

# An Observance of a System Prototyping Methodology on the Daily Time Record System (DTR) Using Biometric Fingerprint Authentication

Asia Pacific Journal of  
Multidisciplinary Research  
Vol. 7 No.2, 1-9  
May 2019  
P-ISSN 2350-7756  
E-ISSN 2350-8442  
www.apjmr.com  
CHED Recognized Journal  
ASEAN Citation Index

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*Date Received: October 2, 2018; Date Revised: May 8, 2019*

**Abstract** - *The Daily Time Record (DTR) is a requirement as a basis primarily for the salary of employees. This DTR is a measure of the behavior of one's employee towards work. It is used to determine the undertaking of employees during their working hours. It gathers the logs in and logs out time information. The study generally aimed to design, develop, implement and evaluate the Daily Time Record (DTR) System using Biometric Fingerprint Authentication. Specifically, the study aimed to design with usable functional requirements considering DTR, Employee, Department and Import modules. Likewise, determine the system's acceptability level using ISO 9126 criteria on its usability and efficiency. The study observed prototyping methodology in systems analysis, design, development, and implementation. The quantitative research was employed particularly purposive sampling during the system's evaluation of its functional requirements, and the system's behavioral aspect particularly usability and efficiency characteristics. The results revealed that the system, generally in accordance to the pre-defined functionalities, particularly, compliance with the Civil Service DTR report, with highly acceptable system's behavioral characteristics on its usability and efficiency. It means the system functions adherence to institutional standards, highly usable particularly in the keeping, monitoring of the employees' attendance and the whole system process provides efficiency. The realization of the study is an indicator of evolving to the culture of innovation for ethical knowledge-based society. It is recommended to consider relevant features like the automatic generation of payroll, summary lists of the employees' requisition of the leave credits, and the computation of absences to sustain evolving the culture of innovation towards ethical knowledge-based society.*

**Keywords:** *Biometric Fingerprint Authentication, Daily Time Record System, Prototyping Methodology, Usability and Efficiency*

## INTRODUCTION

In any public and private establishments, the Daily Time Record (DTR) is a requirement as a basis primarily for the salary of employees. This DTR is a measure of the behavior of one's employee towards work. It is used to determine the undertaking of employees during their working hours. It gathers the logs in and logs out time information. It is a usable and efficient tool to monitor the employee's attendance for more productivity with the HR officer and staff. The old attendance system was prone to error and allows impersonation to an individual employee and provides difficulty to monitor the employee's attendance.

In the study of Rao and Satoa [1], emphasized that attendance is a very important factor for various

purposes and it is one of the important criteria to be followed by employees. According to the study of Nawaz, Pervaiz, Korrani and Azhar-Ud-Din [2], managing people is a difficult task for most of the organizations, and maintaining the attendance record is an important factor in the management of people. Likewise, the study of Savitra et al. [3], resonated that attendance system is a system that is used to track the attendance of a particular person and is applied in the industries, universities, schools and also in working places.

The Human Resource Management Office (HRMO), of any establishment has multifarious defined functions. One of which is the record keeping of the employees DTR for preparation of inputs for the

salary of employees. This is confirmed in the study of Papa [4], he said that one of the major functions of the HR is to monitor the attendance of the employees. The monitoring of employees attendance is a mandate of the Civil Service Commission (CSC). CSC reminds government employees to observe working hours. In Section 5, Rule XVII of the Omnibus Rules Implementing Book V of Executive Order No. 292 stated that all government officials and employees are required to render eight working hours a day for five days a week, or a total of 40 hours a week excluding time for lunch. It is stated further that the normal working hours shall be from 8 AM to 12 NN, and 1 PM to 5 PM. Moreover, Section 6 of the same Rule allows the adoption of flexible working hours or 'flexi-time'. Government employees are required to follow regulations on work hours. Civil Service Commission (CSC) [5]. As a requirement, it is vital to design a mechanism to observe the CSC regulations on working hours.

