A QUASI-EXPERIMENTAL COMPARISON OF ATTENDUINO VERSUS PEN-AND-PAPER FOR ATTENDANCE RECORDING AT UNIVERSIDAD DE STA. ISABEL OF PILI, INC.

A Quantitative Research Study

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PRACTICAL RESEARCH 2: QUANTITATIVE RESEARCH

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This quantitative research of NEZEL T. BAYNOSA, PAUL ANGELO A. BIARES, JANSSEN J. HUGO, XYMON JAN NARCEL V. LOPEZ, and NISHA NICOLE B. TOLENTINO entitled **"A QUASI-EXPERIMENTAL COMPARISON OF ATTENDUINO VERSUS PEN-AND-PAPER FOR ATTENDANCE RECORDING AT UNIVERSIDAD DE STA. ISABEL OF PILI, INC."** prepared and submitted in partial fulfillment of the requirements for the course Practical Research 2: Quantitative Research has been examined and is recommended for acceptance and approval for Oral Examination.

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ABSTRACT

Traditional pen-and-paper attendance recording methods are often time-consuming, error-prone, and inefficient. This study evaluates the AttenDuino, an Arduino-based, RFID-assisted data-logging system, as a modern alternative at Universidad de Sta. Isabel of Pili, Inc. Using a quasi-experimental one-group pretest-posttest design, the study surveyed 23 class secretaries and 12 subject teachers to compare the AttenDuino's performance with traditional attendance-taking methods in terms of accuracy, time efficiency, and long-term usability. Findings from class secretaries indicate that most found the AttenDuino more efficient, with many reporting reduced time spent on attendance recording and fewer errors in data entry. Several noted that retrieving past records was significantly easier with the AttenDuino than with pen-and-paper records, which were often misplaced. Subject teachers similarly observed improvements in attendance tracking, stating that the system allowed them to focus more on instruction rather than administrative tasks. Many also found the automated data exportation more convenient for reviewing attendance trends. Overall, both groups favored the AttenDuino for its ease of use, efficiency, and accuracy. Some concerns were raised about potential misuse of RFID cards for proxy attendance. The study suggests integrating additional security measures, such as biometric authentication or real-time monitoring, to enhance reliability. These findings contribute to the ongoing development of technology-driven attendance management in educational institutions.

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CHAPTER I

THE PROBLEM AND ITS SETTING

Introduction

The AttenDuino, an Arduino-based data-logging system, offers a modern solution to the limitations of traditional pen-and-paper attendance recording methods. Traditional methods are often plagued by issues related to time consumption, inaccuracies, and inefficiencies in data management. The AttenDuino is designed to automate the process of recording student attendance, providing several advantages over conventional approaches. These advantages include improved accuracy in data collection, reduced time spent on attendance recording, increased efficiency of human resources, and long-term convenience in managing and storing attendance records.

Cruz et al. (2019) applied experimental research to develop a low-cost air quality monitoring system using Arduino Leonardo and Internet of Things (IoT) technology. The system demonstrates its ability to accurately measure environmental parameters and transmit data online. This study was vital in determining the type of prototyping technology the researchers will use to develop the AttenDuino. Moreover, it also shows the Arduino's affordability in prototyping.

Attendance-taking is a fundamental aspect of classroom management. It monitors the students' academic accountability and counters issues such as cutting classes, unnoticed absenteeism, and unaccounted late arrivals. Usually, this process is done using pen-and-paper methods where the teachers or class secretaries manually check and record a student's presence. While simple, this method is often time-consuming, prone to errors, and demands significant human resources, particularly in larger classes. Teachers are subjected to use some time of the class duration to record the attendance and call out each student's name. Errors and tedious corrections are made during situations where, for example, the student is simply late and not absent. There are also occurrences where the teacher forgets to bring their attendance recording sheet and fails to take the attendance for their class. This may cause failure to notice discrepancies between student attendance in multiple classes. For instance, a student may have been able to attend their first class, but may still fail to attend their next class for reasons that may vary. Class secretaries who are students of the class are also constantly disturbed by their classmates' late arrival and are obligated to keep track of the arrival and whereabouts of each student. As educational institutions strive for greater efficiency and accuracy in administrative tasks, there is a growing interest in exploring digital alternatives that streamline attendance recording.

The Faucet theory proposes that students only improve during consistent exposure to learning. Absenteeism hinders students' learning opportunities because of their lack of exposure. The strict implementation of attendance recording using an electronic device ensures that absenteeism and tardiness are monitored so that educational institutions can identify the factors that may lead to the phenomenon. This, in turn, allows them to target and eliminate these factors to better deliver personalized educational needs to their students (Keppens, 2023).

Various experimental research has been conducted to develop an Arduino-based attendance recording device using the Radio Frequency Identification (RFID) technology. A research article by Ula et al. (2021) entitled "A New Model of The Student Attendance Monitoring System Using RFID Technology" presented an RFID-based system for monitoring student attendance as a prominent improvement to traditional methods. This system enhanced efficiency, accuracy, and real-time data management in attendance monitoring by incorporating RFID technology. The proposed model simplified the attendance process and encouraged punctuality and accountability for both students and lecturers. As educational institutions aim to modernize and improve their administrative processes, the RFID-based system offers a progressive solution that addresses the limitations of existing methods and meets the demands of contemporary educational environments.

Research conducted by Reyes and Caras (2023) entitled "Designing Of Web-Based Attendance and Class Scheduling System using RFID and Raspberry PI" explored the development of an RFID-based attendance tracking system designed to address the inefficiencies of manual attendance tracking methods at Columban College, Inc. One of the core concepts of the study mentioned was the use of RFID technology to automate data capture from RFID tags without physical contact, which enhances accuracy and reduces the time required for attendance management. The methods involved integrating RFID readers and tags with a back-end database and web-based software to streamline attendance recording and communicate real-time updates to parents and guardians. This approach aimed to resolve issues related to manual errors and extensive paperwork. The research results demonstrated that the proposed system significantly improved attendance accuracy, reduced administrative workload, and facilitated a more efficient and transparent process for monitoring student attendance.

The researchers of this study have decided to use the RFID technology for a scanner interface along with the students' identification card (ID) as the RFID card for the following reasons: (1) Users often misplace or lose their RFID cards entirely—using the students' ID ensures that they do not lose their means for logging into the system, and (2) users will be able to observe the advantages of using an electronic device better if there is a significant interaction between the user and the device which would also encourage them to be involved in technological development (Kuo et al., 2019). The third reason is a phenomenon primarily discussed in the Human-Computer Interaction (HCI) field.

A research article created by Alvarez et al. (2024) suggested that the Human-Computer Interaction (HCI) field explores the hazard management advantages of a web application prototype that functions as a user disaster warning system. Although it received high user satisfaction ratings in different situations, they observed that there were still ways to improve the accessibility of the hazard application further. This study contributed to understanding the application of technology to cater to the students' needs and provide a satisfactory environmental experience. This study also promoted possibilities related to the current research topic in enhancing the usability and availability of the AttenDuino as the central attendance tracker of Universidad de Sta. Isabel Pili, Inc.

This research sought to evaluate the effectiveness of the AttenDuino as a primary attendance tracker at Universidad de Sta. Isabel of Pili, Inc. Specifically, it aimed to compare the AttenDuino to the usual pen-and-paper method of recording attendance in terms of accuracy, time efficiency, and long-term usability. Additionally, the study explored the experiences of teachers and class secretaries during the AttenDuino's trial implementation, focusing on any issues encountered, the ease of data exportation, and the accuracy of records generated by the system. Finally, the research identified the teachers' and class secretaries' preferred attendance recording method, whether they preferred the AttenDuino or the pen-and-paper method. By comparing the AttenDuino with traditional pen-and-paper methods, the researchers were able to assess the device's system advantages in terms of accuracy, time efficiency, human resource requirements, and long-term convenience. This research paper examined the limitations of traditional pen-and-paper attendance recording methods. It proposes the AttenDuino, an electronically operated, Arduino-based system, as a more efficient, accurate, and interactive alternative for monitoring classroom attendance using the quasi-experimental research design.

Statement of the Problem

This study aimed to answer the following research questions:

1. What are the experiences of the class secretaries and subject teachers at Universidad de Sta. Isabel of Pili, Inc. in using the pen-and-paper method and the AttenDuino system as their attendance recording method? In particular with the:
    a. Issues faced
    b. Data exportation
    c. Recording accuracy
2. What advantages does the AttenDuino offer as a primary attendance recorder over the traditional pen-and-paper method in terms of:
    a. Accuracy
    b. Time consumption and manpower efficiency
    c. Long-term convenience
3. What is the preferred attendance recording method among the teachers and class secretaries of Universidad de Sta. Isabel of Pili, Inc.?

Research Objectives

The purposes of this research were as follows:

1. To evaluate the efficacy of the AttenDuino system in accurately and efficiently recording student attendance compared to the traditional pen-and-paper method.
2. To identify the advantages and disadvantages of using the AttenDuino system versus the pen-and-paper method.
3. To determine the preferred attendance recording method among class secretaries and subject teachers at Universidad de Sta. Isabel of Pili, Inc., between both electronic and traditional approaches.

Research Hypotheses

The researchers hypothesized the following outcomes:

H_0: The AttenDuino system will not be significantly advantageous to the accuracy and efficiency of attendance recording any more than the traditional pen-and-paper method at Universidad de Sta. Isabel of Pili, Inc.

H_1: The AttenDuino system will be significantly advantageous to the accuracy and efficiency of attendance recording compared to the traditional pen-and-paper method at Universidad de Sta. Isabel of Pili, Inc.

Scope and Limitations/Delimitations

This research focused primarily on evaluating the efficacy of the AttenDuino in transforming the attendance recording process into a more efficient administrative task. This study used the experiences of the class secretaries and subject teachers of Universidad de Sta. Isabel of Pili, Inc. with using the AttenDuino attendance recording system and the pen-and-paper attendance recording method to take the class attendance of the students. Certain aspects or factors affected this research such as the timeframe in which the study was conducted due to it limiting the duration of testing the AttenDuino prototype. This study did not examine the common reasons for student absenteeism or any phenomena concerning absenteeism.

The researchers employed an experimental development approach to assess the potential impacts of the AttenDuino system on attendance recording processes. This approach was decided upon by evaluating recommendations from previous studies in the field. The researchers utilized the quasi-experimental research design to obtain complete and accurate user feedback from the respondents.

The respondents that were involved in this research were the class secretaries and subject teachers of Universidad de Sta. Isabel of Pili, Inc. identified as of August 2024. The respondents were subjected to two phases of surveying: the pretest phase and the posttest phase. The study was conducted over four months.

Significance of the Study

In pursuing the quantitative research entitled "***A Quasi-Experimental Comparison of AttenDuino versus Pen-and-Paper for Attendance Recording at Universidad de Sta. Isabel of Pili, Inc.***", the researchers aimed to contribute significantly to both the academic and research community wherein the following individuals and organizations were expected to benefit the most:

Class Secretaries. This study will prevent the class secretaries from spending too much time individually recording their classmates' arrivals. It will also avoid written errors caused by premature conclusions regarding a student's attendance.

Teachers. This study will allow teachers to automatically export class attendance records and observe patterns in each student's attendance or tardy behavior. Thus, it will be easier to inquire about a student's whereabouts if there is any concern.

Students. This study will enhance the students' accountability in fulfilling their academic responsibility of attending classes in a timely and consistent manner by providing an interactive device that promotes class attendance recording convenience.

Educational Institutions. This study will increase productivity in creating reports related to recording student attendance throughout the year and creating schedules that may prevent student absenteeism after observing student attendance patterns, such as students being usually absent on days with no major subjects.

Parents. This study will give parents the opportunity to receive feedback about their children's presence in school with clear, complete, and easy-to-understand records. This may be helpful during parent-teacher consultations regarding a student's performance in school, which may be affected by their class attendance.

Researchers. This study will apply the researchers' knowledge of using Arduino, an open-source platform for prototype development. Consequently, the researchers will be able to utilize their knowledge of robotics to conduct research that aims to contribute to the technological and scientific community.

Future Researchers. The findings and components of this study will contribute further to the investigations of future research related to the field of study by providing accurate quantitative data carefully measured using appropriate data collection methods. This research will also provide precise details on how the study was conducted so that future researchers may develop their methodologies using the recommendations from this research and discover possible issues that may occur early on.

Definition of Terms

Arduino. The developer defines Arduino as an open-source electronics platform company that produces hardware and software. Its primary objective is to design easy-to-use and accessible devices and kits that enable users to create interactive electronic projects. The microcontroller Arduino Uno is the main component used in the prototype development of AttenDuino.

Absenteeism. The term is operationally defined as the habitual act of not being present where one is expected to be. With the context of this research, this term refers to the patterns of the students' occasional lack of presence at Universidad de Sta. Isabel of Pili, Inc.

Comma-Separated Values (CSV) File Format. Christensson (2020) on TechTerms defines the term as "the standard way to store structured data in a plain text format.". This is the format stored by the SD card of the AttenDuino.

Human-Computer Interaction (HCI). The term is characterized as the field of study that focuses on how people (users) interact with computers. It is concerned with implementing an efficient and adaptable computer system that will satisfy the user's needs (Brey & Søraker, 2009).

Internet of Things (IoT). According to Yasar and Gillis (2024), IoT refers to a network of physical devices interrelated in a single cloud or connection. These may pertain to a connection that hosts multiple types of technologies, such as sensors, software, and circuits. In the context of the current research, IoT is used to describe the use of multiple modules connected to a single Arduino Uno microcontroller to maximize the device's functionalities and capabilities.

Pen-and-Paper Attendance Recording Methods. These methods refer to traditional manual processes where attendance is documented by physically marking or writing on paper. These methods typically involve teachers or class secretaries using printed spreadsheets or blank sheets to note the presence or absence of students during each class session (Jibble, 2024).

Radio Frequency Identification (RFID). A technology that uses radio waves to identify and track objects, animals, or people through electronic tags (Raikar, 2023). This technology will allow students to scan their own RFID cards and log into the attendance recording system.

CHAPTER II

FRAMEWORKS OF THE STUDY

This chapter includes the frameworks of the study: the conceptual framework and the theoretical framework. The conceptual framework includes the variables of the study and the theoretical framework includes the theories supporting the phenomena occurring in the research.

Conceptual Framework

Figure 1

Conceptual Framework

INPUT

1. Attendance recording method used by class secretaries and subject teachers:
   - AttenDuino
   - Pen-and-Paper Method
2. Factors affecting the research:
   - Class size
   - User familiarity with the technology
   - User preference/bias

PROCESS

1. 2 phases of data collection using survey questionnaire:
   - Pretest about the use of the pen-and-paper method for attendance recording.
   - Posttest about the use of the AttenDuino for attendance recording.
2. Measuring the data using the mean for descriptive statistics.
3. Measuring the data using T-test for inferential statistics

OUTPUT

1. Identified benefits of using the AttenDuino as an alternative attendance recording method to the pen-and-paper method:
   - Data accuracy
   - Time efficiency
   - Manpower efficiency
   - Long-term convenience
2. determined user feedback after the device prototype trial period in regards with:
   - Ease of data exportation
   - User experience and satisfaction

This framework illustrates the concepts used for the study. The researchers used the paradigm method to describe the input, process, and output of the entire research, as shown in Figure 1.

