School Database Class Attendance (SDCA): An attendance monitoring and class record system with RFID for St. Dominic College of Asia

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Abstract - *The allocation of efficiency and effectiveness in checking class attendance and creating/maintaining class records for teachers is important. SDCA faculty members cite the manual checking of class attendance and the creation/maintenance of a class record as one of the causes of delay in processing a students' grades. To resolve this, the proponents seek to innovate the tracking of attendance with the use of RFID (Radio Frequency Identification). The subjects of the study were BSIT and ABMMA students; four (4) groups of them acted as the study's respondents. Each group consists of one (1) teacher per class, who handles no less than eighty students. Non-probability sampling was used to obtain information. To verify this innovation's effectiveness and efficiency, the proponents aimed to conduct an experimental study of controlled and uncontrolled groups using ISO 9126 - Software Quality Characteristics. In developing the software, the proponent adopted the methods of agile software development and the descriptive method. The weighted means of each criterion shows that the proposed software performs at an excellent rate, proving that it makes a great impact on recording class records. With this, the proponents had formulated a result which benefited both teachers and students.*

Keywords – *Attendance, monitoring, software, identification, RIFD, scan, card.*

Introduction

In today's world where most people have access to technology, Information Technology has been a reliable companion for humans in their everyday activities. Adapting to this new trend is a way of showing that one is growing and progressing.

In education, monitoring students' attendance is a very important matter every time class session starts. The instructor/professor must do roll calls at the beginning of each class to identify students who are present, late, or absent. Attendance monitoring can be missed out on or forgotten, specifically if done in manual or paper-based attendance monitoring.

Technology is rapidly changing everyone's life, and more things are yet to be discovered and invented. People are now coping with the use of wireless technology due of its portability and convenience. With this, the proponents decided to use the wireless capabilities of RFID to create an application for SDCA, "Attendance Monitoring and Class Record System with RFID". It is an easy way to use software that can monitor a student's attendance by scanning the RFID tags embedded in their ID cards. When the students log into the class, the information will be transferred to a computer, which will identify who the student is. This simple idea can replace the manual recording of student attendance, and even lessen the risk of recording inaccurate information.

Bar code for humans. As stated by Chua (2014), there are various areas where the implantable micro-chip could be used for personal universal identification and tracking down people. These micro-chips can be used in different fields including financial institutions, public transportation, security, health sectors, government access, research laboratories, nuclear power

plants, correctional facilities, residential and commercial building access, etc. It could also be useful in homeland security and the fight against terrorism. At present, the implantation is purely voluntary.

Access control. In the field of education, the first academy which utilized RFID system in the Philippines is the University of San Jose-Recoletos Main Campus on Magallanes Street in Cebu City, according to Valeros (2013). The city has been implementing RFID technology for three years for automated data capture and analysis. The system provider, Ezware IT Computing Solutions, had expanded the use of the Radio Frequency Identification (RFID) System to the University of San Jose-Recoletos' Basak Campus that holds its preschool, grade school, high school, and select college courses. One of the capabilities of RFID is to enhance security by tracking students and personnel in real-time (Valeros, 2013). A combination of devices such as the "EzLogger" are used to monitor clients from servers, enabling tag reading even a few inches away without physical contact. Tapping the student ID to the device can accurately register the codes to the system, and can also inform the students' parents about whether their children have reported to school.

San Antonio School District to trial student RFID attendance system. Across countries, RFID technology is also being adapted. In 2005, California Elementary School used RFID tags to track students. However, parents, children, school boards, and governments have yet to fully embrace the technology (D' Orazio, 2012).

Tracking school children with RFID tags. In Richmond, California, a preschool also used embedded RFID chips in students' clothing in 2010 (Kravets, 2012). Yet in an elementary school outside of Sacramento, California, scrubbed a plan to adopt RFID in 2005 since parents did not agree with the implementation of the technology. However, other school districts began using the chips to monitor students within 13 campuses in 2004.