According to Dobson (2013), as cited in the study of Buenas, L. J., Malvar, J.A., and Maranan, J.A. [6], tracking attendance can be a time-consuming and tedious chore. In addition, the previous process easily allows for impersonation. Taking attendance is time consuming using the traditional approach. According to Nawaz, Pervaiz, Korrani and Azhar-Ud-Din [2], manually taking the attendance and maintaining it for a long time adds to the difficulty of different tasks as well as wastes a lot of time. Biometric technology that involves the identification and verification of individuals by analyzing the human fingerprint characteristics has been widely used in a various aspect of life for different purposes, most importantly as regards the employee attendance [1]. In the study of Kumbhar, Wanjara, Trivedi, Khairatkar, and Sharma [7], a fingerprint is the authenticated function to identify a match between two person's fingerprints.

It is vital for educational sector like Surigao State College of Technology (SSCT) to have compensatory measures that simplify the tasks of the HR officer and staff for more productivity. This measure is the emergence of the DTR system using Biometric Fingerprint Authentication. The usage of Biometric Fingerprints identifies an individual's identity. It is believed that each finger is unique from one person to another, thus each fingerprint is owned by a certain individual. As confirmed in the study of Rao and Satoa [1], they said that every person holds the individual characteristics of the fingerprint. Nawaz, Pervaiz, Korrani, and Azhar-Ud-Din [2], stressed out

that fingerprint authentication refers to the automated method of verifying a match between two human fingerprints. The fingerprints are one of many forms of biometrics used to identify individuals and verify their identity. As mentioned by Khan, B., Khan M, and Alghathbar (2010), in the study of Sangeetha, Sivaranjani and Shalini [8], the reason for the popularity of fingerprint verification is that fingerprints satisfy uniqueness, stability, permanency and easily taken.

SSCT, Main Campus, is composed of five colleges (academic departments) comprising of more than one thousand employees. With the rising of employees of the college, the Human Resource Management Office (HRMO) is having a hard time managing the employees' attendance records. The previous DTR was a Biometric Bundy Time Clock. A simple process like when employees arrived and departed from their working place, they inserted a card into a slot, and the clock stamped it with the time. This process was prone to errors especially in transferring manually the time in and time out from the card to the official DTR form for submission to the HRMO. The process was found very inconvenient. This previous usage complied with attendance requirements but in a time consuming and difficult process as perceived by the employees during the interview and as experienced by the researchers being in a long-time employee of SSCT.

Thus, researchers are prompted to design a DTR system using Biometric Fingerprint authentication in accordance with institutional functional requirements with usable and efficient systems characteristics to address the defined concerns. This approach is one of the indicators of evolving to the culture of innovation for ethical based society.

## **STATEMENT OF THE PROBLEM**

An Observance of a System Prototyping Methodology on the Daily Time Record System (DTR) Using Biometric Fingerprint Authentication is a usable and efficient tool to monitor the employee's attendance for more productivity with the HR officer and staff. The old attendance system was prone to error and allows impersonation to an individual employee and provides difficulty to monitor the employee's attendance.

## **GENERAL OBJECTIVE**

The study generally aimed to design, develop, implement and evaluate the DTR system using Biometric Fingerprint Authentication observing system

prototyping methodology to eliminate impersonation and provides usable and efficient systems' characteristics.

### SPECIFIC OBJECTIVES

Specifically, design with institutional functional requirements in different four modules: the DTR, Employee, Department and Import modules; and determine the system's acceptability level using ISO 9126 criteria on usability and efficiency system's behavioral characteristics.

### CONCEPTUAL FRAMEWORK OF THE STUDY

These days, it has been observed, in almost all spectrums the widespread use of technology. It is an aid to simplify almost every transaction ranging from the basic to complex one. This observation is true, particularly in all academic sectors. Every transaction comes easy because of the advent of technology. This technological advancement is an aid of evolving to the culture of innovation for ethical based society. The present study is an indicator of evolving to the culture of innovation. It is an innovation from the usage of the Biometric Bundy Clock of monitoring the attendance which was prone to errors. Right now, is the use of Biometrics Fingerprint Authentication. It is ethical as well because it eliminates impersonation during logging in and out.

