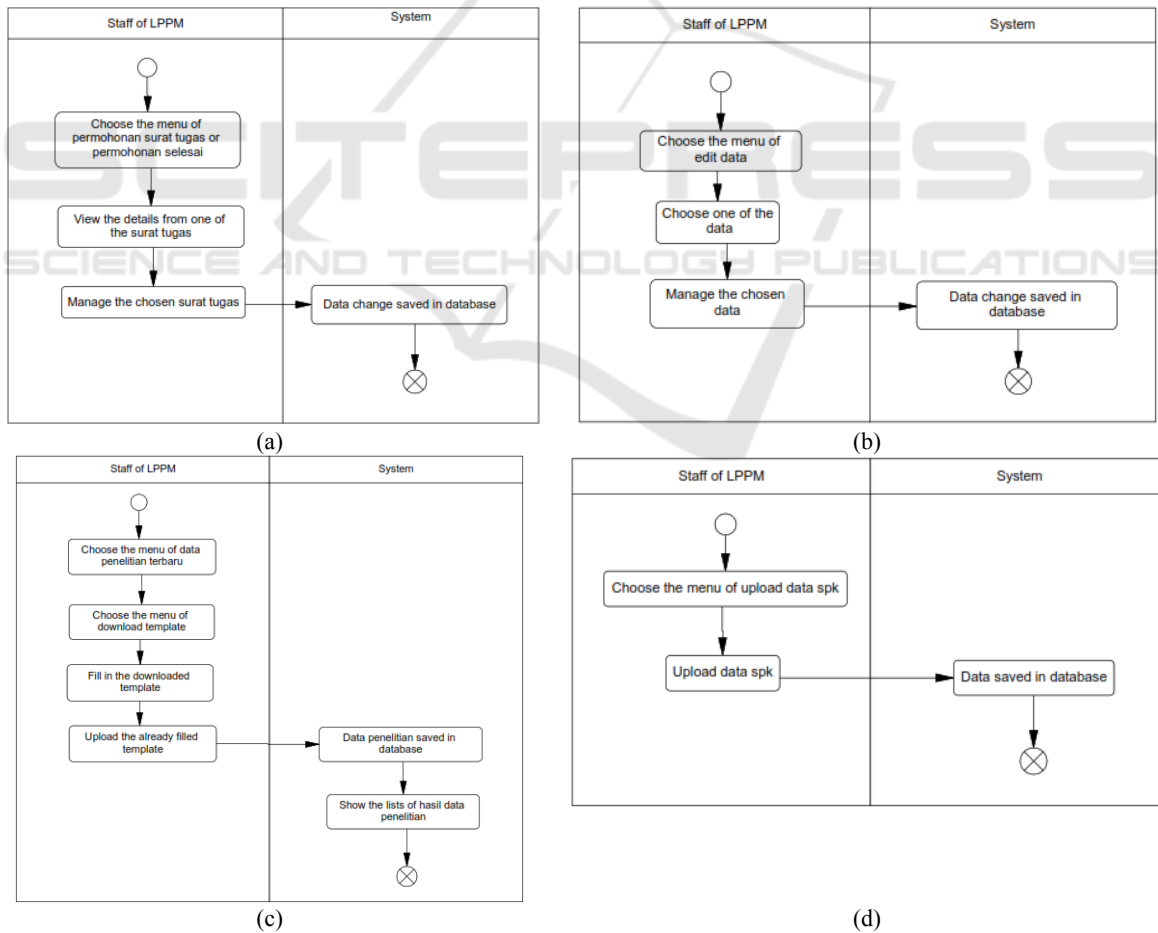

(a)

(b)

(c)

(d)

Figure 4: LPPM Staff Activity Diagram: (a) Assignment Letter Management (b) Data Management (c) Research Data (d) Upload SPK Data.

3 EXPERIMENTAL RESULT

The experiment consists of 3 evaluations: Functionality evaluation (using black box test), Performance evaluation (using JMeter), User opinion (using questionnaire method).

3.1 Functional Evaluation

Functional evaluation is using black box text for each feature and each user. Functional evaluation result can be seen in Table 1. Succeed means the application feature works well with no error in 20 trials. NA means the feature is Not Authorized for the user. Web application can be seen in Figure 5.