Northern Arizona University to use RFID tags to monitor student attendance. The Northern Arizona University used the said technology to target college students for identity-tracking (Boyle, 2010). Students at NAU complained about the plan to monitor their attendance RFID chips embedded in their student IDs. The real intent of the program was to encourage professors to incorporate attendance into grading systems. According to NAU, frequent attendance lead to higher grades.

Statement of the Problem

At the end of the study, the proponents would like to answer the following specific problems:

Attendance checker.

1. What are the required specifications in developing an ideal attendance checker?
2. What is the level of validity of the system in terms of:

   Functionality
   Reliability
   Usability
   Efficiency
   Maintainability
   Portability

3. What are the problems encountered in the use of the software for during attendance making?
4. How will the software serve as a tool in classroom attendance monitoring?

Class record system.

1. What are the required specifications in developing an ideal class record?
2. What is the level of validity of the system in terms of:

   Functionality
   Reliability
   Usability
   Efficiency
   Maintainability
   Portability

3. What are the problems encountered in the use of the system as part of class record making?
4. How will the system serve as a tool in classroom grades monitoring?

Purpose/Objective of the Study

The purpose of this study is to develop a system that will monitor the attendance of students with the integration of RFID technology, and at the same time manage and produce class records.

Significance of the Study

This section will provide a brief description of the significance of the proposed system and its implementation.

1. **Instructors.** Unlike the old system, the new system will reduce the effort needed by professors to do roll calls for attendance. This will be done by using the RFID tags within the students IDs, which automatically transfer data from attendance to the class record.
2. **Students.** This will ensure the accuracy of student records since the system uses hardware that directly matches the RFID tags with the students' records. Moreover, the students will be assured that their attendance and grades are encoded accurately.
3. **School.** The attendance system will be a big help because instead of having students focus on waiting for their names to be called during roll calls, they will have effectiveness and efficiency in their submitting grades in a timely manner.

Scope and Limitation

The scope of the study is composed of the following:

1. The project uses a laptop computer equipped with a RFID receiver, and software that encodes student attendance at the start of every class session.
2. Students are issued with ID cards integrated with RFID tags to send their information to the system.
3. The encoding and generation of class records (quizzes, class standing and exam) are made in such a way that they can be exported in specific file formats like Microsoft Office Document (Word and Excel), Adobe PDF File, and HTML.
4. The project is only implemented in classes that have face-to-face sessions between the instructor and students.

The only limitations of this study are:

1. The study will be conducted within the premise of SDCA campus.
2. Respondents will be made up of students who have an SDCA ID card.
3. The system software and the RFID receiver are installed into a laptop PC.
4. The system will run on a Windows OS platform only.
5. Respondents can only be students who are enrolled in the project's assigned classes.

Hypothesis

On the basis of the specific problem posted in this study, the following hypotheses were tested.

H_0 – There is no significant improvement where RFID tags are attached to student's ID cards, and are used to record their attendance in a fast manner and reduce the effort of doing roll calls.

H_1 – There is a significant improvement where RFID tags are attached to student's ID cards, and are used to record their attendance in a fast manner and reduce the effort of doing roll calls.

Theoretical Framework

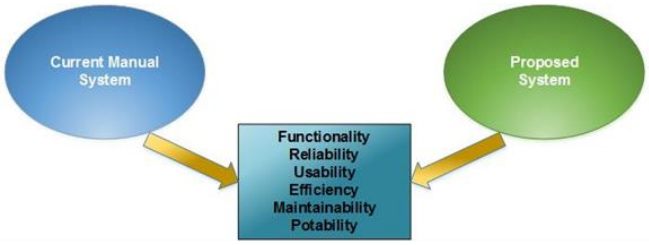

Figure 1. Theoretical framework

The theoretical framework shows that the current manual system and the proposed system will be subjected for testing to see if there is a significant difference in terms of functionality, reliability, usability, efficiency, maintainability, and portability (sqa.net).

Conceptual Framework

Figure 2. Conceptual framework of the current system.

