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Multi Transaction Queuing System

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ABSTRACT
The study focused on the design and development of the Multi Transaction Queuing System for one of the electric companies in Negros Occidental that aims to lessen the waiting time of the client and minimize workloads of the in-charge personnel. The system comprised of the admin and user interface for management. The respondents of the study were the twenty (20) walk-in clients and IT experts determined using purposive sampling. The study further aimed to determine the performance and acceptability of the system functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. The method of research used was developmental and descriptive method and research. Mean was used as statistical tool to treat the data for the study. The Multi Transaction Queuing System was evaluated using a standard instrument of ISO/IEC 25010:2011 System and Software Quality Requirements and Evaluation. The system was evaluated by an IT experts and walk-in clients. The overall rating of the system is 4.49 and rated as "Very Satisfactory" on the level of acceptability of the Multi Transaction Queuing System in terms of functional suitability, performance efficiency, compatibility, usability, reliability, maintainability, and portability, on the other hand, the level of security of the system was evaluated as "Satisfactory", thus the system needs to be improved in terms of authenticity and accountability. The system is recommended for implementation to the company.

.**KEYWORDS:** Multi-transactions, queuing system, queue, and waiting time distribution.

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I. INTRODUCTION

Customer satisfaction has been announced as one of the most significant parameters of making a competitive advantage in service industries. Waiting is often an unavoidable experience in many business settings. Service industries recognized that improving and optimizing their service level is extremely required to increase the efficiency in competitive markets. Innovative technologies could bring support to the quality of life for humans in various aspects and objectives.

Nowadays, customer-service-oriented companies facing difficulties in lengthy queues. These problems often occurred in banks, post office, and airport and it became worsen during peak hours. The improper management of such queues will cause tension and stress among customers and employees (Uddin et al, 2016).

The queue management system enables a fully computerized system. It can display and call the attention of the next customers queuing to take transactions. It provides comfort as well as fairness to consumers, by allowing them to maintain their position in the queue while they are seated comfortably (Abdullah, 2016).

One of the electric cooperative company in Negros Occidental is still using a manual process of giving a number to its consumers on paying their electric bills and manual call of consumers on the installation processes. It takes a lot of time and effort of the personnel in charge to call the consumers, print, and cut the paper every day in their daily transactions.

The researcher was challenged to develop a system to convert the existing manual and tedious queuing procedure of the electric cooperative company and improve customer-oriented services. The proposed system will improve the productivity of the queuing process, reduce clients' waiting time, and make transactions simple. The queuing system composes of multiples transactions where clients can choose either to pay bills, new applications, or other transactions.

Objectives of the Study

The purpose of the study was to design and develop a Multi - Transaction Queuing System for one of the electric companies in Negros Occidental.

Specifically, this study aims to:

1. Design and develop a Multi – Transaction Queuing System with the following technical features:
    a. display the queuing number on the screen
    b. generate a ticket number for client
    c. address multiple transactions in a queue
    d. provide notification sound
    e. generate reports per counter.
2. Evaluate the acceptability of the system using the standard instrument in terms of:
    a. Functional Suitability,
    b. Performance Efficiency,
    c. Compatibility,
    d. Usability,
    e. Reliability,
    f. Security,
    g. Maintainability, and
    h. Portability.
3. Develop a user's manual.

II. Materials and Methods

The Research Design

In this study, the researcher used the developmental research and descriptive methods. According to Owen (2000), developmental research focuses on the progressive changes that occur in a system to develop. Developmental research is also descriptive. The most common descriptive method is the survey which includes questionnaires, personal interviews, and normative interviews. Research procedures are adapted to developmental studies, particularly for identifying the study's participants, creating a research design, and collecting and analyzing the data. A developmental research project often depends upon the problem selected, thus research occurs in natural work environments. This tends to enhance the credibility of the research, as well as create methodological dilemmas for the researcher (Richey, 2005).

Software Development Life Cycle

Software Development Life Cycle (SDLC) is a framework defining tasks performed at each step in the software development process. SDLC used by the software industry to design, develop, and test high-quality software. The SDLC aims to produce high-quality software that meets or exceeds customer expectations, reaches completion within times and cost estimates.

The researcher used the Rapid Application Development (RAD) in developing the system. This method focuses on building applications, in a very short time.RADis a system development strategy that prioritizes the acceleration in the system developed through extensive user involvement in the use of a construction sequence, where the circuit serves as a more effective system model (prototype) (Satyawati, 2017). Prototyping, where an experimental system is developed as a basis for formulating the requirements may be used (Sommerville, 2016).