The present study anchored in the study of Walia and Jain [9], about Fingerprint Based Attendance Systems-A Review. The authors said proper attendance recording and management has become important in today's world as attendance and achievement go hand in hand. The attendance is one of the work ethics valued by employers. They said further that most of the educational institutions and government organizations in developing countries still used the paper-based attendance method for maintaining the attendance records. There is a need to replace these traditional methods of attendance recording with biometric attendance system. The unique nature of fingerprint makes it ideal for use in attendance management systems. Besides being secure, fingerprint-based attendance system will also be environment-friendly.

### MATERIALS AND METHOD

In planning, analysis, design, implementation of the system the study the researchers used the system prototyping methodology as shown in Figure 1.

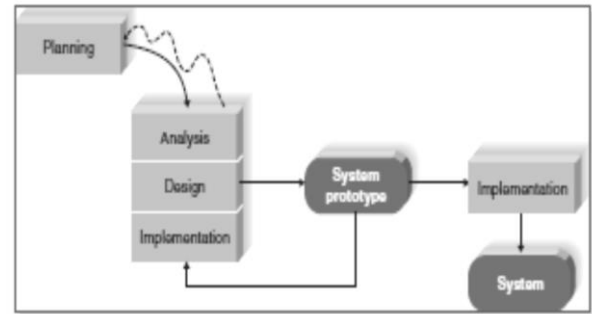


Figure 1. Prototyping Methodology

The prototyping methodology according to Dennis, Wixom, and Roth (2012), as cited in the study of Tabucan and Tuazon [10], emphasized that prototyping methodology performed the analysis, design and implementation phases concurrently to develop a functional application. In the present study, when the system prototype was acquired, it was presented to the HR officer and staff for feedbacks. The researchers applied their feedbacks to the final system. It is noted that the system design based primarily on the user's requirements.

In the planning phase, the researchers gathered the functional requirements and determine the non-functional requirements as defined by the respondents. ISO 9126 Software Quality metrics defines functional requirements as required system characteristics [11]. Functional requirements describe the functions that the software is to execute. The non-functional requirements are the ones that act to constrain the solution. It is sometimes known as constraints or quality requirements according to the study of Azuma, M. [12]. It means that the functional requirements are the mandatory or can be the major requirements of the system. On the other hand, the non-functional requirements are the behavioral aspect of the system like the usability and efficiency. The HR officer and staff emphasized to have functional modules to cater the needs of the institution on DTR requirement. They emphasized further that the system should have modules on different colleges/departments so as printing can be done by colleges/department; provides DTR report so as to give each employee a copy every month without transferring to the DTR form. The employee will just have to sign the DTR print out and return to the HR office for filing. The system eliminated the transferring of the raw data resulted from the Bundy Clock to an official DTR form which was prone to errors.

Further, the HR Officer and staff requirement as noted required for usability and efficiency system's characteristics of the system. Thus, the study designed for usability in the institution and efficient system's characteristics.

### Analysis Phase

In the Analysis phase, the user requirements are summarized and reflected in a Use Case Diagram, Figure 2, which is used to analyze the gathered data.

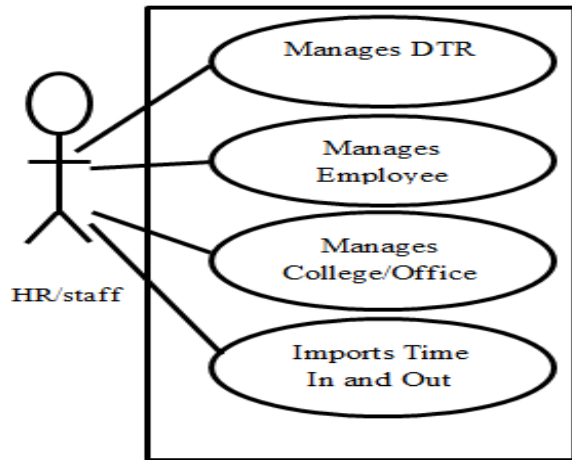


Figure 2. The Use Case Diagram of the Implemented System

Figure 2. reflects the four identified modules by the respondents. This is the basis of the researchers in the design phase. Generally, as shown the system provides management in the four different modules.

