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SPP Payment Recording Information System and SMS Gateway Using the Waterfall Method

Muhamad Zaqy [a,1] , Galih [b,2*] , Moch. Irwan Hermanto [c,3]

[ab] Islan Nusantara University, Jl. Soekarno Hatta no.530, Bandung City 40286 West Java
[1] muhamadzaqy530@gmail.com*; [2] galih@uninus.ac.id; mochirwanh@gmail.com

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ABSTRACT (10PT)

The utilization of information and communication technology in the field of education has not been maximized, one of which is the management of tuition payment data at SMK Bhakti Putra, which still uses conventional methods and has not been computerized. Based on the above problems, this study aims to design and develop a web-based information system and use SMS Gateway that can help manage tuition payment data. The data collection method in this study is the observation method by directly observing the work processes carried out in the agency to obtain a clear picture of the object being studied. The results of this study are a web-based tuition payment information system and SMS Gateway developed using PHP, MySQL, and the Bootstrap Framework. The result is a new system that can maximize the work of the TU (Administration) section in presenting payment information, accuracy, and administrative services for tuition payments can be carried out effectively and efficiently,as proven by a score of 67.5 which is a marginal result, which is acceptable and needs to be improved, after an evaluation using the SUS method.

1. Introduction

Information systems are commonplace and inseparable from organizations, including educational institutions such as[1] . It's are developing rapidly, such as the internet, computers, and telecommunications technology. This is due to the need to utilize technology and information to facilitate work in various fields, including education. The main focus is on SPP, which stands for Sumbangan Pembinaan Pendidikan (Education Development Contribution), which is funds donated for educational activities at an institution[2] . Educational institutions must be able to provide services related to education, such as academic information and the SPP payment information system[3] . In the world of education, information and communication technology can be utilized to manage SPP payments, which are currently still carried out manually using books for recording.

SMK Bhakti Putra is located in Bandung Regency, where tuition fees are paid by parents or guardians of students every month for school operations. The recording of tuition fee payments is still done using Microsoft Excel to compile payment data by financial officers. Then, each bill is issued by teachers who notify each student, which causes delays in information and payments.

This study proposes an information system in the form of a website-based tuition payment recording application to make it more effective and efficient in processing payment data from each student and also to make it easier for financial officers to report to the Foundation.

2. Method

This research method applies the case study research method, which is conducted by examining a program, event, or activity in greater depth and detail at the individual, group, institutional, or organizational level[4] . In order to gain a deeper understanding of the issues, it is necessary to explore one or more cases

within a specified time frame and to collect primary data from various sources through interviews, observations, and other document collection methods.

2.1 Type and Approach of Research

The research method used is a case study, a qualitative research approach used to understand an issue or problem. A case study is the study of an incident, situation, or social phenomenon with the aim of uncovering the unique characteristics of the case being studied[5]. A case study can involve an event, process, activity, program, or one or more individuals. Furthermore, to understand an issue or problem in depth, a researcher needs to investigate and explore one or more cases over a period of time and collect data from various sources.

2.2. Object and Scope of Research

Literature study is an effort made in the activity of collecting library data through the process of reading, taking notes, and then managing reading materials for research[6] . The literature study stage involves searching for theories that are relevant to the case studies found in the field. References can be found by reading journals, articles, and specific books, as well as utilizing the mass media as a broader source of information. The results of this literature study process can be obtained with references that are relevant to the problems formulated in this practicum. This research will implement the creation of an information system in the field of education, especially the payment section, by collecting several references through literature studies.

2.3. Data Collection Techniques

To collect the main data, several techniques were applied, namely observation and interviews. In collecting data through observation of the research object at the school, the focus was on tuition payment activities under the auspices of the finance department in order to capture an overview of the existing system. Meanwhile, the interview technique involved direct communication with finance department staff. This activity was filled with questions directly related to the problems that occurred, so that the shortcomings and problems that could be answered and resolved by utilizing information technology could be explored.

2.4. Tools and Materials Used

One of the uses of components of an information system is the use of hardware and software-based technology[7], which can be used to create website-based applications to manage finances in the education sector, especially in recording payments made by students. For website application development, the PHP programming language is used because it is an open source language that can be used on multiple machines[8] and MySQL is used for database development because it has the advantage of being accessible by many programming languages as a "frontend"[9]. and utilize SMS gateways for information notifications because it is one of the most popular and most sought-after services at the moment because it is relatively inexpensive to use[10]. In this research, we will build an information system for recording tuition payments using Unified Modeling Language (UML), where UML is a language for visualizing, specifying, and documenting system software[11] and finally test it using System Usability Scale (SUS) method with a rating scale of 1-5. It use to determine the level of effectiveness, efficiency and user satisfaction

2.5. Data Analysis techniques

This method uses the *waterfall* development model. The *Waterfall* Model is a classic software development model that has structured stages and is commonly used in information technology[12] . These stages are analysis, design, implementation, testing, and maintenance.