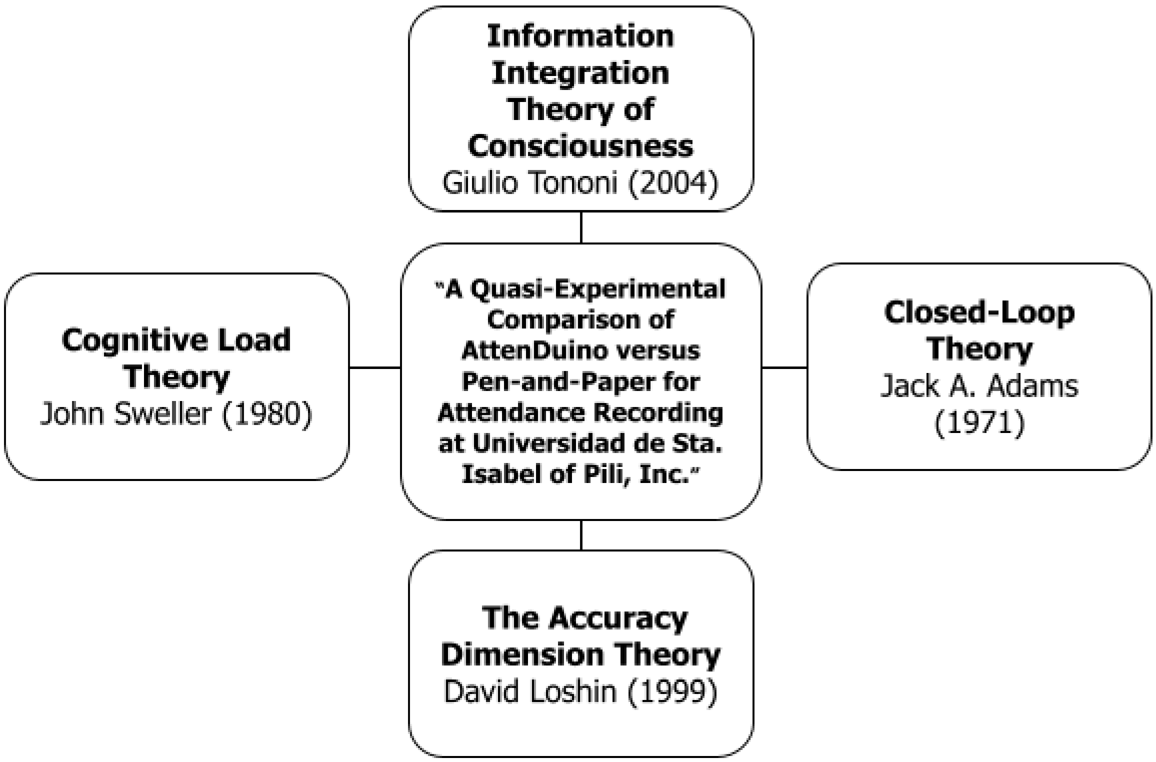
The researchers applied the Input-Process-Output (IPO) model to visualize the research process, incorporating all variables and steps to summarize the research concept. In this framework, the input consists of independent variables that serve as the "cause" for the research problems and moderating variables that might indirectly influence the relationship between the independent and dependent variables. As shown in Figure 1, the process included the data collection and interpretation methods, which the researchers used to draw accurate conclusions from the respondents' data. The output consisted of the dependent variables, expected to be influenced by the independent variable, and the feedback or responses regarding the device's usability.

In this research, the independent variable was the attendance recording method used by class secretaries and subject teachers, which could have been either the AttenDuino or the traditional pen-and-paper method. The dependent variables included data accuracy, time efficiency, human resources efficiency, and the long-term convenience of using the AttenDuino. The moderating variables were the class size, user familiarity with the technology, and user preference/bias. Additionally, the researchers aimed to gather user feedback on the AttenDuino's usability, specifically focusing on data exportation ease and overall user experience and satisfaction after testing the prototype.

Theoretical Framework

Figure 2

Theoretical Framework



Information Integration Theory of Consciousness

Giulio Tononi's (2004) Information Integration Theory of Consciousness offers a valuable foundation for understanding how an Arduino-based data-logging system can be used to track student attendance. Tononi's theory states that consciousness results from information integration, similar to how the Arduino system combines and processes multiple data inputs, such as timestamps and student IDs, to create a coherent attendance record. The efficiency and sophistication of data integration are reflected in the system's ability to integrate this information successfully, which can be assessed similarly to quantifying consciousness. Additionally, the informational connections between data items determine the quality of attendance records, just as the interactions between the constituent elements of conscious experiences characterize those experiences. Every time stamped and contextually appropriate attendance record demonstrates how the system mimics how consciousness gathers and combines contextual and temporal data.

Closed-Loop Theory

Jack A. Adams' (1971) closed-loop theory, which can be applied to create and operate an Arduino-based data-logging system for tracking student attendance, emphasizes the creation of a sensory trace as an error detection mechanism. The theory states that when there is no external input regarding results, people develop an internal system to identify and correct mistakes. This concept also applies to an Arduino-based attendance system, meaning that discrepancies in attendance data can be detected and corrected automatically by the system without the need for human intervention. The system can identify anomalies, including missing entries or inaccurate timestamps, and take corrective action by continuously logging and analyzing data. This internal error detection ensures the accuracy and reliability of attendance data by simulating how people rely on perceptual traces to maintain performance accuracy. As a result, the system provides a strong foundation for maintaining data quality and integrity, in addition to improving operational efficiency.

Cognitive Load Theory

John Sweller believed that the human brain can only handle a limited amount of simultaneous information processing and that productivity and decision-making can be improved by effectively managing cognitive load. When compared to traditional paper-based techniques, AttenDuino's digital data management system minimizes the complexity and effort required to store and retrieve attendance records by automating the process of recording student attendance. This helps reduce cognitive tension. Staff members at Universidad de Sta. Isabel of Pili, Inc. can concentrate more on strategic tasks rather than administrative ones due to this reduction in cognitive load, which enhances productivity and decision-making. Therefore, by enhancing information processing and facilitating more efficient management of student attendance data, the use of AttenDuino aligns with the principles of Cognitive Load Theory.

The Accuracy Dimension Theory

The effectiveness of David Loshin's theory guarantees the success of the data management system. With the goal of properly recording and managing student attendance, Loshin's emphasis on data accuracy, consistency, and reliability is directly applicable to the AttenDuino system. The system can ensure that the attendance data gathered is accurate and trustworthy by following specific data quality guidelines, which are necessary for producing reliable reports and analyses. By implementing Loshin's recommendations, potential problems such as inconsistent or inaccurate data entry can be addressed, improving the overall effectiveness of the attendance tracking system.

CHAPTER III

METHODOLOGY

This chapter contains the breakdown of the methods and processes to be used in conducting the research. Specifically, it includes the following parts: (1) research design, (2) data gathering procedure, (3) sampling technique, (4) research locale and participants, (5) procedure of data analysis, (6) research instrument, (7) role of the researchers, and (8) ethical considerations.

Research Design

The research applied the quasi-experimental research design to determine the AttenDuino's effectiveness compared to the traditional pen-and-paper method for class attendance recording. This design was appropriate for simulating the real-world classroom setting, where the users will presumably transition from the pen-and-paper method to using the AttenDuino as a primary attendance recording method after device implementation. In this study, the one-group pretest-posttest design was utilized wherein the same group of participants were respondents to both the pretest and posttest surveys and were treated as both the experimental group and the control group to ensure that all responses were not based on biases resulting from varied testing experiences.

Sampling Technique

The researchers employed a combination of the census sampling technique or total population sampling technique and the non-probability purposive sampling technique to select the survey respondents. The census sampling technique was employed for the class secretary respondents since the researchers intended to survey all 22 Universidad de Sta. Isabel of Pili, Inc. class secretaries. Isabel of Pili, Inc. to maximize the responses received from the class secretaries portion of the data. The non-probability purposive sampling technique was employed for selecting the subject teacher respondents from the population wherein the researchers selected these respondents according to the following criteria:

The subject teacher must;

1. Have been regularly taking the class attendance of their students on a particular subject prior to testing the AttenDuino.
2. Be familiar with or have a good amount of understanding of the functions of the AttenDuino.
3. Be willing to participate and dedicate an ample amount of time to testing the device prototype and formulating their answers for the survey.

Data Gathering Procedure

The researchers utilized surveys suited for collecting the necessary data required for accurate determination of the results of the research. The survey comprised two phases: the pretest and the posttest. The pretest survey was focused on determining the user experiences and satisfaction with using the traditional pen-and-paper method as a primary attendance recording method while the posttest survey, which was conducted after a short trial period for the device prototype, was focused on the user experiences and satisfaction with using the AttenDuino as an alternative and, eventually, a replacement to the former attendance recording method. The two phases of the survey allowed the researchers to receive enough data to analyze and derive conclusions, thus making the sample size more representative of the entire population.

Procedure of Data Analysis

The data was organized and separated into two data sets: the pretest set and the posttest set. The research utilized a combination of descriptive statistics and inferential statistics to accurately and completely interpret the data and successfully answer the research questions. The weighted mean was used as the descriptive statistical tool to describe the entire data collected and to visualize the data through frequency distribution tables. Furthermore, a paired-sample t-test was used as the inferential statistical tool to directly compare the two sets of data (pretest set and posttest set) since each question or statement in the pretest questionnaire had its direct equivalent for comparison in the posttest questionnaire. For example, the first section's first question or statement in the pretest questionnaire also corresponded to the first section's first question or statement in the posttest questionnaire. Although there was a total of 35 survey respondents for the sample size, the researchers opted to use the t-test instead of the z-test to anticipate the possibility of the absence of the population standard deviation since the t-test was still suitable for the sample size, though it is usually used for sample sizes less than 30.

Formulas Used for the Data Interpretation

Mean. The mean represents the average of a set of values. It is computed using the formula:

$$mean = \frac{sum\ of\ all\ values}{total\ number\ of\ values} \text{ or } \overline{d} = \frac{\Sigma d}{n}$$

Where:

- $\overline{d}$ **=** Mean (average of all responses)
- Σd = Sum of all responses
- n = Total number of responses

Weighted Mean. The weighted mean accounts for the relative importance or weight of each value, ensuring accuracy when some values are more significant than others. The formula is:

$$Weighted\ Mean = \frac{Sum\ of\ Weighted\ Points}{Number\ of\ Questions}$$

Where:

- "Sum of Weighted Points" refers to the total weighted values assigned to responses.
- "Number of Questions" refers to the total questions assessed.

Paired-Sample T-test. A paired-sample t-test is used to assess the significance of the difference between paired observations. The formula is:

$$t = \frac{\bar{d}}{S_d/\sqrt{n}}$$

Where:

- $\bar{d}$ **=** Mean difference between paired observations
- S_d = Standard deviation of differences
- n = Sample size (number of paired observations)

Standard Deviation of Differences. This measures variability among the differences between paired observations. The formula is:

$$S_d = \sqrt{\frac{\Sigma d^2 - (\Sigma d)^2/n}{n-1}}$$

Where:

- d^2 **=** Individual difference value squared
- S_d = Standard deviation of differences
- d = Individual difference value
- n = Sample size (number of paired observations)

Research Instrument

The researchers used survey questionnaires as the primary research instrument for gathering data. The pretest evaluated the experiences and satisfactions of the respondents with using the traditional pen-and-paper method, while the posttest evaluated the same with using the AttenDuino. Both sets of survey questionnaires determined the experiences and satisfactions of the users in terms of ease of usage, accuracy, time efficiency, and the challenges/issues that come with using either method of attendance recording. A 4-point Likert scale was used for formulating the survey questionnaires to ensure simplicity for the respondents and to maximize data interpretation practicality for the researchers. This type of scale was appropriate and ideal for the fulfillment of the research objectives as well as for answering the research questions without compromising data accuracy.

Table 1

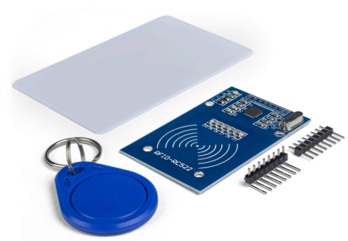
Interpretation of the 4-Point Likert Scale

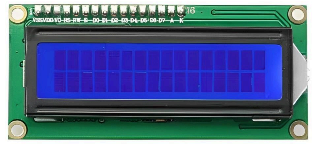
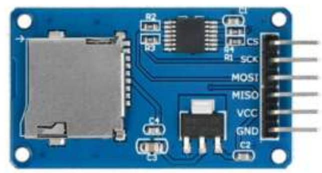
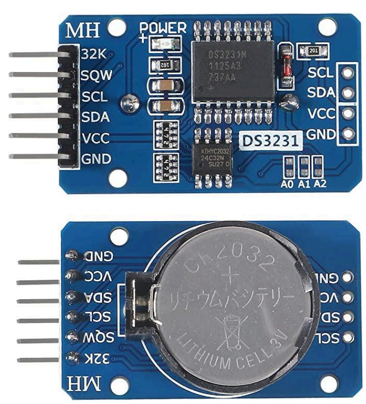
POINT	RANGE	INTERPRETATION
4	3.26-4.00	Strongly Agree
3	2.51-3.25	Agree
2	1.76-2.50	Disagree
1	1.00-1.75	Strongly Disagree

Preparation of Materials

Table 2

Main Components Used for the AttenDuino Prototype Development

NAME	PICTURE	FUNCTION
Arduino Uno R3 Microcontroller Unit (MCU)	 (*Arduino Uno R3*, n.d.)	To support the microcontroller and provide an easy and simple way to start and function with embedded electronics.
RFID MFRC522 Kit	 (RoboCore, n.d.)	To transmit data to a microcontroller that allows us to read and write to RFID tags.
Universidad de Sta. Isabel of Pili Inc. Student Identification Card		To identify and track the students through the attendance recording system

16x2 LCD Module with I2C	 (*16x2 LCD Display With I²C Interface*, n.d.)	To display the information intended as a result of the input.
Micro SD Card Reader Module	 (*Micro SD Card Reader Module*, n.d.)	To read and write data to microSD cards, enabling efficient storage and retrieval of information.
Micro SD Card	 (*Sandisk 32GB Micro SD Card*, n.d.)	To provide portable, high-capacity storage for various digital data, including files, photos, and applications.
Real-Time Clock (RTC) Module	 (GigaNepal, 2023)	To keep track of the time when logged in to the attendance recording system.

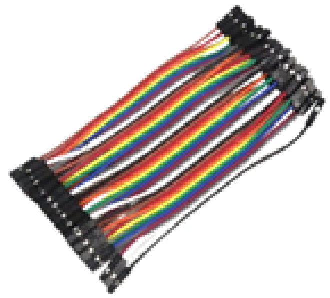
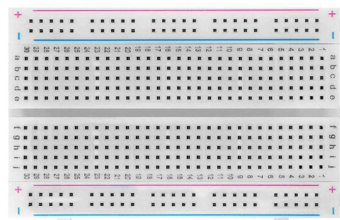
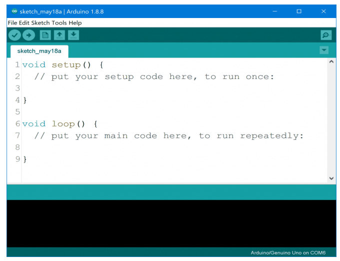
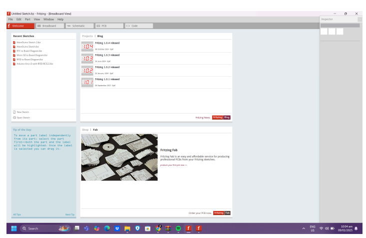
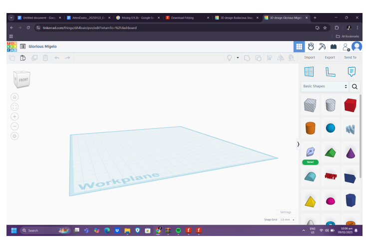
DuPont Jumper Wires	 (Makerlab Electronics, n.d.)	To connect electronic components or different parts of a circuit.
Breadboard	 (*Mini Breadboard 400 PIN With 4 Power Rails for Jumper Cable*, n.d.)	To easily organize the electronic circuits used for the prototype.