### Design Phase

In the design phase, the system was developed with the use of the open source PHP language as the front end and the open source MySQL database as the back end. According to Rani and Jos [13], MySQL is easy, fast and efficient and can store a large number of records and requires a little configuration. It is accompanied by the open source JavaScript to improve the layout of the system to make the design a more simplified, clear and readable.

### Implementation Phase

In the implementation phase, the system was deployed at the HR office for more than six (6) months from now. The implementation of the system was done due to the need of the institution, the SSCT, for efficient DTR reports and to monitor the employee's attendance. Figure 3 shows the flow of implementation.

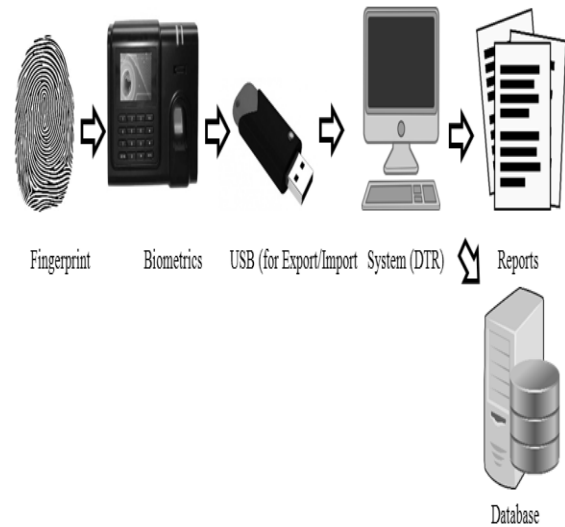


Figure 3. The Flow of System's Implementation

Once employees are inside the SSCT campus, they performed either the logged in and logged out into the Biometric device. When they logged in and logged out, they attached their finger into the Biometric device for their attendance. The system right away authenticated the fingerprint attached to the device to the one registered already. The system gave successful time in and time out based on the time set once the fingerprint was proven registered already. It is believed that each human finger is unique, and no one fingerprint owned by two or more individuals. Thus, researchers believed in its security, and it would eliminate impersonation. The USB drive is used to store the exported file from Biometric Machine. The USB drive is then used to import the exported file to the system for monitoring, management, and printing. The import functional requirement is designed to conform to the physical environment/building of the college at the moment amidst the devastating earthquake a year ago, resulted in the restructuring of the different offices of the institution, SSCT even until this very moment. After the import process, the system allows accumulation of the present imported files from the previous one. After which, manipulation can be made into the different modules. In more than six (6) months of the system implementation at the HR office, the researchers designed a questionnaire on HR officer and staff perspectives. HR officer and staff were chosen because they were the end users who knew about the performance of the system after the deployment. Weighted mean was employed in determining the level of the system's acceptability on functionality and usability system's characteristics.

**Evaluation**

ISO 9126 covers a wide spectrum of system features, including both technical requirements and human interaction with the system [14].

The researchers used the structured evaluation questionnaire. The set of questions are structured based on ISO 9126, particularly usability and efficiency systems characteristics. Conceptually, there are six (6) system’s characteristics with its sub-characteristics. In reference [14], asserted that system characteristics are the reliability, efficiency, functionality, usability, maintainability and portability. However, the researchers considered only usability and efficiency which they believed appropriate based on the demand of the HR officer and staff of a usable and efficient system.

The study used the 5-point Likert scale, as shown in Table 1. with the numerical rating and descriptive interpretation.