Table 1: Functional Evaluation.

| Application Features	User		
	Lecturer / Staff / Student	LPPM Staff	LPPM Management
Create an Assignment Letter	Succeed	Succeed	NA
Upload Assignment File, Support File Type: Pdf	Succeed	NA	NA
Edit Assignment Letter	NA	Succeed	NA
Correcting Assignment Letter	NA	Succeed	NA
Display list of assignment letters	Succeed	Succeed	Succeed
Search for Assignment Letter Data	Succeed	Succeed	Succeed
Edit Assignment Letter Status	NA	Succeed	NA
Monitor Assignment Letter Status	Succeed	Succeed	Succeed
Export Assignment Data, File Type: Xls	NA	Succeed	NA
Upload SPK Research and Community Service Data, File Type: Pdf	NA	Succeed	NA
Download SPK Research and Community Service Data, File Type: Pdf	Succeed	NA	NA
Management of Research and Community Service Fund Sources	NA	Succeed	NA
Management of Research and Community Service Schemes	NA	Succeed	NA
User Management	NA	Succeed	NA
Download the Assignment Letter Draft File, File Type: Doc	NA	Succeed	NA
Upload a signed Assignment Letter, File Type: Pdf	NA	Succeed	NA
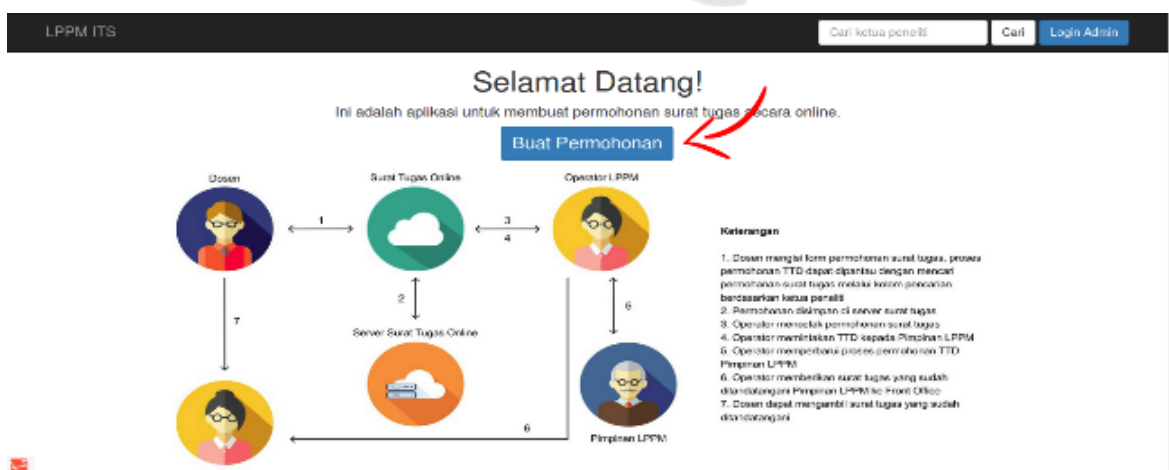
Figure 5: Assignment Letter Website.

3.2 Performance Evaluation

The performance evaluation of Create, Read, Update, Delete (CRUD) in MySQL database uses JMeter tools in Intranet and Internet network. Create data or insert query is when academia submitting "create the assignment letter" request into database. This research calculates the average response time of "insert query" for concurrent 100 requests per second. Update is when LPPM staff updates the assignment letter. This research calculates average response time of "insert query" using single request for 100 times. Delete is when LPPM staff deleting the scheme or the fund source. This research calculates average response time of "delete query" using single request for 100 times. Read data or select query is when user searching the data of assignment letter. This research calculates average response time of "select query" for concurrent 100 requests per second. The result can be seen in Table 2. Average time response is 969.75 ms on the intranet and 1256.25 ms on the internet.

Table 2: Performance Evaluation of CRUD Query.

Query	Intranet (ms)	Internet (ms)
Insert	1,969.00	2,339.00
Update	21.00	305.00
Delete	2.00	90.00
Select	1,887.00	2,291.00

The performance evaluation of uploading, downloading, and exporting file can be seen in Table 3. Upload Pdf, Download Pdf, Export Xls action are using random file size between 500 kb until 5 MB, while Download Doc action is using random file size between 500 kb until 2 MB. This research calculates average response time using single request for 100 times. It can download, upload, and export files in less than 1 second.