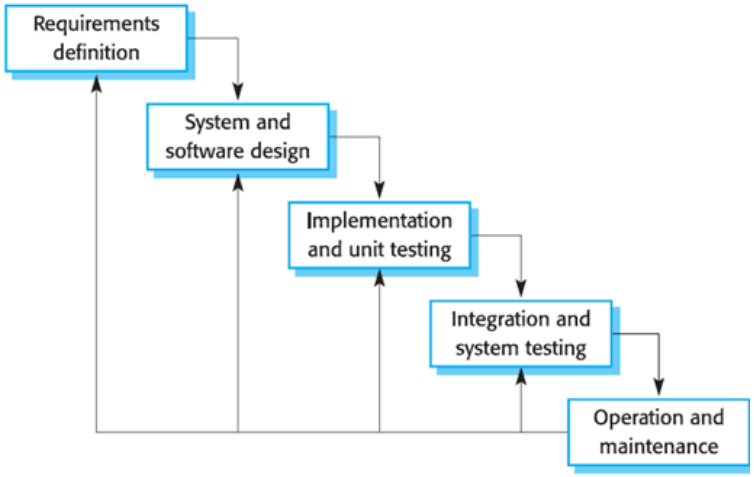

Fig.1 . Waterfall Model [13]

a. *Requirements* (needs analysis)
At this stage, an analysis of the requirements of the system to be implemented is carried out. Several efforts are made, such as data collection through interviews and literature studies. The system analyst will seek relevant information from users in running the system as well as other additional information to produce user requirement documents that will be used as guidelines or references for system analysis in translating general language into programming language in forming the SPP payment recording information system application.
b. *Design*
The design stage is the phase of designing the application that is carried out before coding implementation in order to provide an overall picture of what will be done during its development. To assist *programmers* in implementation, it is documented using *the Unified Modeling Language* (UML).
c. *Implementation*
After the system development design document is formed, the programmer then writes the program code, which is translated from the previous flow, architecture, and display design using the PHP programming language and MySQL for the database.
d. *Testing*
Testing is carried out after the application is formed at the implementation stage using *the waterfall* method. This testing is used to ensure that the application to be implemented meets the requirements specified in the previous stages. Testing of the program uses the *Black Box Testing* technique and System Usability Scale method. The completed SPP payment information system must first undergo system testing to avoid errors in the system's functions when it is put into use. And here is the formula for calculating the questionnaire using the following equation:

$$x = \frac{\sum x}{\mathrm{n}}$$

Information :
x = average score
$\sum x$ = total SUS score
N = number of respondents

The analysis for the conclusion of the SUS calculation results uses the SUS Score. The SUS Score has a value range of 0–50 for Not Acceptable, 50–70 for Marginal, and 70–100 for Acceptable.[14]
e. *Operation & Maintenance*
In the final stage of the waterfall method, maintenance is carried out, one of the activities of which is to make corrections if there are *errors* or *defects* in the program during development by the quality assurance department using a test case scheme in the main feature and additional feature modules.

3. Results and Discussion

3.1 System Requirements Analysis

System development based on the functional requirements of the features in the web-based SPP payment recording information system and SMS *Gateway* resulted in the following:

1. Admin Login, with the following requirement scenarios:

a. The admin can perform operations to add, view, edit, and delete user data that has access rights to the information system.

b. The admin can add, view, edit, and delete class data.

c. The admin can add, view, edit, and delete student data.

d. The admin can add, view, edit, and delete data on the period (academic year) and the tuition fees that must be paid.

e. Administrators can add data and send SMS *Gateway* messages to student parents' contacts.

f. The administrator can add tuition fee transaction data, print tuition fee receipts, and view tuition fee payment transaction data.

2. Staff Login, with the following scenarios:

a. Staff can add tuition fee payment transactions

b. Staff can print SPP receipts.

c. Staff can view SPP payment transaction data.