Table 3

Software/Programs Used for Programming the AttenDuino Prototype

NAME	PICTURE	FUNCTION
Arduino Integrated Development Environment (IDE)		To write, compile, and upload code to Arduino microcontroller boards, supporting embedded system development with C++-based programming.
Fritzing (Version 0.9.3b)		To make circuit diagrams for the prototype. Note: The researchers used an older free version of the application since the new releases were only available for purchase.
Autodesk Tinkercad		To make the 3D Model/Mockup of the AttenDuino prototype.

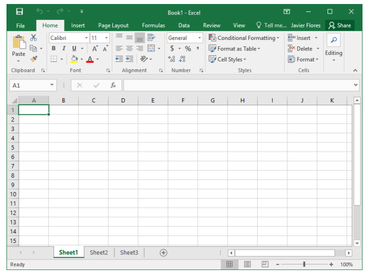
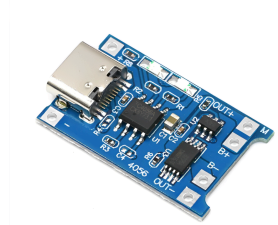
Microsoft Excel		To open, decode, edit, and encode CSV/txt files by automatically converting the comma-separated values into a tabular format for easy viewing and manipulation.

Table 4

Power Supply Components for Powering the AttenDuino Prototype

NAME	PICTURE	FUNCTION
18650-3350mAh 3.7V Li-ion battery	 (Makerlab Electronics, n.d.)	To store and supply reliable power to the prototype, ensuring stable operation of the Arduino and its connected modules.
1-Cell 18650 Battery Holder	 (18650 Battery Holder 1 Cell - Phoenix Group, 2023)	To secure and connect the 18650 battery to the circuit, providing a stable power source for the prototype.
TP4056 Type-C Charging Module	 (circuitrocks, n.d.)	To manage charging and protect the 18650 battery by regulating input power and preventing overcharge or over-discharge.

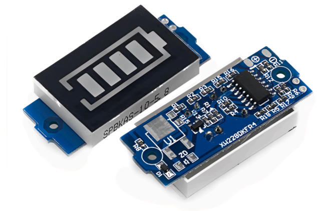
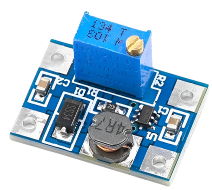
1S Lithium 18650 Battery Pack Power Indicator Board	 (Microscale, n.d.)	To monitor and display the battery's charge level, providing real-time power status for the prototype.
SX1308 Step-Up Converter	 (Makerlab Electronics, n.d.-b)	To boost the 3.7V battery output to a stable 5V, ensuring sufficient power for the Arduino and its modules.
Single-Pole, Single-Throw (SPST) Switch	 (ROCKER SWITCH Red ON/OFF 6A 250VAC, n.d.)	To control the power flow, allowing the prototype to be turned on or off as needed.

Table 5

Voltage Requirements of the Modules Used in the AttenDuino Prototype

COMPONENT	VOLTAGE REQUIREMENT
Arduino Uno R3	5V
RFID MFRC522 Module	3.3V
Micro SD Card Module	4.5V - 5.5V (Has a built-in 3.3V regulator)
RTC Module (DS3231 AT24C32)	5V (Supports 3.3V but optimized for 5V)
16x2 I2C LCD Module	5V

Research Locale and Participants

The research was conducted at Universidad de Sta. Isabel of Pili, Inc. at San Agustin, Pili, Camarines Sur. All 23 elected class secretaries, whether junior high school or senior high school, were included in both phases of the survey. Similarly, all 33 subject teachers were drafted for selection regardless of department, years of experience, or subject handled. Only 12 subject teachers were selected for survey participation. All research participants were provided with the necessary information to ensure they understood the context of their participation.

A pilot test was conducted after validation of the initial survey questionnaires. Respondents for the pilot testing of the survey questionnaires were 8 class presidents and 7 subject teachers. These class presidents temporarily represented the class secretaries since the researchers could not survey the class secretaries themselves for the pilot testing because the researchers utilized the census sampling technique. When class secretaries are unavailable, it is usually the class president that records the attendance. The 7 subject teachers were chosen through their experience with recording the attendance of their class even occasionally. The results of the pilot testing were used to revise the pretest and posttest survey questionnaires.

The class secretaries were chosen as the primary research respondents because they are the ones tasked to record the attendance in a classroom setting for all the students in the class as valid for half of the day or for the whole day while the subject teachers were chosen as the secondary research respondents because they also record the attendance specifically during their subject period only.

Figure 3

Universidad de Sta. Isabel of Pili, Inc. at San Agustin, Pili, Camarines Sur

A total of 35 survey respondents consisting of 23 class secretaries and 12 subject teachers participated in the research. The 23 class secretaries came from all 23 classes/sections of Universidad de Sta. Isabel of Pili, Inc. and the 12 subject teachers also came from various subject departments.

Table 6

Distribution of the Respondents by Group

GROUP	POPULATION NUMBER	NUMBER OF PARTICIPANTS	SAMPLING FRACTION
Class Secretaries	23	23	100%
Subject Teachers	33	12	36.36%
Total	56	35	62.5%

Role of the Researchers

In this quantitative research, the researchers were responsible for the following roles: surveyors, data interpreters, and data analysts. The researchers fulfilled their respective roles during the data collection by diligently conducting and facilitating survey answering with the respondents who were carefully selected for the appropriateness of the study.

Ethical Considerations

In conducting the data gathering for this research entitled "***A Quasi-Experimental Comparison of AttenDuino versus Pen-and-Paper for Attendance Recording at Universidad de Sta. Isabel of Pili, Inc.***", the researchers observed the following ethical considerations:

Voluntary Participation. No respondent was coerced into participating in the research nor was any participant purposely inconvenienced. The researchers administered the surveys at the earliest possible and ideal time with regards to the availability of the research participants.

Informed Consent. The researchers confirmed the respondents' willful participation for the pretest and posttest phases of the surveys by requesting them to sign a consent form stating the necessary details and clauses of their participation.

Confidentiality. The researchers implemented a highly confidential treatment toward any data collected for the research. The researchers acknowledged the respondents' right to data privacy and non-disclosure of information to anyone other than the researchers and necessary faculty. The researchers also treated all data obtained with discretion during consultations and research discussions. Permissions were secured from all involved personalities before sharing associated information.

CHAPTER IV

PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

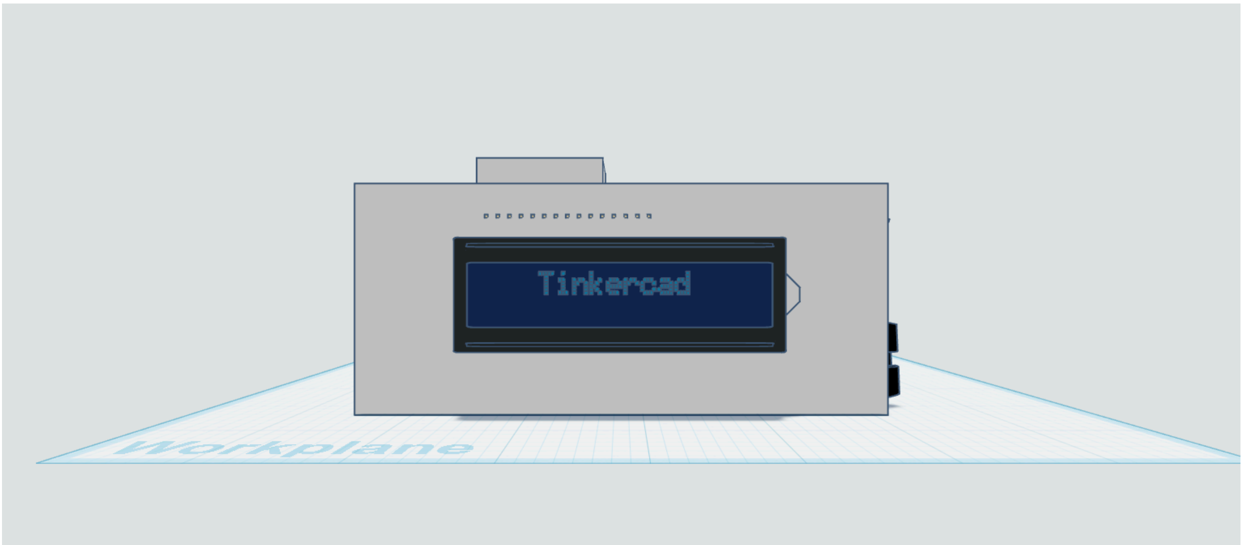
This chapter presents the development and diagram visualization of the AttenDuino, an RFID-based attendance recording device, along with its integrated modules. It includes the results of the data gathered during the study and provides an analysis of the findings. The discussion highlights the device's efficiency, accuracy, and user satisfaction compared to traditional pen-and-paper methods.

3D Model of the Device Mockup

The researchers utilized Tinkercad, an online 3D modeling program, to create the 3D model of the AttenDuino. They designed the container using the Box shape and adjusted its dimensions to fit all components appropriately. A small breadboard was added to simplify the wiring to the Arduino Uno R3 microcontroller, along with modules such as the RFID scanner, Micro SD Card, LCD 16x02 with I2C, and Real-Time Clock (RTC), strategically placed for easy wiring, maintenance, and troubleshooting. Finally, a 9V battery was included to power the device and ensure portability. This mockup ensures all components are protected and accessible, allowing easy battery replacement and micro SD card removal. Figures 4 to 7 show the 3D model from multiple angles.

Figure 4

3D Front View of the AttenDuino



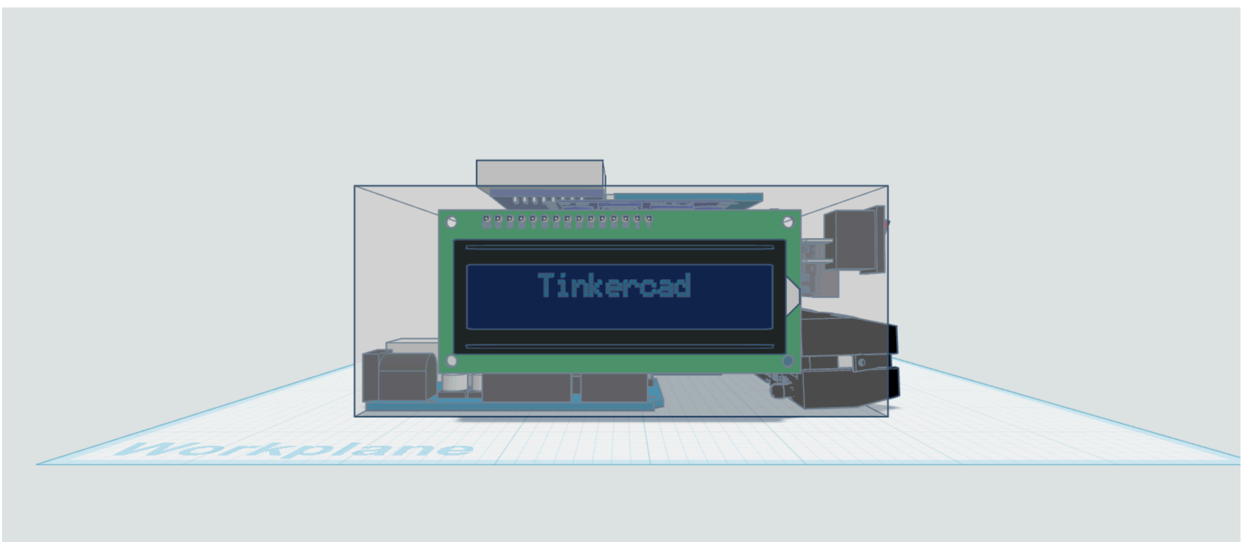
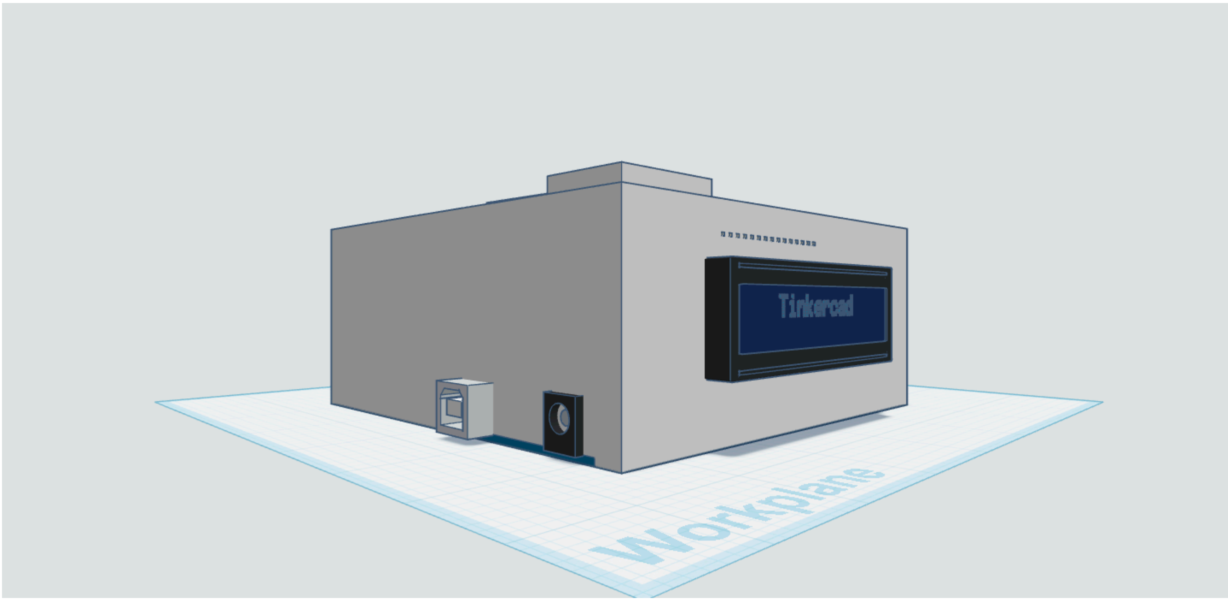