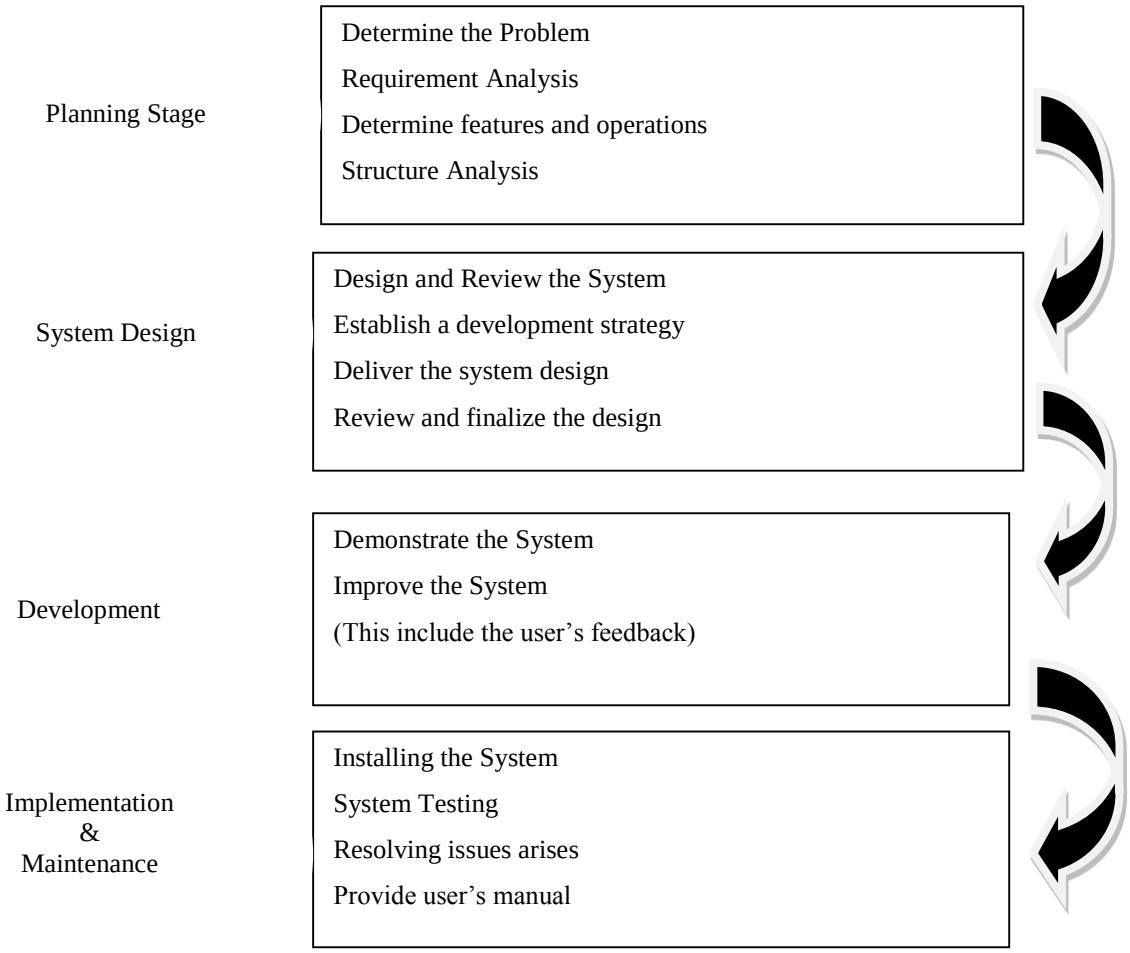

Figure 1: RAD Development Cycle Stage

Figure 1 shows the process involve in developing a system which consists of the following: planning in the first stage cycle; wherein researcher determine the problem that exists in the cooperative and analyze all the requirements for the development of the system; next is the system design; in this stage, the researcher designed and reviewed the system, then the design been finalized; in the third stage is the demonstration for refinement and system's improving as part of the developmental stage of the system that involves the user's feedback and finally the testing and implementation. Furthermore, the researcher identified that RAD development helps in building a system fast and deliver results within minimal time.

Figure 2 and 3 shows the basic overview of the Multi - Transaction Queuing System structure. All pc, phones, or tablets are and the server is connected in one router or switch. Clients will first queue a number for business transactions. The ticket with queuing information including a company's name, date, and time of issue is issued by the thermal printer connected. The client takes a ticket and waits anywhere in the lobby to be called. Then counters will queue or call the number to be served and will appear at the display monitor depending on what transactions the client chose. Admin will edit services if there are changes and can generate reports per counter. It shows how the system flows and provides information to the user.