This paradigm shows the flow of function within the current system: the manual attendance monitoring and class record. The current system uses manual encoding of student attendance in the form of paper records or manually-encoded Microsoft Excel data. Figure 3 shows the conceptual framework of the proposed system.

Figure 3. Conceptual framework of the proposed software.

In this paradigm, the proposed software enhances the current system by means of automating attendance recording with RFID.

Methodology

Methods of research. The proponents executed both exploratory and descriptive research. Using exploratory research, the proponents relied on gathering secondary researches such as reviewing available literature and data, and using quantitative approaches such as informal discussions with SBCS faculty members. Whereas in the descriptive research, the proponents employed several types of quantitative researches for data gathering such as questionnaires, interviews, observation schedules, checklists, and rating scales. Data were recorded and analyze for the software project's further improvement.

Instrumentation. The proponents will choose the following instrumentation for data gathering: questionnaire, interview, evaluation, survey, observation, reviews, and archiving.

Procedures. To effectively develop the proposed system, the proponent explored certain problems about the current manual system through observation. A series of interviews and surveys were then conducted to specify every problem. The proponent also acquired sample softwares that are currently in mainstream use, and tested them to find their functionalities. These software samples were sourced from the internet.

Once all the necessary data and information were gathered, the proponent start developing the proposed software. All the gathered data and information were used as the basis of the the proposed software's develpment, the design's planning and prototyping, and the proposed software's program codes and tools. Testing was also an essential factor in the proposed software's development; a series of software testing was conducted to detect software errors, prevent defects, and reduce the risk of software failure. It was a process that was used to identify the completeness, correctness, and quality of the developed software.

In the final phase of the proposed software's development, a set of tests and surveys were also conducted where it was tested in an actual environment before its release. A dedicated computer laboratory was used to test the proposed system and gather all the necessary data and information. Results gathered were then used to chart and fix certain drawbacks, changes, and enhancements for the proposed software solution before its final release.

A review of all gathered data and information was done to verify if everything was followed according to the plan. Documents were properly archived and safely stored so that, if ever there will be new enhancements and changes for a new release or version of the proposed software, the achieved documents can be opened and used.

Analytical tools. The tools used to understand the flow of the software are composed of the Use Case diagram, Entity-Relationship diagram, and Program flowchart. The analytical tools presented are an overview of the software.

Software development methodology. In the software's development, the proponent adopted Agile Software Development methods (agilemethodology.org). This approach is used by many software development firms to help businesses respond to unplanned changes. The proponent also acquired samples of existing software systems for the basis of other functionalities, features, and tools that were applied in the proposed software.

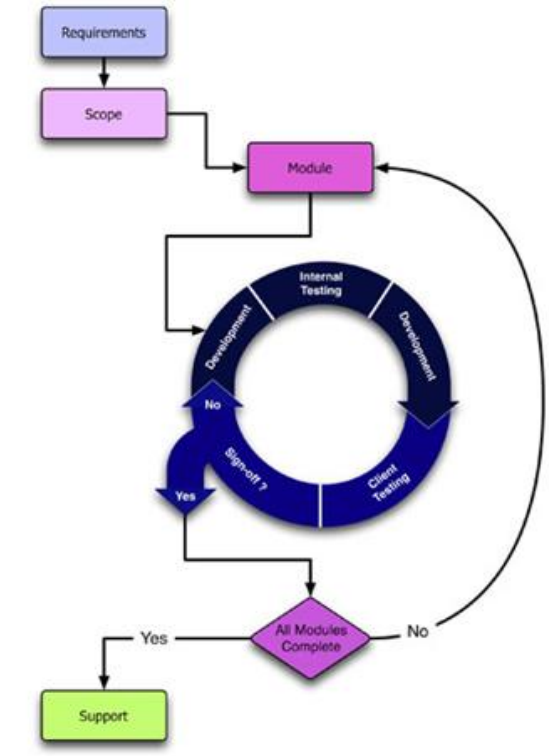

Figure 4. Agile Development Methodology

Software development tools. The proponent used several tools to help effectively develop the system within a short period of time. The proponent used Visual Studio 2013 as the primary tool for designing and developing the software, and Visual Basic.NET as the primary programming language for the software's program codes. RFID chips and a programmable RFID scanner were used to store and transfer data. Third-party tools like Component One were needed and integrated into Visual Studio 2013's environment to help the proponents design a more suitable GUI (Graphical User Interface). SQL Server LocalDB was the software system's back-end database. Finally, a laptop PC was used for both the proposed system's development and deployment.