Figure 5

3D Left-side View of the AttenDuino



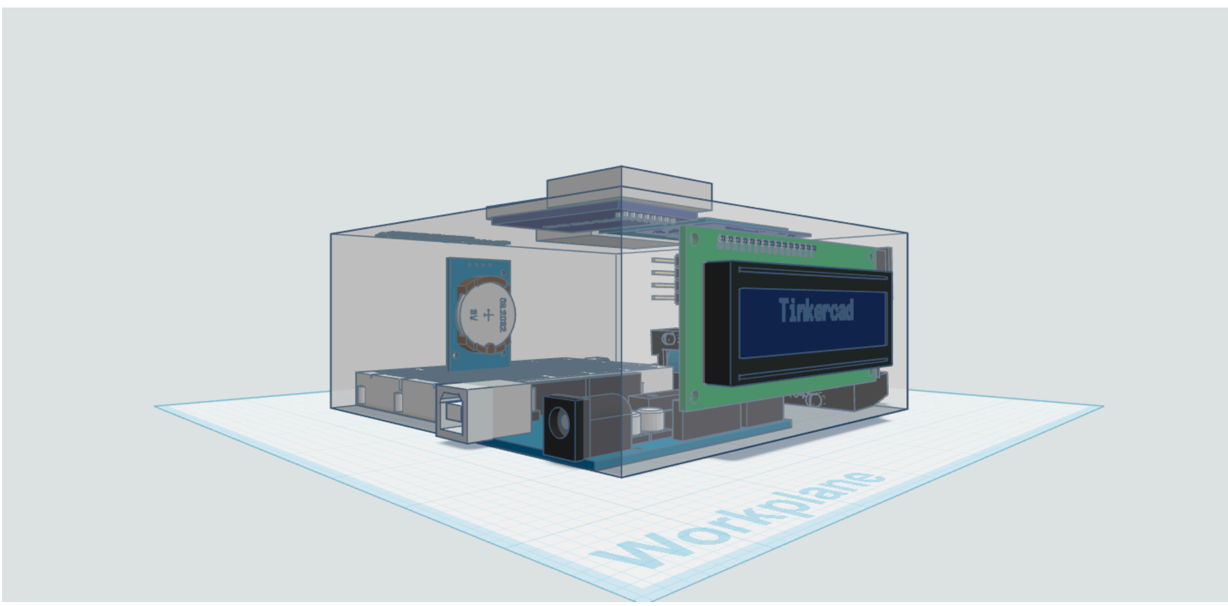


Figure 6

3D Right-side View of the AttenDuino

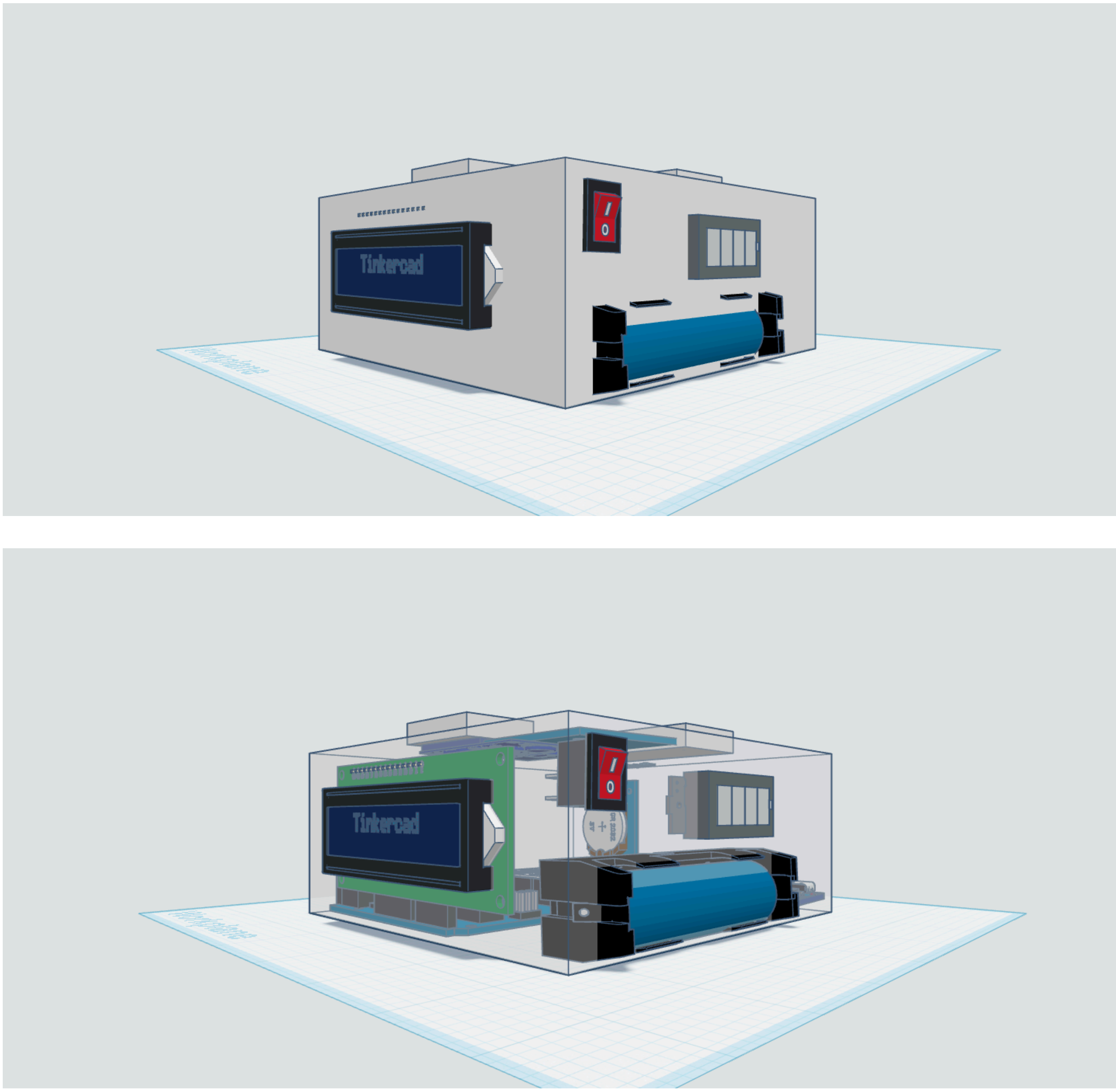
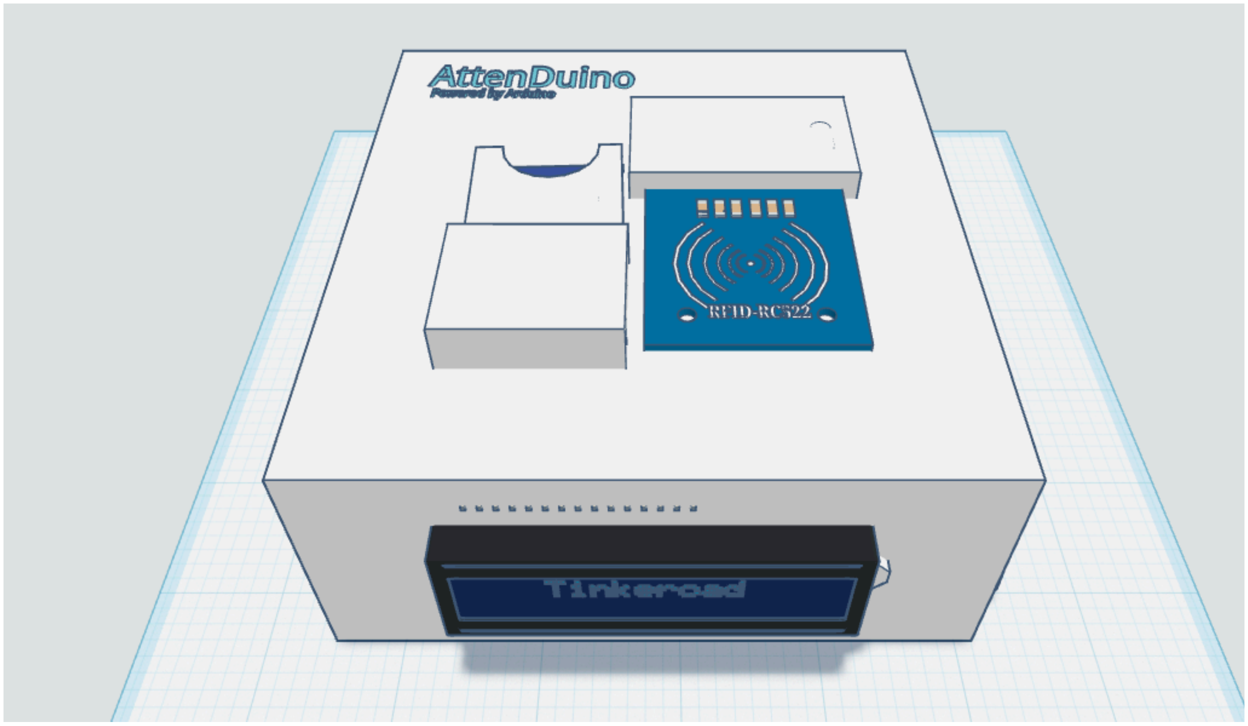


Figure 7

3D Top View of the AttenDuino



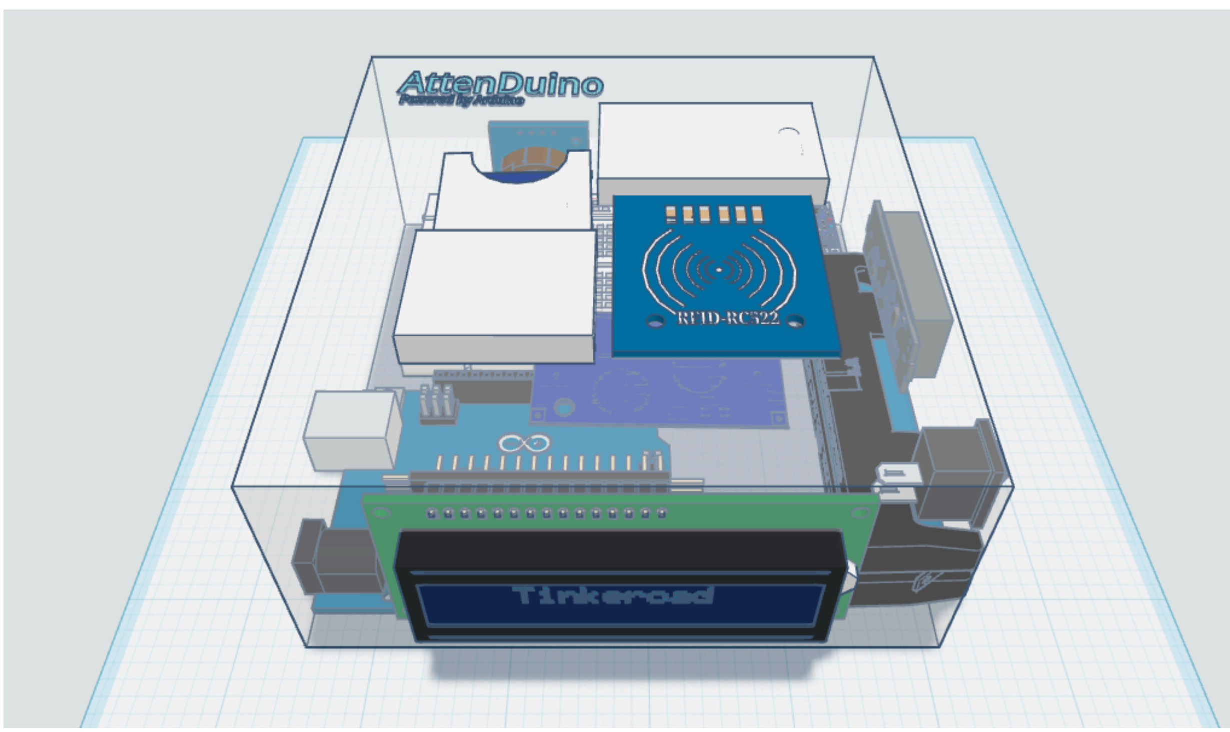
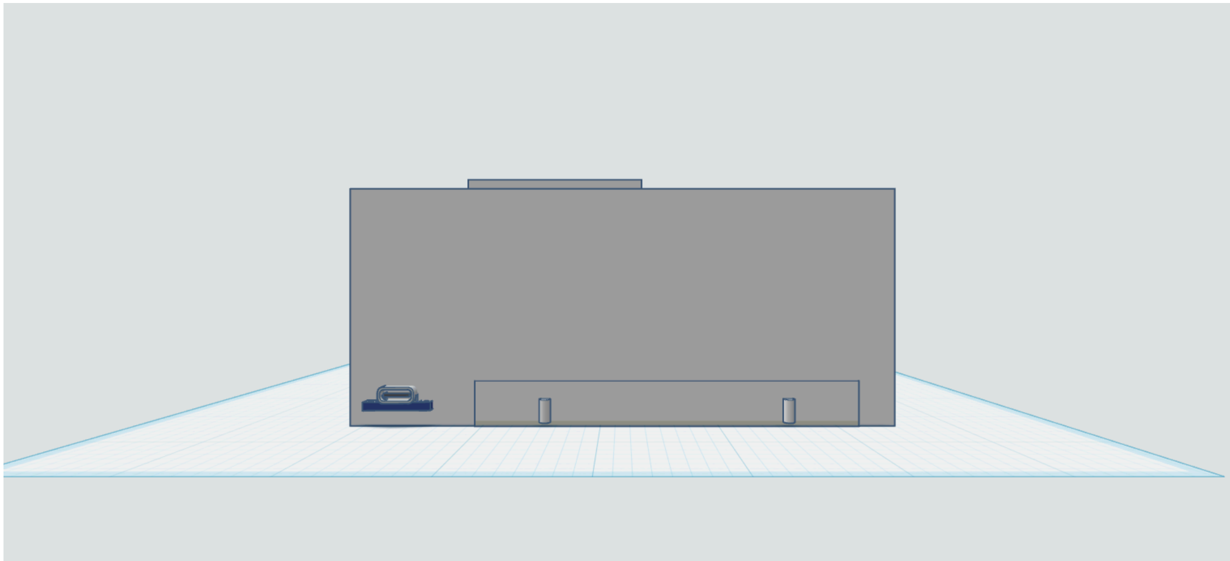
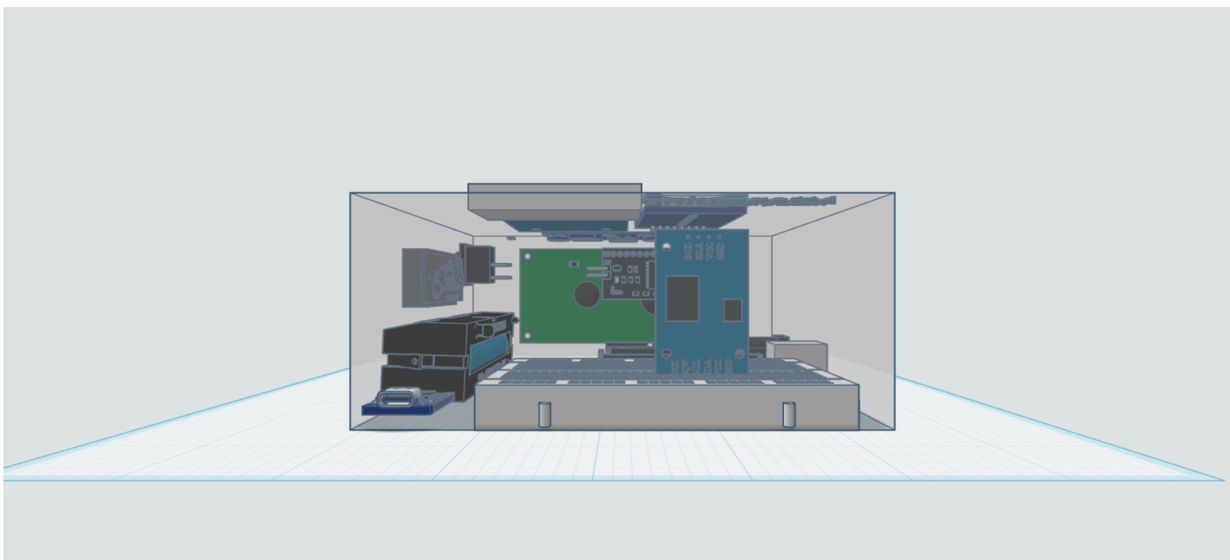


Figure 8

3D Back View of the AttenDuino





Electronic Assembly and Circuit Design

Several Arduino-compatible components were used to reflect the device's reliance on the Internet of Things (IoT) network, enabling its various functions to work together efficiently for the targeted users. To assemble the prototype, the researchers utilized a circuit diagram to visualize the mockup design and ensure the Arduino Uno R3 microcontroller could support all the required modules. Since some components share pin provisions on the Arduino, a breadboard was used to expand the MCU's capacity.