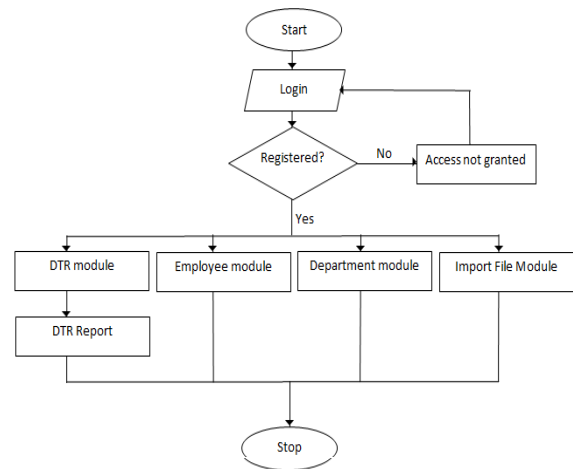
**Table 1. Numerical Rating with Descriptive Interpretation**

Numerical Rating	Descriptive Interpretation
4.50-5.00	Excellent
3.50-4.49	Very Good
2.50-3.49	Good
1.50-2.49	Pair
1.00-1.49	Poor

Purposive sampling was used in the study to choose the right person to answer the questionnaire. In the present study, the HR officer and HR staff were asked to answer the structured questionnaire. They were chosen because they knew about how usable and efficient the system is. Besides, they were the recipients of complaints from the employees whenever drawbacks were encountered by them. The study had five (5) respondents, who evaluated the system. They were all from the HR office.

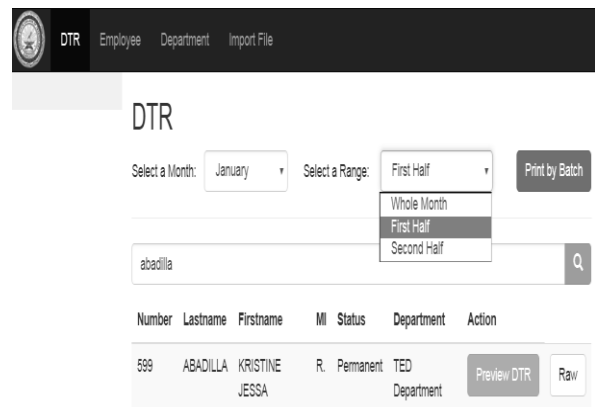
**RESULTS AND DISCUSSION**

This part shows results as reflected in Figures 4-10 and Tables 2-3 with the corresponding discussion in conformity to the claimed specific objectives. It presents different figures of the four claimed modules: the DTR; Employee; Department; and Import.



**Figure 4. System Flowchart**

In Figure 4. is the System Flowchart. It is the general flow of the entire system. First, the user will input the username and password in the log-in page and if he/she is not a registered user, the system will prompt for access not granted, but if he is registered he has given the access of the following modules: DTR, Employee, Department and Import File. In the DTR module, the user then can access DTR Reports for printing purposes.



**Figure 5. The DTR Module**

As shown in Figure 5. is the DTR module. This module allows specific month to print with an option to select whether it would be the first half, second half or the whole month printing. It offers another option for printing by batch and would ask for department/colleges. Further, this module allows to search by family name or by ID number if there is a need for an individual DTR to preview or print. Raw data was also provided to be used in case of failure of

login and log out time reflect in the DTR. It can be printed automatically. It shows the list of employees with ID number, status, and department/colleges.

Figure 6. The Employee Module

As shown in Figure 6. is the employee module. It is the module which allows the adding of employee and automatically asks for ID number, last name, first name, middle initial, status, and department. This is where the data entry of the employee’s profile is done for access and use to other modules. This module allows editing or deleting the employee if deemed necessary. Likewise, the employee can be searched in this module.