Data collection. With all the instruments mentioned earlier in the paper, all the data gathered were treated as essential to the software's development. Interviews were first conducted to address all possible problems concerning the current system. The problems were then verified through observation. After all problems have been listed, the software's initial requirements were designed to solve the problems mentioned and verified. The software itself was then developed through the Agile Software Methodology. Once the initial version was made, it underwent testing to validate and verify whether or not it met the requirements of its intended use. A survey was also conducted to compare the current manual system against the proposed system software.

Results and Discussion

Attendance checker and class record system

Table 1. Required specifications

Minimum Required Specifications	
Operating System	Windows 7, 8, or 8.1 (32-bit or 64-bit)
.NET Framework	.NET Framework v4.5.1
Processor	At least 1.2Ghz (x86 with 64-bit extension)
RAM	At least 512 available RAM
Hard Drive Space	At least 50 MB of free HDD space
Graphics	Capable to view at 1024x768 resolution
USB Port	At least USB v2.0 or up
Other Devices	An RFID receiver and RFID chip integrated in the ID cards.
Other Software Requirements	Adobe Reader and Microsoft Office 2007 to up.

Required specifications. Table 1 shows the list of minimum required specifications in order to develop and run the system software.

System acceptance result (Attendance Checker)

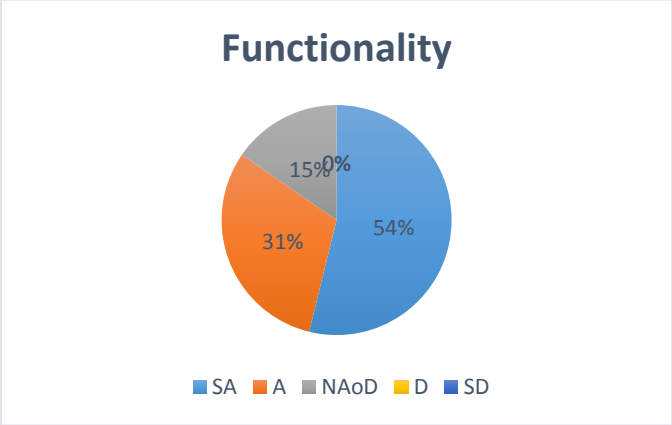

Figure 5. Software measured in terms of functionality

Functionality. Figure 5 shows that 54 percent of the respondents strongly agree with the technology in terms of functionality.

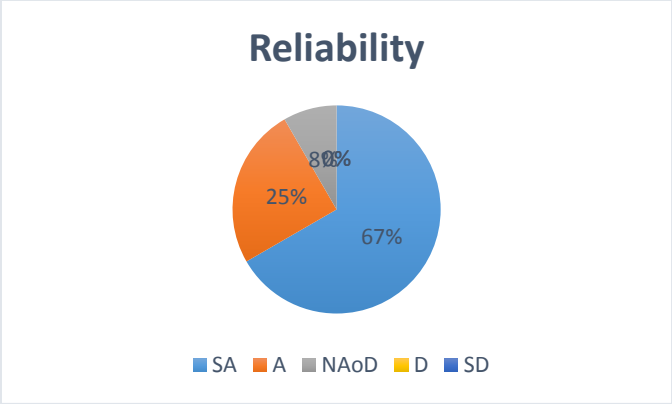

Figure 6. Software measured in terms of reliability

***Reliability*.** Figure 6 shows that 67 percent of the respondents strongly agree with the technology in terms of reliability.