3. Student Login, with the following scenarios:

a. Students can view their personal information

b. Students can view SPP payment transaction data

3.2 Software Design Stage

3.2.1. Use Case Diagram

For the design of the tuition payment recording system, there are three actors, namely the administrator, the officer, and the student. The use case diagram design is as follows:

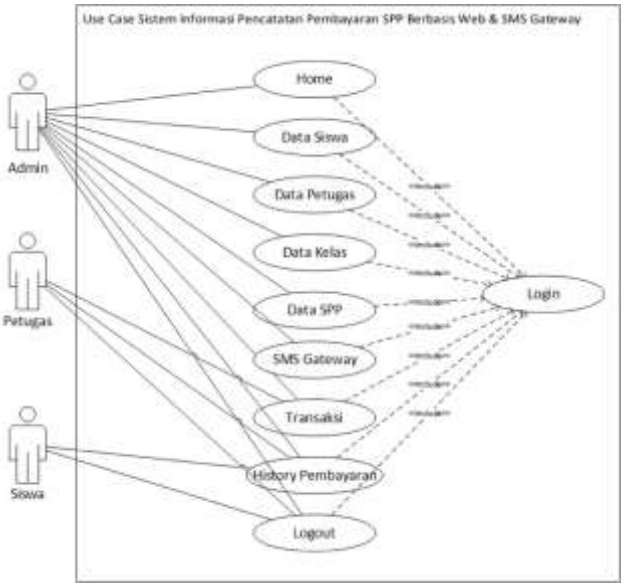

Fig2 Use Case Diagram of the SPP Recording Information System

3.2.2. Activity Diagram

The Activity Diagram design depicts the activities performed by administrators, users, and students in the tuition payment information system. These activities include the following

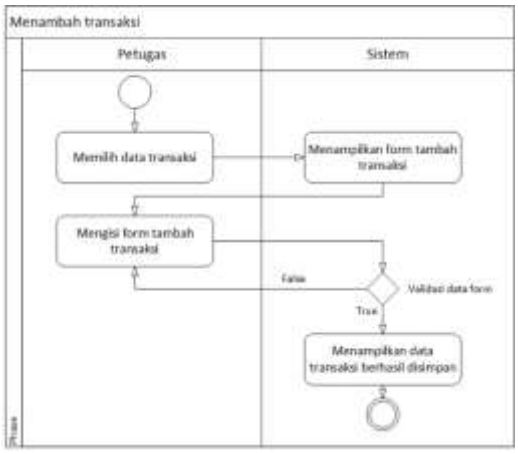

Fig.3 . Activity Diagram for Adding Transactions

3.2.3. Sequence Diagram

The sequence of events that occur in the SPP payment recording information system can be illustrated using a sequence diagram as shown in the following figure

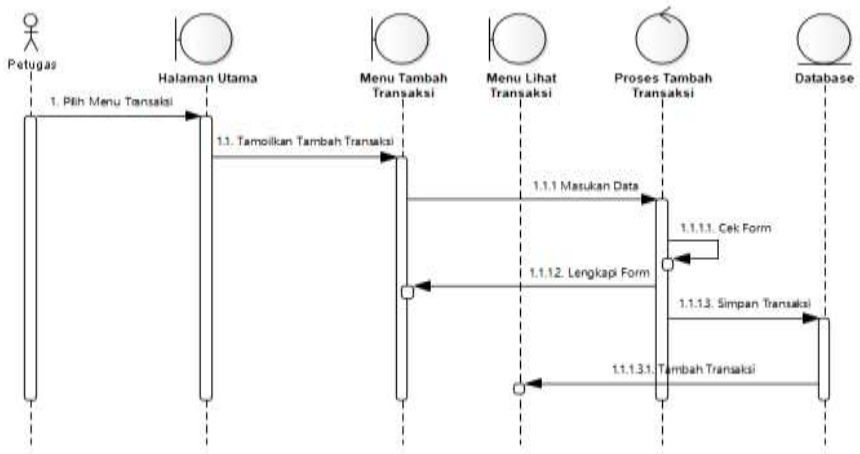

Fig4 . Sequence Diagram for Adding Transaction Data (Officer)

3.2.3. Class Diagram

In the design of the SPP payment recording information system, there are 5 interrelated classes, namely *the* Officer, Payment, Student, Class, and SPP *classes*. All existing *classes* have an association relationship, so that each *class* can influence other *classes*.