Figure 7. The Department Module

Figure 7. is the Department Module. It allows adding the department and the head labeled as In-charged. The complete name as reflected in the In-charge field goes directly to the DTR report as a signatory of the DTR as to what Department a certain employee belongs. In addition, this module allows editing and deleting data whenever necessary.

Figure 8. Import Module

As shown in Figure 8 is the Import module. It allows importing of the file by choosing the file directory and the files to import. After the import process, the new content of the files imported is added to the old content of a specific file. Moreover, the system prompts if the file imported is wrong.

Civil Service Form No. 48

Day	Arrival (A.M.)	Departure (P.M.)	Uvertime
1			
2			
3			
4	6:47 AM	12:03 PM	5:16 PM
5	6:57 AM	12:08 PM	6:04 PM
6			
7			
8	6:59 AM	12:31 PM	7:38 PM
9	6:59 AM	12:55 PM	5:08 PM
10	7:03 AM	12:27 PM	5:13 PM
11	6:57 AM	12:16 PM	6:20 PM
12	6:59 AM	12:34 PM	5:46 PM
13			
14			
15	7:01 AM	12:24 PM	7:31 PM
16	7:00 AM	12:22 PM	6:38 PM
17	6:54 AM	12:21 PM	7:33 PM
18	6:48 AM	12:21 PM	6:17 PM
19	6:54 AM	12:08 PM	5:15 PM
20			
21			
22	7:06 AM	12:07 PM	7:30 PM
23	7:00 AM	12:23 PM	7:30 PM
24	6:54 AM	12:28 PM	7:33 PM
25	6:39 AM	12:05 PM	5:22 PM
26	6:53 AM	12:00 PM	5:16 PM
27			
28			
29	6:53 AM	12:02 PM	7:33 PM
30	6:59 AM	12:01 PM	5:01 PM

I CERTIFY on my honor that the above is true and correct report of hours of work performed, record of which was made daily at the time of arrival and departure from office.

Employee Signature  
 Verified as to the prescribed office hours:  
 Engr. Alexis P. Espaldon  
 In-Charge

Figure 9. The DTR Report

Figure 9. is the DTR report. As shown, it reflects the actual time in and out of an employee. The printed report as labeled on top of the Figure with the Civil Service Form Report No. 48 is consistent with the Civil Service report form. This report belongs to the DTR module. The preview DTR is clicked when individual DTR is needed. The system automatically provides two (2) employee’s DTR for the submissions to the two (2) requiring offices: The Vice President for Academic Office; and to the HRMO.

**Table 2. Level of Usability Quality System Characteristic**

Usability: The respondent perceives/accepts that:	Mean
1 The system is easy to operate;	4.80
2 The system functions are easily understood;	4.80
3 The users learn the system with less effort;	4.80
4 The system provides the user with a friendly interface; and	4.60
5 The system keeps and monitors employee’s attendance.	5.00
<b>Weighted Mean</b>	<b>4.80</b>

Table 2. as shown, presents the different items with corresponding mean values with the system’s acceptability level on usability quality system characteristic as perceived by the respondents. It shows the usability weighted mean of 4.80, as Excellent as interpreted. It means that the system is highly usable in the institution. It connotes that the system is easy to operate; functions are easily understood; learn the system with less effort; provides the user with a user-friendly interface and keeps and monitors employee’s attendance.

In detail, the item such as “The system keeps and monitor the employee’s attendance” garnered the highest mean of 5.00, as Excellent. It implies that the system is useful because it keeps and monitors the attendance of the employees as one of the major roles of the HR office. The statement was confirmed in the study of Papa [4], that monitoring of attendance is the main role of the HR. However, the item such as “The system provides the user with a user-friendly interface” garnered the lowest mean of 4.60, but still Excellent as construed. It means there still to be modified to increase the mean rating to make it a user-friendly interface. This is probably the result because of the import process required by the system. This process was designed because of the physical environment of the institution where some of the offices are temporary,

resulted to on hold the Local Area Networking (LAN), implementation while restructuring of different offices. However, it shows that the system is usable in the institution. Usability means the ease of use for a given function [8].