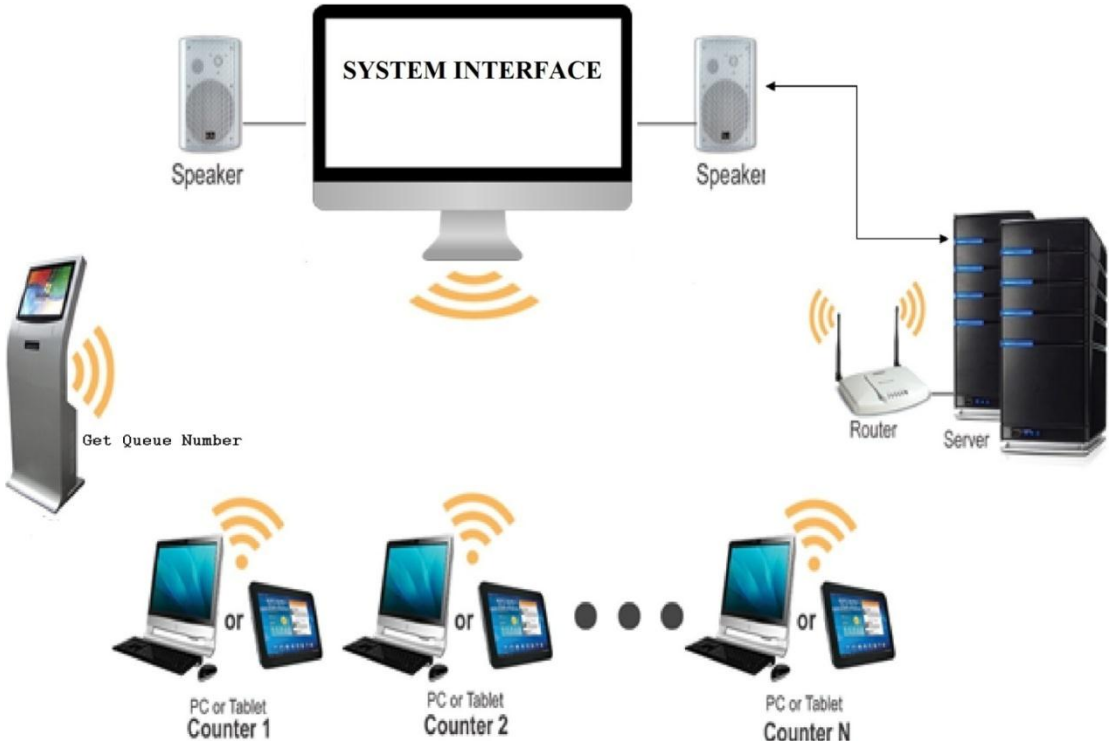

Figure 2. *System Architecture*

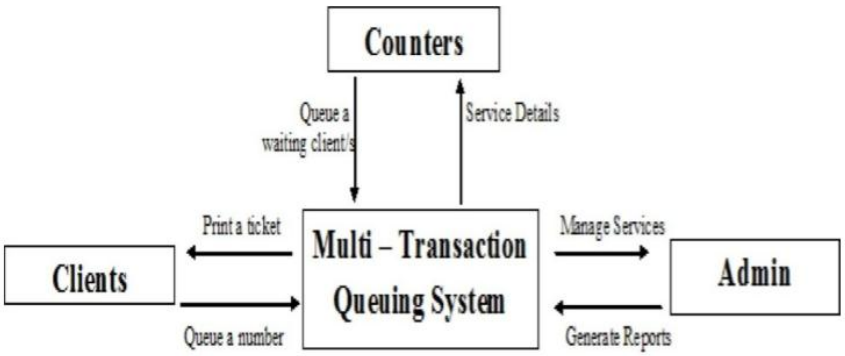

Figure 3: Data Flow Diagram

Research Instrument

Queuing System was evaluated using the ISO/IEC 25010:2011 System and Software Quality Requirements and Evaluation. The questionnaire was used to determine the acceptability of the system in terms of functionality, reliability, efficiency, portability, maintainability, and usability of the system. Since the instrument is a standardized questionnaire, validity and reliability was not established.

Data Analysis

To treat the statistical data of the study, the following procedure was adapted to analyze the data gathered for this study.

The respondents used a standardized questionnaire based on ISO/IEC 25010:2011 System and Software Quality Requirements and Evaluation according to Functionality, Reliability, Efficiency, Portability, Maintainability, and Usability of the system by responding to a five-point Likert Scale with the following scale, 5 being the highest and 1 is the lowest; they were distributed as follows 5 – Very Satisfied; 4 – Satisfied; 3 – Neutral; 2 – Unsatisfied; 1 – Very Unsatisfied.