Figure 9

Circuit Diagram of the Modules of the AttenDuino

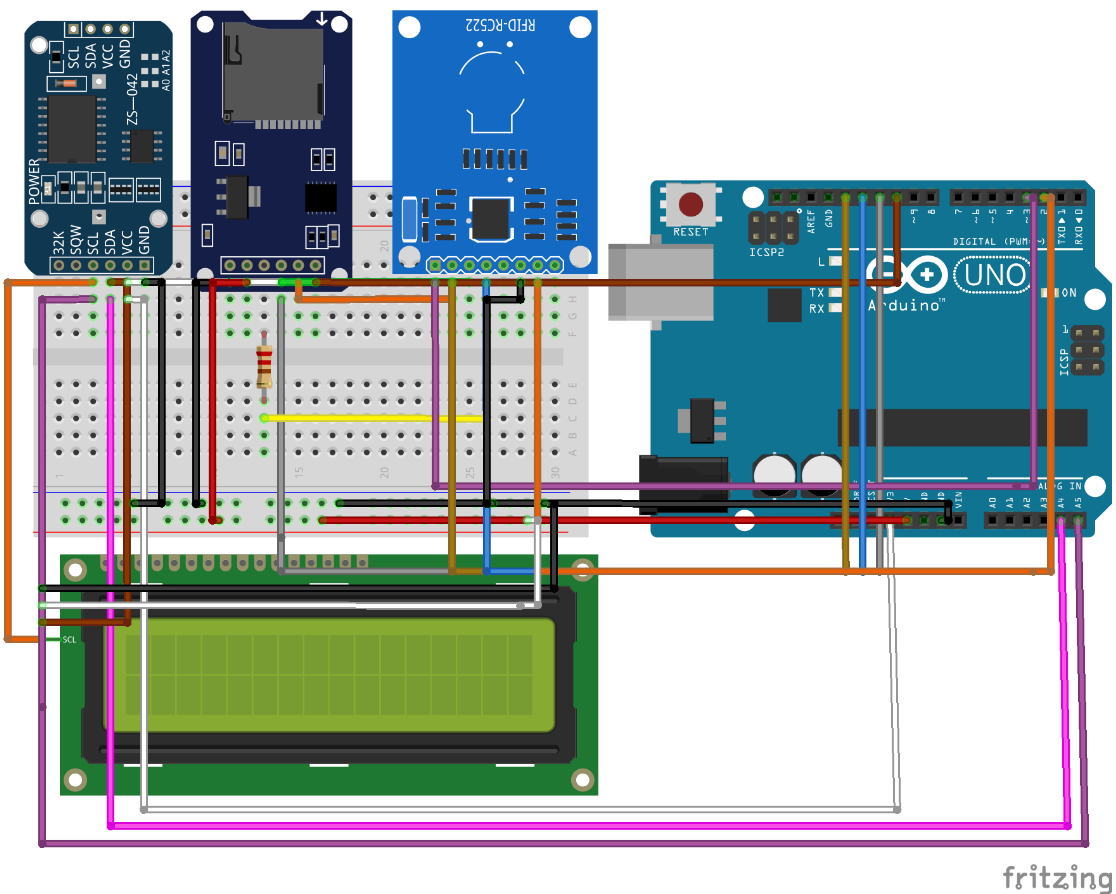


Figure 9 shows the complete wiring of the modules of the AttenDuino system, which integrates an Arduino Uno microcontroller, RFID module, RTC module, microSD card module, and a 16x2 LCD module with I2C. The RFID module is connected to the Arduino Uno using the SPI protocol, facilitating the reading of RFID tags. The SDA pin, responsible for selecting the RFID module in SPI communication, is connected to Arduino Pin 3. The SCK pin, which provides the clock signal for data synchronization, is connected to Arduino Pin 13. The RFID MOSI pin, shared with the microSD card's MOSI pin, is used for data transfer from the Arduino to the RFID module. The MISO pin, connected to Arduino Pin 12, allows data transfer from the RFID module back to the Arduino. Additionally, the GND pin is connected to the breadboard's ground (-) rail, while the RST pin, used to reset the RFID module, is connected to Arduino Pin 2. The RFID module's 3.3V pin is powered by the RTC module's VCC.

The microSD card module, used for storing attendance records in a removable format, is also connected using the SPI protocol. Its GND and VCC pins are connected to the breadboard's ground (-) and positive (+) rails, respectively, to provide power. The MOSI pin, shared with the RFID module, facilitates data transfer, while the SCK pin, shared with the RFID module's SCK, synchronizes the clock signal. The CS pin, which selects the micro SD module, is connected to Arduino Pin 10. This configuration ensures efficient logging of attendance data.

The RTC module, which provides real-time timestamps for attendance records, communicates with the Arduino via the I2C protocol. Its SCL and SDA pins are connected to the I2C SCL (A5) and SDA (A4) pins on the Arduino, as well as to the LCD module's SCL and SDA pins. The RTC module's GND pin is connected to the breadboard's ground (-) rail, and its VCC pin is powered by the RFID module's 3.3V pin. This ensures a synchronized and reliable time-keeping mechanism for the system.

The 16x2 LCD module with I2C displays attendance information such as RFID tag data, date, and time. The I2C interface reduces the number of connections required, with only four pins needed: VCC, GND, SDA, and SCL. The VCC pin is connected to the Arduino's 3.3V pin, and the GND pin is connected to the breadboard's ground (-) row. The SDA and SCL pins are connected to the Arduino's A4 and A5 pins, respectively, and are shared with the RTC module. This streamlined connection setup simplifies communication between the Arduino and the LCD module.

Finally, the power and ground connections are established through the breadboard. The breadboard's positive (+) rail is connected to the Arduino's 5V pin, distributing power to all modules, while the negative (-) rail is connected to the Arduino's GND pin, providing a shared reference point for the circuit. Together, these connections enable the Arduino Uno to manage inputs from the RFID module, log data to the microSD card, maintain real-time timestamps with the RTC module, and display relevant information on the LCD module, creating a complete and efficient attendance tracking system.

Table 7

Connection Table of the Modules of the AttenDuino

START	END
RFID SDA	ARDUINO Pin 3
RFID SCK	ARDUINO Pin 13
RFID MOSI	MICRO SD MOSI
RFID MISO	ARDUINO Pin 12
RFID NC	No connection
RFID GND	BREADBOARD GND (-) Rail
RFID RST	ARDUINO Pin 2
RFID 3.3V	RTC VCC
MICRO SD GND	BREADBOARD Ground (-) Rail
MICRO SD VCC	BREADBOARD Positive (+) Rail
MICRO SD MISO	No connection
MICRO SD MOSI	RFID MOSI
MICRO SD SCK	RFID SCK (BREADBOARD rail)
MICRO SD CS	ARDUINO Pin 10
RTC 32K	No connection
RTC SQW	No connection
RTC SCL	LCD 12C SCL
RTC SDA	LCD 12C SDA
RTC VCC	RFID 3.3V
RTC GND	BREADBOARD Ground (-) Rail
BREADBOARD SCL Rail	ARDUINO A5 Pin

BREADBOARD SDA Rail	ARDUINO A4 Pin
BREADBOARD VCC Rail	ARDUINO 3.3V Pin
BREADBOARD Ground (-) Rail	ARDUINO GND Pin
BREADBOARD Positive (+) Rail	ARDUINO 5V Pin

The connection table of the modules of the AttenDuino provides a simplified overview of all the connections in the prototype, listing each module's pins alongside their corresponding connections. By enumerating these connections in a structured format, the table offers a concise and organized reference to ensure accurate assembly of the circuit. It aids in cross-checking connections between components, the Arduino Uno, and the breadboard, facilitating efficient troubleshooting and assembly.

Figure 10

Circuit Diagram of the Power Supply of the AttenDuino

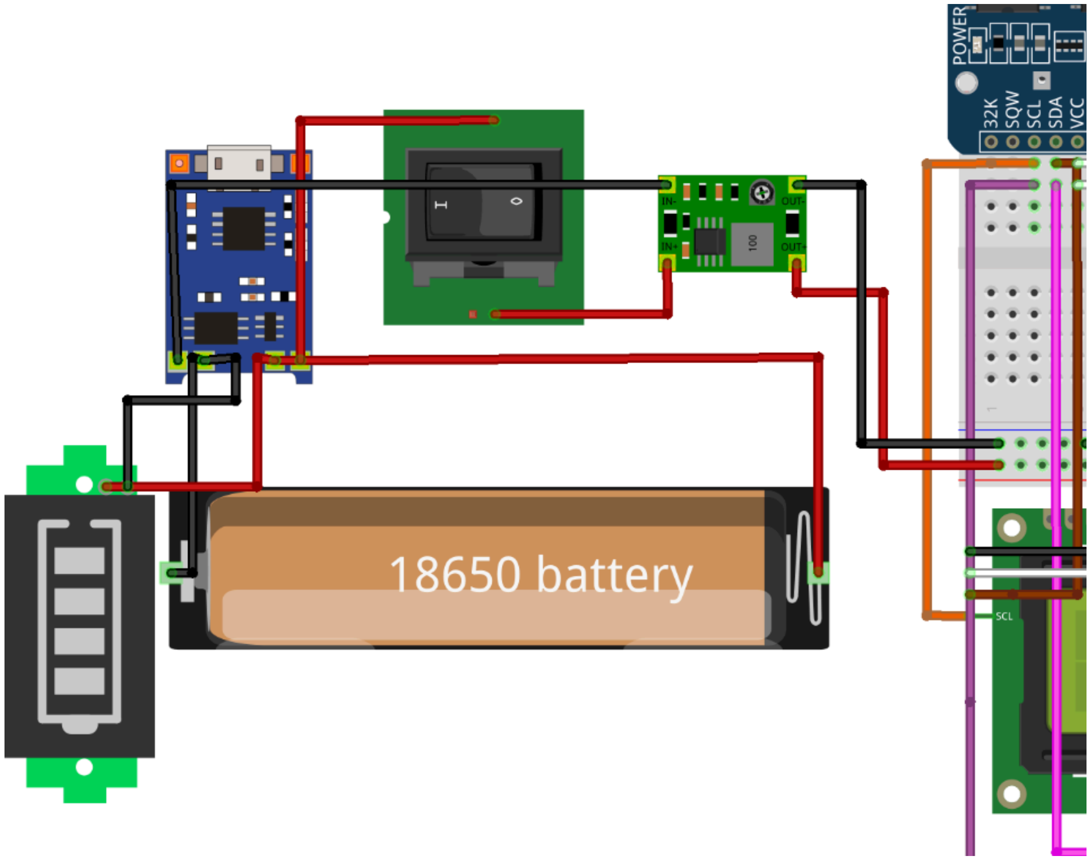


Figure 10 illustrates the complete wiring of the power distribution system for the AttenDuino prototype, ensuring efficient power regulation, storage, and switching control using a single 18650 Li-ion battery with a TP4056 charging module, an SX1308 step-up converter, and an SPST switch for user control. The system is designed to provide a stable 5V output to power the Arduino Uno and its connected modules while allowing for safe battery charging and power monitoring.

The battery holder's positive terminal is connected to both the power level indicator module and the TP4056 charging module's B+ terminal. This setup enables real-time monitoring of the battery charge level while ensuring safe charging and discharge management through the TP4056 module. Similarly, the negative terminal of the battery is shared between the TP4056 module and the power level indicator module, completing the circuit while allowing charge status to be displayed without interfering with the charging process.

From the TP4056 module, the OUT+ terminal is routed to the common (C) terminal of an SPST switch, which serves as the primary power control. When the switch is turned on, the normally open (NO) terminal connects to the SX1308 step-up converter’s input positive terminal (IN+), allowing power from the battery to be directed into the voltage-boosting system. Meanwhile, the OUT- terminal of the TP4056 module is connected directly to the SX1308 step-up converter’s IN- terminal, forming a complete circuit for proper voltage regulation.

Once power reaches the SX1308 module, it is boosted from 3.7V to 5V, which is essential for running the Arduino Uno and its connected components. The step-up module’s OUT+ terminal is connected to the breadboard’s positive rail, serving as the 5V power source for the system, while its OUT- terminal is connected to the breadboard’s ground rail, ensuring a common ground reference across all modules. The breadboard's positive rail is then connected to the Arduino Uno’s 5V pin to supply power, while the ground rail is linked to the Arduino's GND pin, maintaining proper electrical consistency throughout the system.

This power distribution setup was chosen to ensure safe battery charging, efficient power regulation, and user control over the AttenDuino system. The TP4056 module prevents overcharging and deep discharge, thereby protecting the 18650 battery and prolonging its lifespan. The SX1308 step-up converter stabilizes the voltage at 5V, preventing fluctuations that could affect the Arduino and its peripherals. The SPST switch provides manual control, allowing users to turn off the system when not in use, thereby conserving battery life. Additionally, using the breadboard's power rails ensures consistent and reliable distribution of power to all components, including the LCD, RFID module, RTC module, and SD card module. Overall, this configuration guarantees a safe, stable, and efficient power supply for the AttenDuino system, optimizing battery efficiency while ensuring extended usage and reliability.

Table 8

Power Distribution Table of the Power Supply of the AttenDuino

START	END
Battery Holder (+)	TP4056 B+
Battery Holder (-)	TP4056 B-
1S Power Indicator B+	TP4056 B+
1S Power Indicator B-	TP4056 B-
TP4056 OUT+	SPST SWITCH Common (C) Terminal

SPST SWITCH Normally Open (NO) Terminal	SX1308 IN+
TP4056 OUT-	SX1308 IN- (Battery GND)
SX1308 IN+	SPST SWITCH Common (C) Terminal (Connected to TP4056 OUT+)
SX1308 IN-	TP4056 OUT- (Battery GND)
SX1308 OUT+	BREADBOARD Positive (+) Rail (5V Line)
SX1308 OUT-	BREADBOARD Ground (-) Rail (GND Line)
BREADBOARD Positive (+) Rail	ARDUINO 5V Pin
BREADBOARD Ground (-) Rail	ARDUINO GND Pin

The power distribution table of the AttenDuino provides a structured overview of the power connections within the prototype, detailing the flow of electricity from the battery to each module. By systematically listing the starting and ending points of each connection, the table ensures proper wiring, accurate power distribution, and efficient circuit assembly. This reference helps in verifying connections, preventing wiring errors, and facilitating troubleshooting during the development and testing of the system.

Software Development and Simulation

The AttenDuino system relies on the seamless integration of several Arduino-compatible modules to ensure optimal functionality and performance. The software system of the device plays a critical role in managing its input, processing, output, and control functions. To achieve this, the system is categorized into three main parts: (1) Installation of the Arduino IDE, which serves as the development environment for coding and uploading programs to the Arduino microcontroller; (2) Programming of the Interconnected Modules, including the RFID scanner module, Micro SD Card module, RTC module, and LCD module, to function cohesively as a system; and (3) Exportation of attendance data using the Micro SD Card module to upload to Microsoft Excel, enabling the storage and retrieval of information for record-keeping purposes. Each component is programmed to perform its specific role while maintaining synchronization with the overall system to deliver reliable and efficient service.

Installation of the Arduino IDE

The Arduino IDE (Integrated Development Environment) is a user-friendly software for programming Arduino boards. It allows users to write, compile, and upload code (sketches) using a simplified version of C++. With built-in libraries and debugging tools, it enables interaction with hardware components like sensors and displays. Accessible even to beginners, the Arduino IDE is essential for developing and deploying custom Arduino projects.