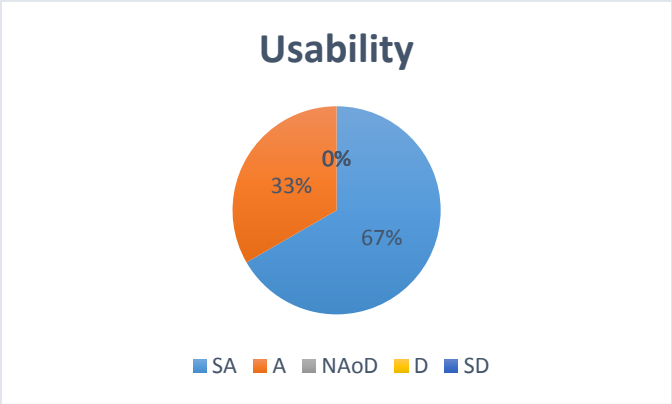

Figure 7. Software measured in terms of usability

***Usability*.** Figure 7 shows that 67 percent of the respondents strongly agree with the technology in terms of usability.

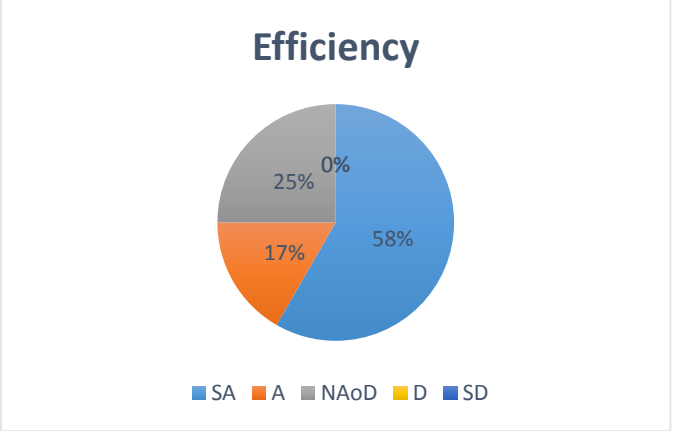

Figure 8. Software measured in terms of efficiency

***Efficiency*.** Figure 8 shows that 58 percent of the respondents strongly agree with the technology in terms of efficiency.

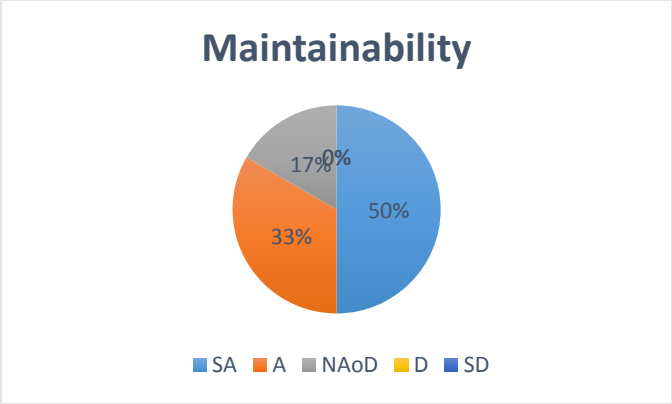

Figure 9. Software measured in terms of maintainability

***Maintainability*.** Figure 9 shows that 50 percent of the respondents strongly agree with the technology in terms of maintainability.

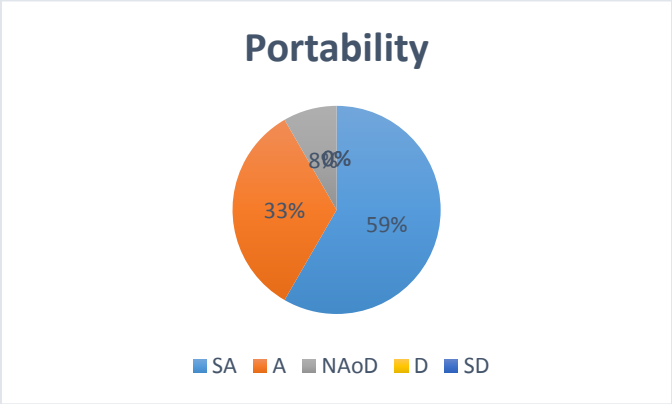

Figure 10. Software measured in terms of portability

***Portability*.** Figure 10 shows that 59 percent of the respondents strongly agree with the technology in terms of portability.