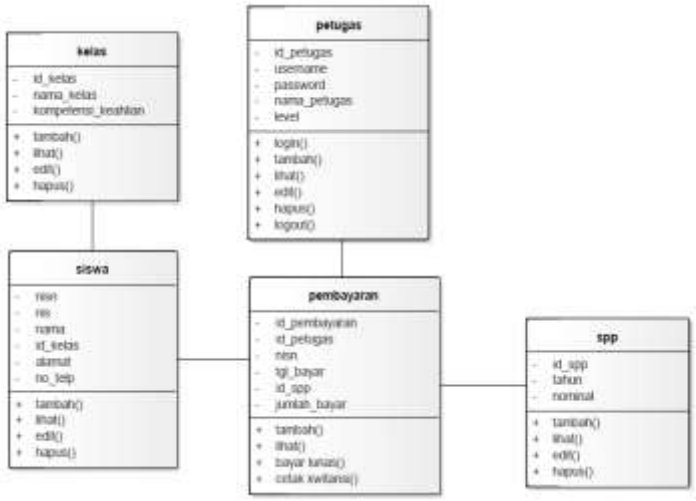

Fig5 Class Diagram for SPP Payment

3.3 Implementation Stage

3.3.1. Admin Login Page Display

Fig6 : Admin Login Page

3.3.2. Admin Main Page Display

Fig7 : Admin Main Page

3.3.3. Student Data Display

Fig8 Student Data Display Page

3.3.4. Staff Data Page Display

Fig9 Staff Data Page

3.3.5. SPP Data Add Page Display

Fig10 Add SPP Data Page

3.3.6. SMS Message Send Page Display

Fig11 SMS Input Page

3.3.7. SMS Message Page Display

Fig12 SMS Display

3.4 System Testing Stage

This testing phase occurs when the system is *deployed* on the server to identify deficiencies and errors in the functioning of each system feature using black box testing techniques, which focus on software functionality[15] .Then the system was tested using the System Usability Scale method on 10 system users, each distributed to system users consisting of: teachers, principals, operators, financial administration and representatives of students' parents which had 10 questions as follows:

1. Q1 : Menurut saya, aplikasi pembayaran SPP ini terlalu sulit untuk digunakan
2. Q2 : Menurut saya, aplikasi pembayaran SPP ini mudah untuk digunakan
3. Q3 : Menurut saya, dalam mengoperasikan aplikasi pembayaran SPP ini membutuhkan bantuan orang lain
4. Q4 : Menurut saya, fitur-fitur yang ada pada aplikasi pembayaran SPP berjalan sesuai kebutuhan
5. Q5 : Menurut saya, fungsi-fungsi pada aplikasi pembayaran SPP terintegrasi dengan baik
6. Q6 : Menurut saya, ada terlalu banyak inkonsistensi pada aplikasi pembayaran SPP ini
7. Q7 : Menurut saya, pada aplikasi pembayaran SPP ini sangat merepotkan untuk digunakan
8. Q8 : Menurut saya , saya merasa percaya diri aplikasi pembayaran SPP ini digunakan berkelanjutan
9. Q9 : Menurut saya, tidak ada hambatan dalam menggunakan aplikasi pembayaran SPP ini
10. Q10 : Menurut saya, perlu mempelajari banyak hal terlebih dahulu sebelum menggunakan aplikasi pembayaran SPP ini

Calculate the average SUS score (scale 1-5) using the calculation for each odd question, the respondent's questionnaire score is reduced by 1, while for each even question the respondent's questionnaire score is reduced by 5. After the SUS questionnaire questions were distributed and processed, the average score was obtained as in the following table 1:

Table 1

Respondents	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Amount	Score (amount x 2,5)
Respondent 1	2	4	1	5	4	1	2	5	5	2	31	77.5
Respondent 2	1	3	2	4	4	2	2	4	4	1	27	67.5
Respondent 3	2	3	1	4	3	1	1	4	3	1	23	57.5
Respondent 4	1	4	2	5	4	1	1	4	4	1	27	67.5
Respondent 5	2	3	2	4	4	1	1	4	4	1	26	65
Respondent 6	2	4	1	5	4	1	2	5	5	2	31	77.5
Respondent 7	1	4	2	3	4	2	1	4	4	1	26	65
Respondent 8	2	3	1	4	3	1	1	4	3	1	23	57.5
Respondent 9	1	4	2	5	4	1	1	4	4	1	27	67.5
Respondent 10	1	5	1	5	5	1	2	4	4	1	29	72.5
Score Total												675
Total Average Score												67.5

Based on the results of the SUS test by distributing questionnaires to 10 system user respondents, the average score obtained was 67,5. Based on the SUS scale, a score of 67,5 is included in the marginal category in terms of effectiveness, efficiency and user satisfaction.

4. Conclusion

Based on the results of the design and implementation that has been carried out, the website-based tuition fee payment information system with SMS Gateway integration is able to improve the effectiveness and efficiency of the payment administration process in schools. This system makes it easier for schools to manage payment data, minimize recording errors, and speed up the delivery of information to parents or guardians through real-time SMS notifications. In addition, the reporting feature can support more accurate and transparent managerial decision-making. Thus, this system not only helps streamline the tuition payment process, but also improves the overall quality of school administrative services. and this tuition payment application was well received after being evaluated using the SUS method with a result of 67.5 which falls into the marginal category.

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