Figure 11

Installing the Arduino IDE

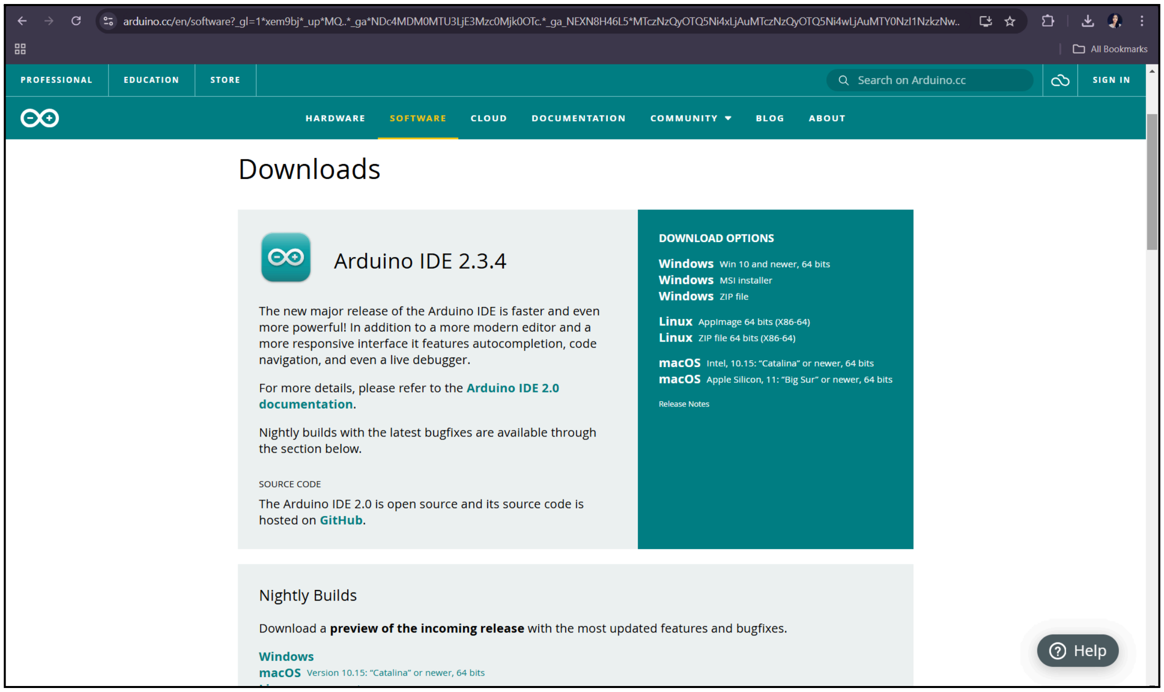


Figure 11 shows the site where the Arduino IDE is downloadable from. The Arduino IDE can be downloaded from the official Arduino website. To download, navigate to the "Software" section on the website, where you will find the latest version of the IDE available for various operating systems, including Windows, macOS, and Linux. Select the version compatible with your operating system, and click on the download link. Once the file is downloaded, follow the installation instructions provided on the website or within the downloaded file to install the IDE on your computer. The process is straightforward, and after installation, the IDE will be ready to use for writing and uploading programs to your Arduino board.

Programming of the Interconnected Modules

Coding all the modules together as a cohesive system, rather than programming them separately, ensures seamless integration and communication among the components. When modules such as the RFID scanner, Micro SD card, RTC, and LCD are programmed together, they can work synchronously to perform tasks efficiently without conflicts or delays. For example, the RFID scanner can capture user data, the RTC can timestamp the event, the LCD can display the information in real time, and the Micro SD card can save the data—all in a coordinated manner. This approach eliminates potential compatibility issues that might arise if each module were programmed in isolation, as the shared resources (e.g., pins and communication protocols) are managed holistically. Additionally, combining the modules into a single program allows for centralized error handling and easier debugging, ensuring the system operates reliably and meets the desired performance standards.

Figure 12

Complete Code for the AttenDuino Software Including All Modules

```
#include <SPI.h>              // SPI communication library for RFID and SD card
#include <MFRC522.h>          // RFID library
#include <Wire.h>             // Library for I2C communication
#include <LiquidCrystal_I2C.h> // Library for I2C LCD
#include <RTClib.h>           // Real-time clock library
#include <Arduino.h>          // Standard Arduino library
#include <SD.h>               // SD card library for file operations

#define SS_PIN 3            // Slave Select pin for RFID
#define RST_PIN 2           // Reset pin for RFID
#define LED_PIN 8           // LED pin for feedback
#define SD_CS_PIN 10        // Chip select pin for SD card

MFRC522 mfrc522(SS_PIN, RST_PIN);  // Create an instance of the RFID reader
RTC_DS3231 rtc;                    // Create an instance of the DS3231 RTC
LiquidCrystal_I2C lcd(0x27, 16, 2); // Set up the LCD with I2C address

// Array of valid RFID UIDs (Unique Identifier) for students
byte validUIDs[][4] = {
  {0x2D, 0xB3, 0x9A, 0x3F},  // UID of student 1
  {0x26, 0x27, 0xCA, 0xC6},  // UID of student 2
  {0x7D, 0xAF, 0xBB, 0x3F},  // UID of student 3
  {0x96, 0x26, 0xC9, 0xC6},  // UID of student 4
  {0x7E, 0x4C, 0x31, 0x60},  // UID of student 5
};

// Names corresponding to each student's UID
const char* studentNames[] = {
  "NISHA TOLENTINO",
  "JANSSEN HUGO",
  "NEZEL BAYNOSA",
  "XYMON LOPEZ",
  "PAUL BIARES",
};

struct Schedule {
  int startHour;
  int startMinute;
  int endHour;
  int endMinute;
};

Schedule schedules[] = {
  {7, 20, 7, 35}, {7, 35, 8, 35}, {9, 5, 10, 5}, {10, 5, 11, 5}, {11, 5, 12, 5},
  {13, 10, 14, 10}, {14, 30, 15, 30}, {15, 30, 16, 30}, {16, 30, 17, 30}
};

void setup() {
  Serial.begin(9600);
  SPI.begin();
  mfrc522.PCD_Init();
  lcd.begin(16, 2);
  lcd.init();
  lcd.backlight();
  lcd.clear();
  lcd.setCursor(2, 0);
```

```
  lcd.print("Scan ID card");
  pinMode(LED_PIN, OUTPUT);

  if (!rtc.begin()) {
    Serial.println("RTC initialization failed!");
    lcd.setCursor(0, 1);
    lcd.print("RTC Init Failed");
    while (1);
  }
  if (rtc.lostPower()) {
    rtc.adjust(DateTime(F(__DATE__), F(__TIME__)));
  }

  if (!SD.begin(SD_CS_PIN)) {
    Serial.println("SD card initialization failed!");
    lcd.setCursor(0, 1);
    lcd.print("SD Init Failed!");
    while (1);
  }
  Serial.println("SD card initialized successfully.");
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Ready to scan!");
}

void loop() {
  if (mfrc522.PICC_IsNewCardPresent() && mfrc522.PICC_ReadCardSerial()) {
    String content = "";
    for (byte i = 0; i < mfrc522.uid.size; i++) {
      content.concat(String(mfrc522.uid.uidByte[i] < 0x10 ? "0" : ""));
      content.concat(String(mfrc522.uid.uidByte[i], HEX));
    }
    content.toUpperCase();

    bool uidMatched = false;
    int studentIndex = -1;
    for (int i = 0; i < sizeof(validUIDs) / sizeof(validUIDs[0]); i++) {
      if (memcmp(mfrc522.uid.uidByte, validUIDs[i], mfrc522.uid.size) == 0) {
        uidMatched = true;
        studentIndex = i;
        break;
      }
    }

     if (uidMatched) {
       DateTime now = rtc.now();
       const char* status = getAttendanceStatus(now.hour(), now.minute());
       digitalWrite(LED_PIN, HIGH);
       delay(1000);
       digitalWrite(LED_PIN, LOW);
       updateAttendance(studentIndex + 1, status, now);
       delay(3000);
     } else {
       lcd.clear();
       lcd.setCursor(0, 0);
       lcd.print("ID doesn't match");
       delay(2000);
     }

     lcd.clear();
     lcd.setCursor(2, 0);
     lcd.print("Scan ID card");
```

```
    mfrc522.PICC_HaltA();
    mfrc522.PCD_StopCrypto1();
  }
}

const char* getAttendanceStatus(int hour, int minute) {
  for (Schedule sched : schedules) {
    if (hour == sched.startHour && minute >= sched.startMinute && minute <
    sched.startMinute + 10) { //connect with previous line
      return "Present";
    } else if (hour == sched.startHour && minute >= sched.startMinute + 10
     && minute < sched.startMinute + 20) { //connect with previous line
      return "Late";
    } else if ((hour == sched.startHour && minute >= sched.startMinute + 20) ||
     (hour > sched.startHour && hour < sched.endHour) || (hour == sched.endHour
     && minute <= sched.endMinute)) { //connect lines 133 and 134 with line 132
      return "Absent";
    }
  }
  return "No Class";
}

void updateAttendance(int studentID, const char* status, DateTime timestamp) {
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print(studentNames[studentID - 1]);
  lcd.setCursor(0, 1);
  lcd.print(status);
  lcd.setCursor(8, 1);
  lcd.print(timestamp.hour(), DEC);
  lcd.print(":");
  lcd.print(timestamp.minute(), DEC);

  char filename[12];
  sprintf(filename, "%02d-%02d-%02d.txt", timestamp.year() % 100, timestamp.month(),
     timestamp.day()); //connect with previous line

  File dataFile = SD.open(filename, FILE_WRITE);
  if (dataFile) {
    dataFile.print(studentNames[studentID - 1]);
    dataFile.print(",");
    dataFile.print(status);
    dataFile.print(",");
    dataFile.print(timestamp.hour());
    dataFile.print(":");
    dataFile.print(timestamp.minute());
    dataFile.println();
    dataFile.close();
    Serial.println("Attendance logged successfully!");
  } else {
    Serial.println("Error opening file!");
    lcd.setCursor(0, 1);
    lcd.print("SD Write Failed");
    delay(2000);
  }
}
```

Figure 12 shows the entire code used to program the AttenDuino prototype. The code is organized in a way that allows both administrators and users to identify which parts of the code correspond to which module of the AttenDuino. The code has also been simplified according to the researchers' knowledge of the C++ coding language from their previous studies with their Information and Communication Technology (ICT) subject, Technology and Livelihood Education-Computer System Servicing (TLE-CSS) subject, and Robotics subject.

Exportation of Attendance Data

When the micro SD card is inserted into a compatible device, the data stored in the micro SD card module is accessed and converted into a structured file format. Specifically, the recorded attendance data is saved in a text (.txt) file or a comma-separated values (.csv) file, ensuring compatibility with a wide range of applications. The CSV format organizes data into a tabular structure, where each value is separated by a comma, making it easy to interpret and process in spreadsheet software. Once accessed, the CSV or TXT file can be opened and read using Microsoft Excel, which automatically recognizes the format and presents the data in an organized tabular view. Microsoft Excel also allows for automatic sorting, filtering, and formatting of the recorded information. The formatted data can then be saved as an exportable file, which can be converted into different formats, including PDF (.pdf), ensuring accessibility, readability, and ease of sharing across multiple platforms.

Figure 13

CSV/txt File Format in Microsoft Excel

Student: NISHA TOLENTINO	UID: 2627CAC6	Status: Present	Date: 2024/12/26	Time: 10:45	Student: JANSSEN HUGO	0
Student: NISHA TOLENTINO	UID: 7DAFBB3F	Status: Present	Date: 2024/12/26	Time: 11:00	Student: PAUL BIARES	7
Student: NISHA TOLENTINO		Status: Present			Student: XYMON LOPEZ	4
Student: NISHA TOLENTINO		Status: Present			Student: NEZEL BAYNOSA	7
Student: NISHA TOLENTINO		Status: Present				
Student: NISHA TOLENTINO		Status: Present			TOTAL OF PRESENT	33
Student: NISHA TOLENTINO		Status: Present			TOTAL NO. LATE	3
Student: NISHA TOLENTINO		Status: Present			ABSENTS	1
		Status: Present				
Student: NISHA TOLENTINO		Status: Present				
Student: NISHA TOLENTINO		Status: Present				
Student: NISHA TOLENTINO		Status: Present				
Student: NISHA TOLENTINO		Status: Present				
Student: NISHA TOLENTINO		Status: Present				
Student: NISHA TOLENTINO		Status: Present				
Student: NEZEL BAYNOSA		Status: Present				
Student: PAUL BIARES		Status: Present				
Student: XYMON LOPEZ		Status: Late				
		Status: Present				
Student: PAUL BIARES		Status: Late				
Student: NEZEL BAYNOSA		Status: Present				
Student: PAUL BIARES		Status: Present				
Student: NEZEL BAYNOSA		Status: Present				
Student: PAUL BIARES		Status: Present				
Student: PAUL BIARES		Status: Present				
Student: NEZEL BAYNOSA		Status: Present				
Student: PAUL BIARES		Status: Present				
Student: XYMON LOPEZ		Status: Present				
Student: PAUL BIARES		Status: Late				
Student: NEZEL BAYNOSA		Status: Present				
Student: NEZEL BAYNOSA		Status: Present				
Student: XYMON LOPEZ		Status: Present				
		Status: Present				

The AttenDuino system exports attendance records via an SD card in CSV/txt format. Each file corresponds to a specific class schedule, such as a General Chemistry class, and organizes data into columns: student name, unique identifier (UID), attendance status, date, and time logged in. This format ensures the data is easy to view and analyze.

Class Secretary-Respondents' Evaluation of Using the Pen-and-Paper Method as the Primary Attendance Recording Method Used in Universidad de Sta. Isabel of Pili, Inc.

Table 9

Class Secretaries' Issues Faced with Using the Pen-and-Paper Method for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
Recording attendance with pen-and-paper is time-consuming.	2.6	Agree
Recording attendance with the pen-and-paper method is prone to mistakes or incomplete data.	2.6	Agree
Organizing attendance sheets using the pen-and-paper method can be confusing.	2.6	Agree
Correcting attendance errors in the pen-and-paper records is messy and tedious.	3.0	Agree
Taking attendance with pen and paper often interrupts class activities.	3.0	Agree
Weighted Mean	**2.76**	**Agree**

According to the data gathered from the 23 class secretaries for the first statement, "Recording attendance with pen-and-paper is time-consuming.", nine (9) respondents strongly agreed, three (3) agreed, five (5) disagreed, and six (6) strongly disagreed. This yields a weighted mean of 2.6, which indicates that the participants generally "Agree" that this method is time-consuming, although a few respondents believe that it is not.

Similarly, in the second statement, "Recording attendance with the pen-and-paper method is prone to mistakes or incomplete data.", the same weighted mean of 2.6 was obtained with four (4) respondents strongly agreeing, nine (9) agreeing, six (6) disagreeing, and four (4) strongly disagreeing, showing that participants "Agree" with the statement, reflecting concerns about the accuracy of data recorded through this method.

For the third statement, "Organizing attendance sheets using the pen-and-paper method can be confusing.", five (5) strongly agreed, seven (7) who agreed, eight (8) disagreed, and three (3) strongly disagreed, yielding a weighted mean of 2.6, which signifies a general agreement among the respondents, with some participants expressing difficulties in organizing attendance sheets.

For the fourth statement, "Correcting attendance errors in the pen-and-paper records is messy and tedious.", 10 respondents strongly agreed, seven (7) agreed, two (2) disagreed, and four (4) strongly disagreed. This results in a higher weighted mean of 3.0, which corresponds to "Agree" indicating that most participants experience significant challenges with correcting errors.