Table 2. Summary of evaluation of the software by weighted mean for attendance checker

Rate	SA	A	NAoD	D	SD	WM
Functionality	7	4	2	0	0	4.75
Reliability	8	3	1	0	0	4.58
Usability	8	4	0	0	0	4.67
Efficiency	7	2	3	0	0	4.33
Maintainability	6	4	2	0	0	4.33
Portability	7	4	1	0	0	4.50
Overall	**7.17**	**3.5**	**1.5**	**0**	**0**	**4.53**

Table 2 shows the summary of the respondents' evaluation of the proposed software. The weighted means of each criterion show that the proposed software performs at an excellent rate, proving that it makes a great impact on recording attendance.

System acceptance result (Class Record)

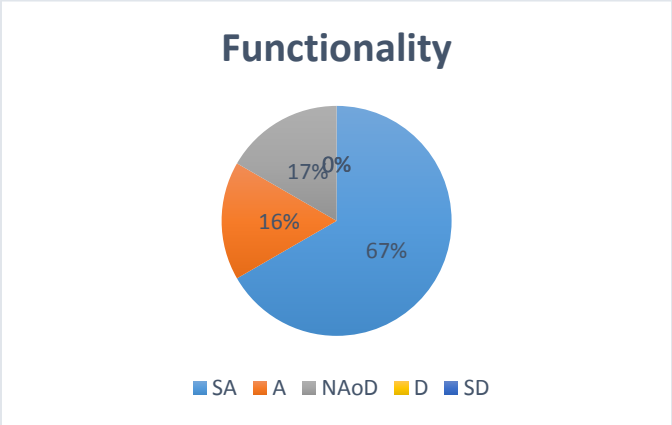

Figure 11. Software measured in terms of functionality

***Functionality*.** Figure 11 shows that 67 percent of the respondents strongly agree with the technology in terms of functionality. This means that the software is capable of providing functions that meet stated and implied needs when used.

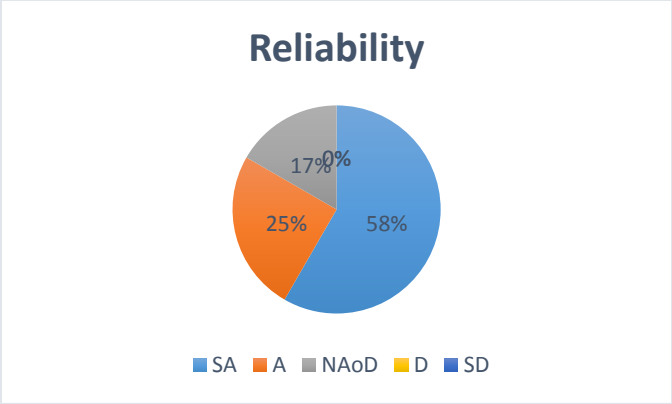

Figure 12. Software measured in terms of reliability

***Reliability*.** Figure 12 shows that 58 percent of the respondents strongly agree with the technology in terms of reliability. This means that the software is capable of providing recoverability and failure-free service.

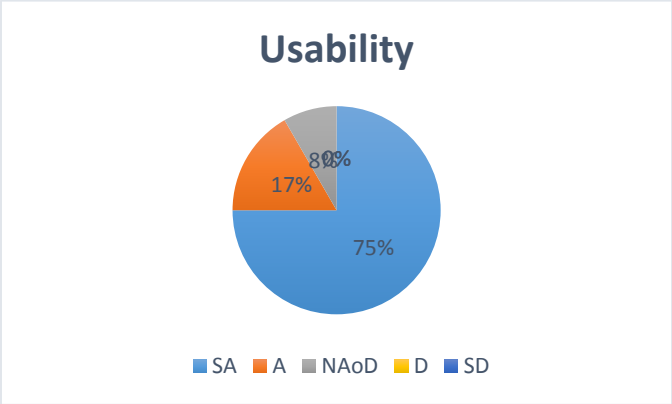

Figure 13. Software measured in terms of usability

***Usability*.** Figure 13 shows that 75 percent of the respondents strongly agree with the technology in terms of usability. This means that the software is capable of being understood, learned, and used by the end-user.