Table 3: Performance Evaluation of Upload, Download, and Export File.

Action	Filetype	Intranet (ms)	Internet (ms)
Upload	Pdf	294.00	335.33
Download	Pdf	220.50	947.50
Download	Doc	44.00	189.00
Export	Xls	119.00	512.00

3.3 End User Perspective

The quality of the web based application is measured by comparing the independent variables of reliability, responsiveness, assurance, emphaty, and tangible as well as user aspects divided into a variety of factors, such as age, work experience, and education. The values of user aspect are shown in Figure 6. This experiment is using questionnaire to collect end user perspective. The questionnaire was distributed from July to August 2018 to LPPM staff, management and department staff. The population of this study is 6 respondents and the entire population was studied. The user aspect can be seen in Figure6.

The questionnaire was tested in previous studies (Gui, 2009) so that the questionnaire was valid and reliable for research. Questionnaires were distributed to all respondents. From the questionnaires distributed, all are valid and complete. The questionnaire distributed to respondents consisted of 2 types: the questionnaire state the respondent's expectations for application and questionnaire regarding the performance of the application (reality).

Gap analysis method will produce 2 results: satisfied and dissatisfied. Those results provide wide area of decision making. To improve application performance, it has to be narrowed and create the priority aspects (aspect which has to be fixed first). The priority can be seen from the level of perceived satisfaction by user. The level of satisfaction can be obtained by dividing 14 aspect of satisfaction measurement becomes 5 classes: very dissatisfied, dissatisfied, quite satisfied, satisfied and very satisfied. Based on gap analysis theory, the biggest gap value is 4 and the smallest gap value is -4. By using the formula to find the class range, the value of the class range is 1.6 then we classify it into 5 classes as shown in Table 4.

The survey result for each aspect can be seen in Table 5 or Figure 7, while for each dimension can be seen in Table 6 or Figure 8. The survey analysis shows that the application meets respondent expectation and the user quite satisfied with it (the average gap between expectation and reality is -0.096).
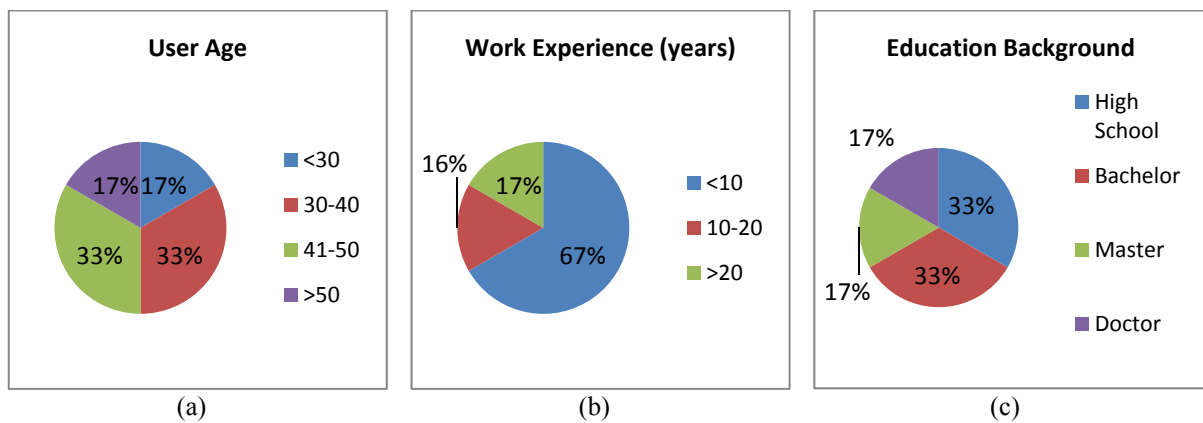
Figure 6: User Aspect (a) Age (b) Work Experience (c) Education Background.

Table 4: Class Distribution Level of Satisfaction.

Class	Range	Explanation
1	(-4) - (-2.5)	Very dissatisfied
2	(-2.4) - (-0.9)	Not satisfied
3	(-0.8) - 0.7	Quite satisfied
4	0.8 - 2.3	Satisfied
5	2.4 - 4	Very satisfied

Table 5: Gap Analysis For Each Aspect.