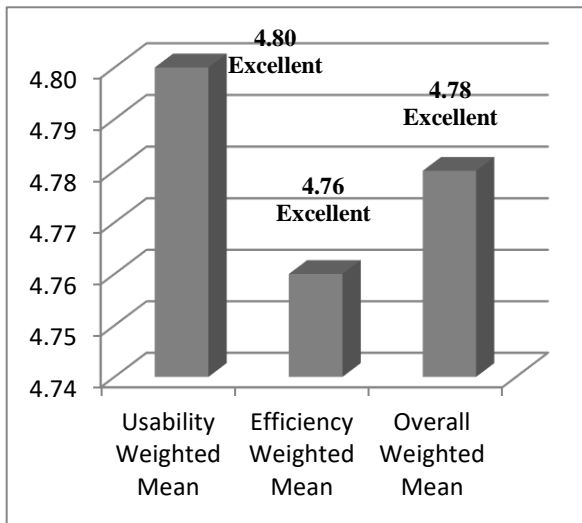
**Table 3. Level of Efficiency Quality System Characteristic**

Efficiency: The respondent perceives/accepts that:	Mean
1 The system consumes lesser time when importing of files;	4.60
2 The system responds speedily during logging in and out;	4.60
3 The system is quick in the generation of DTR and other reports;	4.80
4 The system responds speedily during data entry; and	4.80
5 The system whole process provides efficiency.	5.00
<b>Weighted Mean</b>	<b>4.76</b>

Table 3. as shown, presents the different items with corresponding mean values with the system’s acceptability level on efficiency quality system characteristic as perceived by the respondents. It shows the efficiency weighted mean of 4.76, as Excellent. It means the system is highly efficient system’s characteristics. It implies that the system consumes lesser time when importing of files; responds speedily during logging in and out; offers quickly in the generation of DTR and other reports; response speedily during data entry, and the whole process provides efficiency.

In detail, the item such as “The system’s whole process provides efficiency” garnered the highest mean of 5.00, as Excellent. It implies further that the whole functions of the system are efficient. Amplified by Omorog [15], efficiency speaks of productivity. In relation to the present study, with the emergence of the system at the HR office, it ensures a more productive HR officer and personnel.

As reflected in Figure 9., the usability gained the highest weighted mean of 4.80, described as *Excellent* followed by the efficiency got the weighted mean of 4.76 still *Excellent* as interpreted. As observed, both usability and efficiency garnered the closest *Excellent* weighted mean values. It means that the system is usable in the institution and the set of processes provide efficiency as shown in the overall *Excellent* weighted mean value of 4.78, in usability and efficiency system’s characteristics.



**Figure 9. Summary Result of the Client's Acceptability Level**

## CONCLUSION AND RECOMMENDATION

In the light of the findings, the system was successful in Observance of a System Prototyping Methodology on the DTR System using Biometric Fingerprint Authentication in the design of usable and efficient institutional requirements in different four modules: the DTR, Employee, Department, and Import. The results revealed that the system, generally in accordance to the pre-defined functionalities, particularly, compliance with the Civil Service report form, with highly acceptable system's behavioral characteristics on its usability and efficiency. It means the system functions adherence to institutional standards, highly usable particularly in the keeping, monitoring of the employees' attendance and the whole system process provides efficiency. The realization of the study is an indicator of achieving competitive advantage among other institutions, a contributory for more productivity and operational efficiency within the HR office. It is recommended to consider relevant features like the automatic generation of payroll, summary lists of the employees' requisition of the leave credits, and the computation of absences to sustain evolving the culture of innovation towards ethical knowledge-based society.

## ACKNOWLEDGMENT

This research was realized because of the urgent need for an efficient DTR of the institution. The researchers would sincerely like to thank the SSCT

College President, and to the rest of the administrators, for their encouragement, and to the MIS team for the constant support and guidance until the study becomes a reality.

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