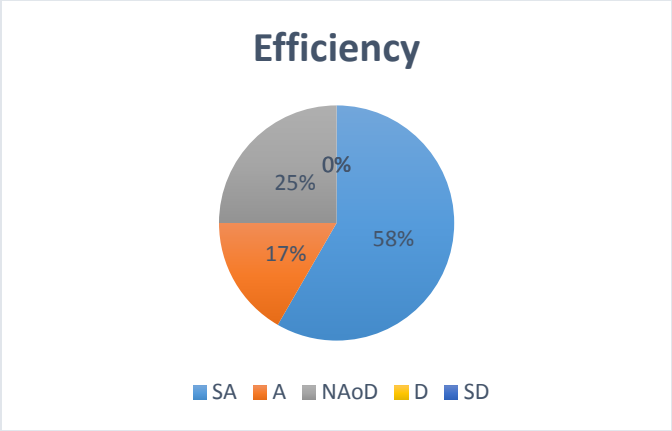

Figure 14. Software measured in terms of efficiency

***Efficiency*.** Figure 14 shows that 58 percent of the respondents strongly agree with the technology in terms of efficiency. This means that the software is capable of providing appropriate performance relative to the amount of resources used.

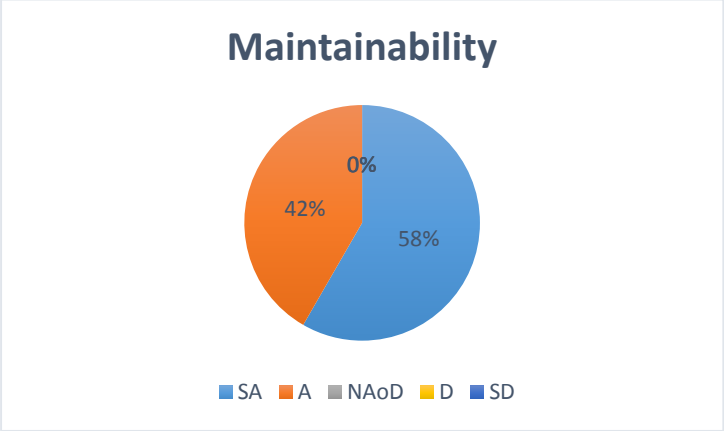

Figure 15. Software measured in terms of maintainability

***Maintainability*.** Figure 15 shows that 58 percent of the respondents strongly agree with the technology in terms of maintainability. This means that the software is capable of being modified for the purposes of adaptation, making corrections, and/or improvements.

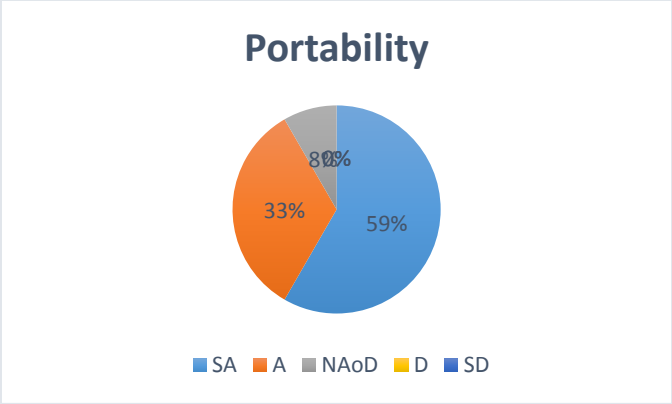

Figure 16. Software measured in terms of portability

***Portability*.** Figure 16 shows that 59 percent of the respondents strongly agree with the technology in terms of portability. This means that the software is capable of being adapted for different specified environments without applying actions or means other than those provided for this purpose in the product.