The respondents' responses were treated using the mean. To determine the systems' level of functionality, reliability, efficiency, portability, maintainability, and usability, the following range, and interpretation below were applied.

Range of Mean Scores	Interpretation
4.21 – 5.00	Very Satisfactory
3.41 – 4.20	Satisfactory
2.61 – 3.40	Fair
1.81 – 2.60	Poor
1.00 – 1.80	Very Poor

Hardware and Software Requirements

To successfully run the system, there are several hardware and software requirements to be met.

Table 1

Minimum System Hardware and Software Requirements

Hardware	Specification
CPU	Dual Core
RAM	4GB
Communication	LAN
Operating System	Windows 7 or higher
Database Server	MySql Version 5.6+
Programming Language	PHP, JavaScript
Printer	POS Printer (POS 58)

Testing Phase

This phase will determine the performance and functionality of the queuing system. To achieve the ideal result of the study successfully, the researcher conducted a systematic assessment of the flow of operation of the existing queuing system to serve as input for the functionality and feature of the research study.

The multi – transaction queuing system was tested in an electric company on a particular department, the system was functioning well and most likely the manager of the said department, as well as the staff, were satisfied with the testing of the multi – transaction queuing system.

III. RESULTS

The second objective of the study was to evaluate the acceptability of the system using the standard instrument of ISO/IEC 25010:2011 System and Software Quality Requirements and Evaluation in terms of functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability.

Table 2: Mean Score on Multi Transaction Queuing System in Terms of Functional Stability.

	Mean	Interpretation
Functional Suitability	**4.68**	**Excellent**
Completeness	4.80	Excellent
Correctness	4.55	Excellent
Appropriateness	4.70	Excellent

Table 2 shows the mean score of Multi Transaction Queuing System evaluated by 15 respondents and 5 IT experts. As to the level of functional suitability of the Multi Transaction Queuing System rated was "Excellent" with the mean score of 4.68. Specifically, when classified according to functional completeness, correctness and appropriateness; the result was "Excellent" with the mean of 4.80, 4.55, and 4.70 respectively.

The level of functional suitability of the Multi Transaction Queuing System means that the system achieved the functionality as described in the objectives and was guaranteed to be working properly according to its designed output under a specified condition.

Table 3: Summary of Evaluation of Multi Transaction Queuing System in Terms of Performance Efficiency.

	Mean	Interpretation
Performance Efficiency	**4.50**	**Excellent**
Time Behavior	4.45	Excellent
Resource Utilization	4.55	Excellent
Capacity	4.50	Excellent

Table 3 shows; as to the level of performance efficiency of the Multi Transaction Queuing System; taken as a whole, the level of performance was "Excellent" with the mean score of 4.50. Specifically, the level of performance efficiency classified according to the categories of time behavior, resource utilization, and capacity; the result was "Excellent" as revealed in the mean score of 4.45, 4.55, and 4.50 respectively. The level of performance efficiency of the Multi Transaction Queuing System indicates that the system bears on response and processing time and on throughout rates in performances its function.

Table 4: Summary of Evaluation of Multi Transaction in Terms of Compatibility.

	Mean	Interpretation
Compatibility	**4.63**	**Excellent**
Co-existence	4.45	Excellent
Interoperability	4.80	Excellent

Table 4 shows; as to the level of compatibility of the Multi Transaction Queuing System; taken as a whole, the level of performance was "Excellent" with the mean score of 4.63. Specifically, the level of compatibility classified according to the categories of co-existence, and interoperability; the result was "Excellent" as revealed in the mean score of 4.45 and 4.80 respectively. The level of compatibility of the Multi Transaction Queuing System indicates that the system is compatible to different gadgets; either tablet, cellphone, laptop and computer as long as it connects in one network.

Table 5: Summary of Evaluation of Multi Transaction in Terms of Usability.

	Mean	Interpretation
Usability	**4.48**	**Excellent**
Appropriateness Recognizability	4.50	Excellent
Learnability	4.50	Excellent
Operability	4.50	Excellent
User error Protection	4.60	Excellent
User Interface Aesthetics	4.25	Excellent
Accessibility	4.50	Excellent

Table 5 shows; as to the level of usability of the Multi Transaction Queuing System; taken as a whole, the level of performance was "Excellent" with the mean score of 4.48. Specifically, the level of usability classified according to the categories of appropriateness recognizability, learnability, operability, user error protection, user interface aesthetics and accessibility. The result was "Excellent" as revealed in the mean score of 4.50 on appropriateness recognizability, learnability, operability and accessibility; 4.60 mean score on user error protection and 4.25 mean score on user interface aesthetics. The level of usability of the Multi Transaction Queuing System indicates the system protects users against making errors and the system enables pleasing and satisfying interaction for the user. It also operates its expected output at any given time. Furthermore, such systems must be user-friendly and avoid complexity in executing basic tasks.