Lastly, for the statement, "Taking attendance with pen and paper often interrupts class activities.", nine (9) respondents strongly agreed, five (5) agreed, eight (8) disagreed, and one (1) strongly disagreed. The weighted mean of 3.0 signifies that participants "Agree" that this method interferes with classroom activities.

Overall, the summarized results reveal an average weighted mean of 2.76, which is interpreted as "Agree". This suggests that the participants find the pen-and-paper method inconvenient, particularly in terms of time consumption and error correction.

Table 10

Class Secretaries' Data Exportation Experiences with Using the Pen-and-Paper Method for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
The pen-and-paper method allows for easily finalized attendance sheets without errors.	2.8	Agree
Managing and organizing attendance records with pen and paper requires significant effort.	3.6	Strongly Agree
I find it difficult to retrieve past attendance records when using the pen-and-paper method.	3.0	Agree
Records using the pen-and-paper method are often lost or misplaced.	3.0	Agree
The pen-and-paper method provides a reliable system for exporting attendance data.	3.0	Agree
Weighted Mean	**3.08**	**Agree**

For the first statement, "The pen-and-paper method allows for easily finalized attendance sheets without errors.", five (5) respondents strongly agreed, nine (9) agreed, another nine (9) disagreed, and none strongly disagreed. This yields a weighted mean of 2.8, which indicates that participants "Agree" that the pen-and-paper method aids in finalizing attendance sheets, despite some participants reporting difficulties.

In the second statement, "Managing and organizing attendance records with pen and paper requires significant effort.", 14 respondents strongly agreed, eight (8) agreed, one (1) disagreed, and none disagreed. The weighted mean of 3.6, interpreted as "Strongly Agree" reflects that the majority of participants perceive record management as a tedious task.

For the third statement, "I find it difficult to retrieve past attendance records when using the pen-and-paper method.", nine (9) respondents strongly agreed, six (6) agreed, seven (7) disagreed, and one (1) strongly disagreed. This results in a weighted mean of 3.0, interpreted as "Agree" highlighting that retrieving records is a recurring issue.

For the fourth statement, "Records using the pen-and-paper method are often lost or misplaced.", seven (7) strongly agreed, 11 agreed, four (4) disagreed and one (1) strongly disagreed. The weighted mean of 3.0, interpreted as "Agree" underscores the risk of records being lost or misplaced in this method.

Lastly, for the statement, "The pen-and-paper method provides a reliable system for exporting attendance data.", four (4) respondents strongly agreed, 14 agreed, five (5) disagreed, and none strongly disagreed. The weighted mean of 3.0, interpreted as

"Agree" reflects some skepticism about the reliability of this method for data exportation.

Overall, the section’s weighted mean of 3.08 signifies "Strongly Agree" indicating that participants face challenges in exporting, organizing, and retrieving data.

Table 11

Class Secretaries’ Observations Regarding Recording Accuracy with Using the Pen-and-Paper Method for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
The pen-and-paper method accurately reflects student attendance.	3.2	Agree
Discrepancies in attendance records are common with the pen-and-paper method.	3.1	Agree
Correcting errors in attendance records is challenging when using the pen-and-paper method.	3.2	Agree
The pen-and-paper method ensures accurate tracking of tardy, present, or absent students.	3.2	Agree
Attendance records are prone to missing entries when using the pen-and-paper method.	2.9	Agree
Weighted Mean	**3.12**	**Agree**

For the statement, "The pen-and-paper method accurately reflects student attendance.", nine (9) respondents strongly agreed, 10 agreed, four (4) disagreed, and none strongly disagreed. The weighted mean of 3.2, interpreted as "Agree" indicates that while participants find the method accurate overall, a few still encounter discrepancies.

For the second statement, "Discrepancies in attendance records are common with the pen-and-paper method.", five (5) strongly agreed, 15 agreed, three (3) disagreed, and none strongly disagreed. The weighted mean of 3.1, interpreted as "Agree" highlights the frequent occurrence of errors or inconsistencies.

Similarly, for "Correcting errors in attendance records is challenging when using the pen-and-paper method.", eight (8) respondents strongly agreed, twelve (12) agreed, three (3) disagreed, and none strongly disagreed. The weighted mean of 3.2 signifies "Agree" reflecting difficulties in rectifying errors.

For the fourth statement, "The pen-and-paper method ensures accurate tracking of tardy, present, or absent students.", seven (7) strongly agreed, 14 agreed, two (2) disagreed, and none strongly disagreed. The weighted mean of 3.2, interpreted as "Agree" emphasizes confidence in tracking attendance statuses accurately.

Lastly, for "Attendance records are prone to missing entries when using the pen-and-paper method.", six (6) strongly agreed, nine (9) agreed, seven (7) disagreed, and one (1) strongly disagreed. The weighted mean of 2.9, interpreted as "Agree" shows that missing entries remain a concern for some participants.

The overall weighted mean of 3.12 signifies "Agree" suggesting that accuracy issues such as discrepancies, missing entries, and error correction are common challenges with this method.

Table 12

Class Secretaries' Time Efficiency Observations with Using the Pen-and-Paper Method for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
Recording attendance with pen-and-paper is quick and efficient.	2.6	Agree
The pen-and-paper method does not delay other classroom activities.	2.4	Disagree
The process of recording attendance is consistent and smooth when using the pen-and-paper method.	2.7	Agree
The pen-and-paper method reduces the time I spend on attendance tasks.	2.5	Agree
The pen-and-paper method reduces time spent on attendance-related tasks.	2.6	Agree
Weighted Mean	**2.56**	**Agree**

For the first statement, "Recording attendance with pen-and-paper is quick and efficient.", two (2) respondents strongly agreed, 12 agreed, seven (7) disagreed, and two (2) strongly disagreed. The weighted mean of 2.6, interpreted as "Agree" shows moderate approval of the method’s efficiency.

The second statement, "The pen-and-paper method does not delay other classroom activities.", received three (3) strongly agrees, six (6) agrees, 11 disagrees, and three (3) strongly disagree responses. The weighted mean of 2.4, interpreted as "Disagree" suggests that delays are a concern for many participants.

For the statement, "The process of recording attendance is consistent and smooth when using the pen-and-paper method.", three (3) respondents strongly agreed, nine (9) agreed, 11 disagreed, and none strongly disagreed. The weighted mean of 2.7, interpreted as "Agree" reflects some inconsistencies in the process.

In the fourth statement, "The pen-and-paper method reduces the time I spend on attendance tasks.", one (1) strongly agreed, 10 agreed, 12 disagreed, and none strongly disagreed. The weighted mean of 2.5, interpreted as "Agree" suggests mixed perceptions of time efficiency.

Lastly, for "The pen-and-paper method reduces time spent on attendance-related tasks.", one (1) respondent strongly agreed, 12 agreed, 10 disagreed, and none strongly disagreed. The weighted mean of 2.6, interpreted as "Agree" highlights varied experiences with time-saving aspects of the method.

Overall, the section’s weighted mean of 2.56 signifies "Agree" reflecting that while some find the method efficient, many still encounter delays and inefficiencies.

Table 13

Class Secretaries' Evaluation of the Long-term Convenience of Using the Pen-and-Paper Method for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
The pen-and-paper method is convenient for attendance recording over time.	2.9	Agree
The steps involved in the pen-and-paper method are straightforward and simple.	3.1	Agree
Using the pen-and-paper method for attendance recording is simple and manageable.	3.3	Strongly Agree
Paper-based records are easy to store and access over time.	2.6	Agree
Paper-based records are efficient to use for managing long-term attendance data.	3.0	Agree
Weighted Mean	**2.98**	**Agree**

For the statement, "The pen-and-paper method is convenient for attendance recording over time.", five (5) respondents strongly agreed, 11 agreed, six (6) disagreed and one (1) strongly disagreed. The weighted mean of 2.9, interpreted as "Agree" shows a moderate level of convenience.

The second statement, "The steps involved in the pen-and-paper method are straightforward and simple.", received seven (7) strongly agrees, 12 agrees, four (4) disagree responses, and none strongly disagreed. The weighted mean of 3.1, interpreted as "Agree.”, suggests general simplicity.

For "Using the pen-and-paper method for attendance recording is simple and manageable.", nine (9) respondents strongly agreed, 12 agreed, two (2) disagreed, and none strongly disagreed. The weighted mean of 3.3, interpreted as "Strongly Agree" highlights simplicity.

For "Paper-based records are easy to store and access over time.", two (2) strongly agreed, 12 agreed, seven (7) disagreed and two (2) strongly disagreed. The weighted mean of 2.6, interpreted as "Agree" indicates concerns about accessibility.

Lastly, "Paper-based records are efficient to use for managing long-term attendance data.", had eight (8) strongly agrees, eight (8) agrees, seven (7) disagrees, and no strongly disagree responses. The weighted mean of 3.0, interpreted as " Agree" highlights agreement among the majority.

The overall section weighted mean of 2.98 is interpreted as "Agree" suggesting that the pen-and-paper method remains a practical choice for some participants when recording attendance over long periods.

Class Secretary-Respondents' Evaluation of Using the AttenDuino System as the Primary Attendance Recording Method Used in Universidad de Sta. Isabel of Pili, Inc. Inc.

Table 14

Class Secretaries' Issues Faced with Using the AttenDuino System for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
Recording attendance with the AttenDuino is less time-consuming than the pen-and-paper method.	3.5	Strongly Agree
Recording attendance with the AttenDuino system is less prone to mistakes or incomplete data compared to the pen-and-paper method.	3.3	Strongly Agree
Organizing attendance records using the AttenDuino system is straightforward.	3.4	Strongly Agree
Correcting errors in AttenDuino records is manageable and efficient.	3.81	Strongly Agree
Taking attendance with the AttenDuino system rarely disrupts class activities.	3.3	Strongly Agree
Weighted Mean	**3.47**	**Strongly Agree**

For the statement, "Recording attendance with the AttenDuino is less time-consuming than the pen-and-paper method.", 13 respondents strongly agreed, nine (9) agreed, one (1) disagreed, and none strongly disagreed. The weighted mean of 3.5, interpreted as "Strongly Agree" highlights that most respondents found the system significantly more efficient in terms of time management.

The second statement, "Recording attendance with the AttenDuino system is less prone to mistakes or incomplete data compared to the pen-and-paper method.", was rated with 10 respondents strongly agreeing, 11 agreeing, two (2) disagreeing, and none strongly disagreeing. This yielded a weighted mean of 3.3, also interpreted as "Strongly Agree" reflecting participants' trust in the system's accuracy.

For the statement, "Organizing attendance records using the AttenDuino system is straightforward." 11 respondents strongly agreed, 10 agreed, two (2) disagreed, and none strongly disagreed. The resulting weighted mean of 3.4 signifies "Strongly Agree" indicating that the majority found the system user-friendly for managing attendance records.

The fourth statement, "Correcting errors in AttenDuino records is manageable and efficient.", had 18 respondents strongly agreeing, five (5) agreeing, and none disagreeing nor strongly disagreeing. The weighted mean of 3.8, interpreted as "Strongly Agree" demonstrates that most respondents considered the system effective for error correction.

Finally, for the statement, "Taking attendance with the AttenDuino system rarely disrupts class activities.", 12 respondents strongly agreed, seven (7) agreed, three (3) disagreed, and one (1) strongly disagreed. The weighted mean of 3.3, corresponding to

"Strongly Agree" indicates that the system minimizes interruptions to classroom activities.

Overall, the results for this table yield an average weighted mean of 3.47, interpreted as "Strongly Agree" confirming the AttenDuino system's ability to address common issues associated with attendance recording effectively.

Table 15

Class Secretaries' Data Exportation Experiences with Using the AttenDuino System for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
Attendance data exported by the AttenDuino system is easy to interpret.	3.8	Strongly Agree
Attendance data exported by the AttenDuino system is easy to interpret.	3.5	Strongly Agree
Managing and organizing digital records in the AttenDuino system is efficient.	3.7	Strongly Agree
Retrieving past attendance records from AttenDuino exported files is easier than retrieving paper documents.	3.4	Strongly Agree
Lost or misplaced records are rare with the AttenDuino system.	3.4	Strongly Agree
Weighted Mean	**3.57**	**Strongly Agree**

For the statement, "Attendance data exported by the AttenDuino system is easy to interpret.", 19 respondents strongly agreed, four (4) agreed, none disagreed, and none strongly disagreed. The weighted mean of 3.8, interpreted as "Strongly Agree" shows that participants found the exported data clear and understandable.

The second statement, "The AttenDuino system minimizes errors in finalized attendance records.", received ratings of 13 strongly agreeing, nine (9) agreeing, and one (1) disagreeing, with no responses for strongly disagreeing. This led to a weighted mean of 3.5, also interpreted as "Strongly Agree" reflecting the system's reliability in producing accurate records.

For the statement, "Managing and organizing digital records in the AttenDuino system is efficient.", 15 respondents strongly agreed, eight (8) agreed, and none disagreed or strongly disagreed. The weighted mean of 3.7 signifies "Strongly Agree" indicating efficiency in digital record management.

The fourth statement, "Retrieving past attendance records from AttenDuino exported files is easier than retrieving paper documents.", had 10 respondents strongly agreeing, 13 agreeing, and none disagreed or strongly disagreed. The resulting weighted mean of 3.4, interpreted as "Strongly Agree" highlights the ease of accessing past records digitally.

Lastly, for the statement, "Lost or misplaced records are rare with the AttenDuino system.", 11 respondents strongly agreed, 11 agreed, one (1) disagreed, and none strongly disagreed. The weighted mean of 3.4, corresponding to "Strongly Agree" underscores the system's reliability in record management.

Overall, the average weighted mean for this table is 3.57, interpreted as "Strongly Agree" indicating that the AttenDuino system significantly improves data exportation and management processes.

Table 16

Class Secretaries' Observations Regarding Recording Accuracy with Using the AttenDuino System for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
Attendance discrepancies are minimal with the AttenDuino system.	3.3	Strongly Agree
The AttenDuino system is effective at preventing errors in attendance records.	3.7	Strongly Agree
Correcting errors in AttenDuino records is manageable and efficient.	3.7	Strongly Agree
The AttenDuino system ensures accurate tracking of tardy, present, or absent students.	3.5	Strongly Agree
Attendance records generated by the AttenDuino system are complete and free from missing entries.	3.5	Strongly Agree
Weighted Mean	**3.53**	**Strongly Agree**

For the statement, "Attendance discrepancies are minimal with the AttenDuino system.", nine (9) respondents strongly agreed, 12 agreed, and two (2) disagreed, with none strongly disagreeing. The weighted mean of 3.3, interpreted as "Strongly Agree" reflects confidence in the system's ability to minimize errors.

The second statement, "The AttenDuino system effectively prevents errors in attendance records.", had 16 respondents strongly agreeing, seven (7) agreeing, and none disagreeing or strongly disagreeing. The weighted mean of 3.7 corresponds to "Strongly Agree" indicating that the system ensures error-free records.

For the statement, "Correcting errors efficiently in the AttenDuino system is possible.", 15 respondents strongly agreed, eight (8) agreed, and none disagreed or strongly disagreed. The weighted mean of 3.7, interpreted as "Strongly Agree" highlights the system's effectiveness in addressing errors.

The fourth statement, "The AttenDuino system ensures accurate tracking of tardy, present, or absent students.", received 12 respondents strongly agreeing, 10 agreeing, and one (1) disagreeing, with no strongly disagreeing responses. The weighted mean of 3.5 reflects "Strongly Agree."