Table 3. Summary of evaluation of the software by weighted mean for class record

Rate	SA	A	NAoD	D	SD	WM
Functionality	7	4	2	0	0	4.75
Reliability	8	3	1	0	0	4.58
Usability	8	4	0	0	0	4.67
Efficiency	7	2	3	0	0	4.33
Maintainability	6	4	2	0	0	4.33
Portability	7	4	1	0	0	4.50
Overall	**7.17**	**3.5**	**1.5**	**0**	**0**	**4.53**

Table 3 shows the summary of evaluation of the respondents on the proposed software. The weighted means of each criterion shows that the proposed software performs on an excellent rate, proving that it makes a great impact on recording class records.

Problems encountered

Attendance checker. There was no problem found or encountered during the use of the system software in this regard.

Class record. There was no problem found or encountered during the use of the system software in this regard.

Serve as a tool. Based on the system acceptance results for both the attendance checker and class record system features, it proves that the system software is capable of automatically recording student attendance and creating class records. It makes monitoring and recording class attendance easier for the instructor by scanning his/her students' RFID-integrated IDs, eliminating the need for roll calls and letting the class start immediately. The software also makes the creation

of class records easier by integrating itself with a local database installed in the SDCA system that holds attendance and class records. With this feature, there is no need to make separate files for recording class records.

Conclusions and Recommendations

This chapter discusses a summary of the study, its findings, and its conclusion and recommendations. In line with the problem stated, the following items were concluded:

Conclusions

1. The required specifications for both Attendance Checker and Class Record are the following:

Minimum Required Specifications	
Operating System	Windows 7, 8, or 8.1 (32-bit or 64-bit)
.NET Framework	.NET Framework v4.5.1
Processor	At least 1.2Ghz (x86 with 64-bit extension)
RAM	At least 512 available RAM
Hard Drive Space	At least 50 MB of free HDD space
Graphics	Capable to view at 1024x768 resolution
USB Port	At lease USB v2.0 or up compatible
Other Devices	An RFID receiver and RFID chip integrated to the ID cards.
Other Software Requirements	Adobe Reader and Microsoft Office 2007 to up.

2. The level of validity (for Attendance Checker) in terms of:

   Functionality means that the software is capable of providing functions which meet stated and implied needs when used.

   Reliability means that the software is capable of providing failure-free service and recoverability.

   Usability means that the software is capable of being understood, learned, and used by the end-user.

   Efficiency means that the software is capable of providing appropriate performance relative to the amount of resources used.

   Maintainability means that the software is capable of being modified for the purposes of adaptation, and making corrections and/or improvements

   Portability means that the software is capable of being adapted for different specified environments without applying actions or means other than those provided for this purpose in the product.

3. The level of validity (for class record) in terms of:

   Functionality means that the software is capable of providing functions which meet stated and implied needs when used.

   Reliability means that the software is capable of providing failure-free service and recoverability.

   Usability means that the software is capable of being understood, learned, and used by the end-user.

   Efficiency means that the software is capable of providing appropriate performance relative to the amount of resources used.

   Maintainability means that the software is capable of being modified for the purposes of adaptation, and making corrections and/or improvements

   Portability means that the software is capable of being adapted for different specified environments without applying actions or means other than those provided for this purpose in the product.

4. There is no problem found or encountered during the use of the system software for the attendance checker and class record.

The proponents conclude that using software integrated with RFID tags in student IDs brought about a significant improvement in how instructors recorded student attendance at the start of a class. This also brings about an improvement of the instructor's work efficiency.

Recommendations. The proponents recommend this software to be implemented as an alternative way of recording and monitoring student attendance during class sessions. Although there will always be room for improvement in the future, the proponents believe that there are possible enhancements that can be included with the system software at a later time.

For future researchers who will conduct the same study, the proponents recommend that they use this study's concepts and findings as further reference.

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