Table 6: Summary of Evaluation of Multi Transaction in Terms of Reliability.

	Mean	Interpretation
Reliability	**4.46**	**Excellent**
Maturity	4.50	Excellent
Availability	4.40	Excellent
Fault Tolerance	4.40	Excellent
Recoverability	4.55	Excellent

Table 6 shows; as to the level of reliability of the Multi Transaction Queuing System; taken as a whole, the level of performance was "Excellent" with the mean score of 4.46. Specifically, the level of reliability classified according to the categories of maturity, availability, fault tolerance, and recoverability; the result was "Excellent" as revealed in the mean score of 4.50, 4.40, 4.40, and 4.55 respectively. The level of reliability of the Multi Transaction Queuing System indicates that the system can performs specified functions under specified conditions on a specified period of time, and the capability to re-establish its level of performance and recover the data directly affected in case of failure, also the system can also be operate and access with fewer errors despite of the presence of software faults.

Table 7: Summary of Evaluation of Multi Transaction in Terms of Security.

	Mean	Interpretation
Security	**4.19**	**Very Satisfactory**
Confidentiality	4.25	Excellent
Integrity	4.30	Excellent
Non-repudiation	4.35	Excellent
Accountability	4.05	Very Satisfactory
Authenticity	4.00	Very Satisfactory

Table 7 shows; as to the level of security of the Multi Transaction Queuing System; taken as a whole, the level of performance was "Very Satisfactory" with the mean score of 4.19. Specifically, the level of security classified according to the categories of confidentiality, integrity, and non-repudiation the result was "Excellent", as revealed in the mean score of 4.25, 4.30, and 4.35 respectively; and on accountability and authenticity the result was "Very Satisfactory" as revealed in the mean score of 4.05 and 4.00 respectively. The level of security of the Multi Transaction Queuing System needs improvement and have more security and confidentiality to bear

on its ability to prevent unauthorized access, whether accidental or deliberate to programs or data.

Table 8: Summary of Evaluation of Multi Transaction in Terms of Maintainability.

	Mean	Interpretation
Maintainability	**4.38**	**Excellent**
Modularity	4.40	Excellent
Reusability	4.35	Excellent
Analyzability	4.35	Excellent
Modifiability	4.35	Excellent
Testability	4.45	Excellent

Table 8 shows; as to the level of maintainability of the Multi Transaction Queuing System; taken as a whole, the level of performance was "Excellent" with the mean score of 4.38. Specifically, the level of maintainability classified according to the categories of modularity, reusability, analyzability, modifiability, and testability the result was "Excellent", as revealed in the mean score of 4.40, 4.35, 4.35, 4.35, and 4.45 respectively. The level of maintainability of the Multi Transaction Queuing System bears on the effort needed for validating

the modified software and queuing system express that the flexibility of a system to adjust on degrading or modifying data.

Table 9: Summary of Evaluation of Multi Transaction in Terms of Portability.

	Mean	Interpretation
Portability	**4.58**	**Excellent**
Adaptability	4.65	Excellent
Installability	4.50	Excellent
Replaceability	4.60	Excellent

Table 9 shows; as to the level of portability of the Multi Transaction Queuing System; taken as a whole, the level of performance was "Excellent" with the mean score of 4.58. Specifically, the level of adaptability, installability and replaceability the result was "Excellent", as revealed in the mean score of 4.65, 4.50 and 4.60 respectively. The level of portability of the Multi Transaction Queuing System bears on the effort needed to install the software in a specified environment and can bear on opportunity and effort using it in place of specified software.

The following are the findings of the study:

1. The multi – transaction queuing system has the following technical feature, display screen of the queuing number, generated ticket for clients, multiple transactions display, display monitor for sound notification, and generated reports per counter.
2. IT experts and walk-in clients evaluated the level of acceptability of Multi – Transaction Queuing System in terms of functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability was "Very Satisfactory".

3. The user's manual served as a guide to users adopting the system.

IV. CONCLUSIONS

The overall results of the Multi Transaction Queuing System in all Systems and Software Quality Characteristics of the ISO/IEC 25010:2011 is "Excellent" except on its security which is "Very Satisfactory" which means that the system performed as expected, convenient and acceptable to the user, thus the system needs improvement the security feature specifically on its accountability and authenticity.

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