Question	Aspect	Expected	Reality	Gap	Result
1	Fast application access to database	5.00	5.00	0.00	Quite satisfied
2	System protection	4.83	4.83	0.00	Quite satisfied
3	Fast creating assignment letter	5.00	5.00	0.00	Quite satisfied
4	Online data backup	5.00	5.00	0.00	Quite satisfied
5	Feature easy to understand	5.00	4.67	-0.30	Quite satisfied
6	Fast response to input	5.00	4.50	-0.50	Quite satisfied
7	Feature easy to use	5.00	4.83	-0.20	Quite satisfied
8	Accurate assignment letter	5.00	4.83	-0.20	Quite satisfied
9	Provide clear information when an error occurs	5.00	4.83	-0.20	Quite satisfied
10	Provide complete usage instructions	5.00	5.00	0.00	Quite satisfied
11	Easy to adapt to user needs	4.83	4.83	0.00	Quite satisfied
12	Creating assignment letters is easier, faster resolved, and easier monitored	4.67	5.00	0.30	Quite satisfied
13	Provide complete documentation	5.00	4.83	-0.20	Quite satisfied
14	Application documentation is easy to understand	4.67	4.67	0.00	Quite satisfied

Table 6: Gap Analysis for Each Dimension.

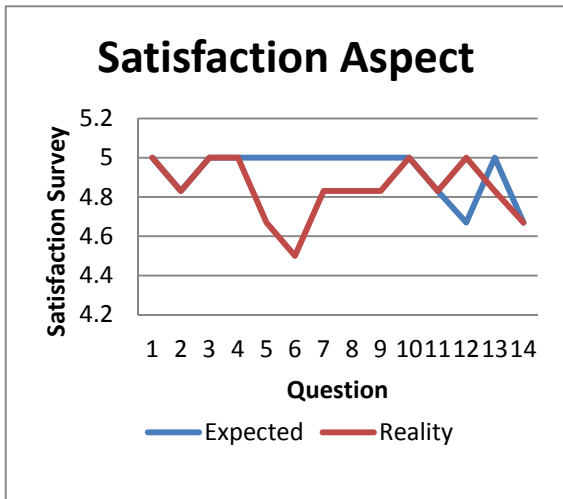| No	Dimension	Expected	Reality	Gap	Result
1	Reliability (Question 1-4)	4.96	4.96	0.00	Quite satisfied
2	Responsiveness (Question 5-7)	5.00	4.67	-0.33	Quite satisfied
3	Assurance (Question 8-9)	5.00	4.83	-0.17	Quite satisfied
4	Empathy (Question 10-12)	4.83	4.94	0.11	Quite satisfied
5	Tangible (Question 13-14)	4.84	4.75	-0.09	Quite satisfied

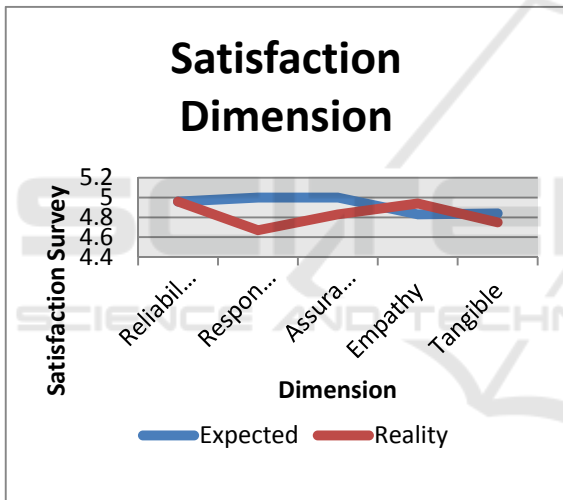Figure 7: Gap for Each Satisfaction Aspect.

Figure 8: Gap for Each Satisfaction Dimension.

4 CONCLUSIONS

From the experimental result, we can conclude as follows: The web application can provide good assignment letter management. All application features can work well and have no error; the application is reliable enough. It could serve 100 user requirements in less than 1.5 second and can serve download, upload, and export files request in less than 1 second; the quality of reliability, responsiveness, assurance, emphaty, and tangible from user's perspective is good enough. The survey analysis shows that the application meets respondent expectation and the user quite satisfied with it (the average gap between expectation and reality is -0.096).

For further research, the number of respondents should be multiplied by various variations of user aspects. The quality aspect of web-based applications can also be sharpened by adding more questions to each dimension of user satisfaction.
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