Lastly, for the statement, "Attendance records generated by the AttenDuino system are complete and free from missing entries.", 13 respondents strongly agreed, nine (9) agreed, and one (1) disagreed, with none strongly disagreeing. The weighted mean of 3.5, corresponding to "Strongly Agree" emphasizes the system's ability to produce complete records.

Overall, the average weighted mean for this table is 3.53, interpreted as "Strongly Agree" signifying that the AttenDuino system ensures high accuracy in attendance recording.

Table 17

Class Secretaries' Time Efficiency Observations with Using the AttenDuino for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
Recording attendance with the AttenDuino system is quick and effective.	3.6	Strongly Agree
The AttenDuino system does not delay other classroom activities.	3.7	Strongly Agree
The process of recording attendance is consistent and smooth with the AttenDuino system.	3.5	Strongly Agree
The AttenDuino system reduces the time I spend on attendance tasks.	3.5	Strongly Agree
The AttenDuino system reduces time spent on attendance-related tasks.	3.5	Strongly Agree
Weighted Mean	**3.57**	**Strongly Agree**

For the statement, "Recording attendance with the AttenDuino system is quick and effective.", 14 respondents strongly agreed, nine (9) agreed, and none disagreed or strongly disagreed. The weighted mean is 3.6, interpreted as "Strongly Agree" indicating that participants found the system efficient for recording attendance in a timely manner.

The second statement, "The AttenDuino system does not delay other classroom activities.", was rated with 15 respondents strongly agreeing, eight (8) agreeing, and none disagreeing or strongly disagreeing. This yielded a weighted mean of 3.7, interpreted as "Strongly Agree" highlighting the system's ability to avoid disruptions during class.

For the statement, "The AttenDuino is consistent and smooth with the AttenDuino system.", 12 respondents strongly agreed, 11 agreed, and no one answered disagreed or strongly disagreed. The weighted mean is 3.5, reflecting "Strongly Agree" and highlighting the system's streamlined nature.

The fourth statement, "The AttenDuino system reduces the time I spent on attendance tasks.", received 13 respondents strongly agreeing, nine (9) agreeing, and one (1) disagreeing, with none strongly disagreeing. The weighted mean is 3.5, interpreted as "Strongly Agree."

Lastly, for the statement, "The AttenDuino system reduces time spent on attendance-related tasks.", 12 respondents strongly agreed, 11 agreed, and no one answered disagreed or strongly disagreeing. The weighted mean of 3.5, corresponding to "Strongly Agree" emphasizes the system's ability to produce complete records.

Overall, the average weighted mean for this table is 3.57, affirming that the AttenDuino system significantly enhances time efficiency in attendance recording.

Table 18

Class Secretaries' Evaluation of the Long-term Convenience of Using the AttenDuino System for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
The AttenDuino system is convenient for attendance recording over time.	3.4	Strongly Agree
The steps involved in the AttenDuino system are straightforward and simple.	3.3	Strongly Agree
Using the AttenDuino system for attendance recording is simple and manageable.	3.5	Strongly Agree
Digital-based records are easy to store and access over time.	3.4	Strongly Agree
Digital-based records are efficient to use for managing long-term attendance data.	3.5	Strongly Agree
Weighted Mean	**3.44**	**Strongly Agree**

For the statement, "The AttenDuino system is convenient for attendance recording over time.", 14 respondents strongly agreed, five (5) agreed, and four (4) disagreed, with no responses for strongly disagreeing. The weighted mean is 3.4, interpreted as "Strongly Agree" indicating that the system provides long-term usability.

The second statement, "The steps in the AttenDuino system are simple and easy to follow." had nine (9) respondents strongly agreeing, 12 agreeing, and two (2) disagreeing, with none strongly disagreeing. The weighted mean of 3.3 suggests that the system's steps are user-friendly.

For the statement, "Using the AttenDuino system for attendance recording is simple and manageable.", 12 respondents strongly agreed, 11 agreed, with no responses for disagreeing or strongly disagreeing responses. The weighted mean is 3.5, interpreted as "Strongly Agree" reflecting ease of use.

The fourth statement, "Digital-based records are easy to store and access over time.", had 11 respondents strongly agreeing, 11 agreeing, and one (1) disagreeing, with no responses for strongly disagreeing. The weighted mean of 3.4 highlights the system's practicality for long-term data storage.

Finally, for the statement, "The AttenDuino system is efficient for managing long-term attendance data.", 12 respondents strongly agreed, 11 agreed, with no responses for disagreeing or strongly disagreeing. The weighted mean of 3.5 underscores the system's reliability for long-term attendance management.

Overall, the average weighted mean for this table is 3.44, interpreted as "Strongly Agree" indicating that the AttenDuino system is a sustainable solution for attendance recording.

Table 19

Class Secretaries' Declaration of Preference of Using Either the Pen-and-Paper Method or AttenDuino System for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
I find the AttenDuino system easier to use than the pen-and-paper method.	3.5	Strongly Agree
I find the AttenDuino system easier to use than the pen-and-paper method.	3.5	Strongly Agree
I prefer using the AttenDuino system over the pen-and-paper method.	3.5	Strongly Agree
The AttenDuino system saves more time compared to the pen-and-paper method.	3.6	Strongly Agree
The AttenDuino system provides more accurate attendance data than the pen-and-paper method.	3.8	Strongly Agree
Weighted Mean	**3.57**	**Strongly Agree**

For the statement, "I find the AttenDuino system easier to use than the pen-and-paper method.", 13 respondents strongly agreed, eight (8) agreed, two (2) disagreed, and none strongly disagreed. The weighted mean of 3.5, interpreted as "Strongly Agree" indicates that most participants preferred the system's ease of use.

The second statement, "The AttenDuino system is more convenient than the pen-and-paper method.", received ratings of 13 strongly agreeing, eight (8) agreeing, and two (2) disagreeing, with none strongly disagreeing. This yielded a weighted mean of 3.5, corresponding to "Strongly Agree" emphasizing the system's convenience.

For the statement, "I prefer using the AttenDuino system over the pen-and-paper method.", 14 respondents strongly agreed, seven (7) agreed, two (2) disagreed, and none strongly disagreed. The weighted mean of 3.5 reflects "Strongly Agree" highlighting participants' clear preference for the system.

The fourth statement, "The AttenDuino system saves more time compared to the pen-and-paper method.", had 14 respondents strongly agreeing, eight (8) agreeing, and one (1) disagreeing, with none strongly disagreeing. The weighted mean of 3.6 signifies "Strongly Agree" emphasizing the time-saving benefits of the system.

Finally, for the statement, "The AttenDuino system provides more accurate attendance data than the pen-and-paper method.", 19 respondents strongly agreed, three (3) agreed, one (1) disagreed, and none strongly disagreed. The weighted mean of 3.8, interpreted as "Strongly Agree" demonstrates participants' trust in the system's accuracy.

Overall, the average weighted mean for this table is 3.62, interpreted as "Strongly Agree" confirming the strong preference for the AttenDuino system over the traditional pen-and-paper method.

Statistical Comparison of Class Secretary-Respondents' Overall Evaluation of Using the AttenDuino System as an Alternative Attendance Recording Method to the Pen-and-Paper Method Used in Universidad de Sta. Isabel of Pili, Inc.

Table 20

Class Secretaries' Experiences with Using Either Methods in Terms of Issues Faced

STATISTICS	VALUE
Pretest Mean	2.76
Posttest Mean	3.47
Mean Difference ($\bar{d}$)	0.713
Standard Deviation (S_d)	1
T-Statistics (t)	3.420
P-Value	<0.05
Conclusion	$\mathbf{H_1}$

The analysis for Section 1 of the questionnaires focuses on the ability of each attendance recording system or method to address common challenges encountered in attendance recording. The pretest mean score (M = 2.76, SD = 1) reflects the limitations of the traditional pen-and-paper method, such as time consumption and error management. In contrast, the posttest mean score (M = 3.47, SD = 1) indicates significant improvement with the AttenDuino system. The paired t-test revealed a statistically significant mean difference of 0.713 and a t-statistic of 3.420, supporting the conclusion that the AttenDuino system effectively reduces issues faced in attendance recording.

Table 21

Class Secretaries' Experiences with Using Either Methods in Terms of Data Exportation

STATISTICS	VALUE
Pretest Mean	3.08
Posttest Mean	3.57
Mean Difference ($\overline{d}$)	0.496
Standard Deviation (S_d)	0.346
T-Statistics (t)	6.870
P-Value	<0.05
Conclusion	**H_1**

Section 2 evaluated the ease and efficiency of exporting and managing attendance data when using either of the two (2) attendance recording methods. The pretest mean score (M = 3.08, SD = 0.346) highlights the challenges of manual data handling. The posttest mean score (M = 3.57, SD = 0.346) demonstrates the system's efficiency in minimizing errors and organizing records. A paired t-test showed a significant mean difference of 0.496 and a t-statistic of 6.870, confirming that the AttenDuino system improves data exportation and retrieval processes.

Table 22

Class Secretaries' Experiences with Using Either Methods in Terms of Recording Accuracy

STATISTICS	VALUE
Pretest Mean	3.12
Posttest Mean	3.53
Mean Difference ($\overline{d}$)	0.409
Standard Deviation (S_d)	0.428
T-Statistics (t)	4.580
P-Value	<0.05
Conclusion	**H_1**

In Section 3, the focus is on the accuracy of the attendance recording system or method being used. The pretest mean score (M = 3.12, SD = 0.428) underscores the prevalence of discrepancies and errors in the traditional method. The posttest mean score (M = 3.53, SD = 0.428) reflects the system's ability to ensure accurate and complete attendance records. A significant mean difference of 0.409 and a t-statistic of 4.580 was observed, indicating that the AttenDuino system reliably enhances recording accuracy compared to the pen-and-paper method.

Table 23

Class Secretaries' Advantage of Using the AttenDuino for Attendance Recording in Terms of Time Efficiency

STATISTICS	VALUE
Pretest Mean	2.56
Posttest Mean	3.57
Mean Difference ($\overline{d}$)	1.009
Standard Deviation (S_d)	0.554
T-Statistics (t)	8.732
P-Value	<0.05
Conclusion	**H_1**

Section four (4) of the questionnaires highlights the system's impact on time management during attendance recording. The pretest mean score (M = 2.56, SD = 0.554) reflects the inefficiency of the traditional method, which often disrupts classroom activities. The posttest mean score (M = 3.57, SD = 0.554) shows a substantial improvement, with participants reporting faster and smoother attendance processes. The t-test results of a 1.009 mean difference and 8.732 t-statistic confirm that the AttenDuino system significantly enhances time efficiency.

Table 24

Class Secretaries' Advantage of Using the AttenDuino for Attendance Recording for Long-Term Convenience

STATISTICS	VALUE
Pretest Mean	2.98
Posttest Mean	3.44
Mean Difference ($\overline{d}$)	0.465
Standard Deviation (S_d)	0.636
T-Statistics (t)	3.508
P-Value	<0.05
Conclusion	**H_1**

Section 5 evaluates the long-term practicality of the AttenDuino system. The pretest mean score (M = 2.98, SD = 0.636) suggests challenges in managing attendance data manually over extended periods. The posttest mean score (M = 3.44, SD = 0.636) highlights the benefits of digital-based records for storage and retrieval. The paired t-test showed a significant mean difference of 0.465 and a t-statistic of 3.508, confirming the system's advantage in providing sustainable and convenient attendance management solutions.

Subject Teacher-Respondents' Evaluation of Using the Pen-and-Paper Method as the Primary Attendance Recording Method Used in Universidad de Sta. Isabel of Pili, Inc. Inc.

Table 25

Subject Teachers' Issues Faced with Using the Pen-and-Paper Method for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
Recording attendance with pen-and-paper is time-consuming.	3.5	Strongly Agree
Recording attendance with the pen-and-paper method is prone to mistakes or incomplete data.	2.7	Agree
Organizing attendance sheets using the pen-and-paper method can be confusing.	2.3	Disagree
Correcting attendance errors in the pen-and-paper records is messy and tedious.	3.1	Agree
Taking attendance with pen and paper often interrupts class activities.	3.0	Agree
Weighted Mean	**2.92**	**Agree**

For the first statement, "Recording attendance with pen-and-paper is time-consuming.", seven (7) respondents strongly agreed, four (4) agreed, one (1) agreed, and none strongly disagreed. This yields a weighted mean of 3.5, which corresponds to "Strongly Agree." Most participants recognize the inefficiency of the pen-and-paper method in managing attendance, which could impact teaching time.

For the second statement, "Recording attendance with the pen-and-paper method is prone to mistakes or incomplete data.", five (5) respondents strongly agreed, three (3) agreed, none agreed, and four (4) strongly disagreed. The weighted mean of 2.7, interpreted as "Agree" indicates that errors are acknowledged as a challenge by many respondents.

The third statement, "Organizing attendance sheets using the pen-and-paper method can be confusing.", had two (2) respondents strongly agreeing, four (4) agreeing, two (2) disagreeing, four (4) strongly disagreeing, leading to a weighted mean of 2.3. This lower mean still reflects agreement but suggests organizational challenges are less pressing compared to other issues.

For the fourth statement, "Correcting attendance errors in the pen-and-paper records is messy and tedious.", six (6) respondents strongly agreed, three (3) agreed, one (1) disagreed, and two (2) strongly disagreed. The weighted mean of 3.1, which corresponds to "Agree" indicates that most participants find the correction of errors particularly burdensome.

Finally, for the fifth statement, "Taking attendance with pen and paper often interrupts class activities.", five (5) respondents strongly agreed, four (4) agreed, one (1) disagreed, and two (2) strongly disagreed. The resulting weighted mean of 3.0, signifying "Agree" highlights that the traditional method disrupts the flow of teaching and learning activities.

Overall, the results for this table yield an average weighted mean of 2.92, interpreted as "Agree" reflecting that respondents generally perceive the pen-and-paper method as inefficient and error-prone.

Table 26

Subject Teachers' Data Exportation Experiences with Using the Pen-and-Paper Method for Attendance Recording

STATEMENTS	µ	VERBAL DESCRIPTIONS
The pen-and-paper method allows for easily finalized attendance sheets without errors.	2.8	Agree
Managing and organizing attendance records with pen and paper requires significant effort.	3.4	Strongly Agree
I find it difficult to retrieve past attendance records when using the pen-and-paper method.	2.7	Agree
Records using the pen-and-paper method are often lost or misplaced.	2.7	Agree
The pen-and-paper method provides a reliable system for exporting attendance data.	3.2	Agree
Weighted Mean	**2.96**	**Agree**

For the first statement, "The pen-and-paper method allows for easily finalized attendance sheets without errors.", four (4) respondents strongly agreed, four (4) agreed, two (2) disagreed, and another two (2) strongly disagreed. The weighted mean of 2.8, interpreted as "Agree" suggests mixed opinions, with many acknowledging that the process can lead to errors despite its simplicity.

The second statement, "Managing and organizing attendance records with pen and paper requires significant effort.", saw seven (7) respondents strongly agreeing, four (4) agreeing, none disagreeing, and one (1) strongly disagreeing. The weighted mean of 3.4, interpreted as "Strongly Agree" underscores that the organizational aspect of manual attendance methods is particularly labor-intensive for most participants.

For the third statement, "I find it difficult to retrieve past attendance records when using the pen-and-paper method.", four (4) respondents strongly agreed, four (4) agreed, one (1) disagreed, and three (3) strongly disagreed. The weighted mean of 2.7 reflects "Agree" indicating that while retrieval difficulties are commonly experienced, some participants do not face significant challenges in this area.

The fourth statement, "Records using the pen-and-paper method are often lost or misplaced.", received three (3) strongly agreeing, four (4) agreeing, three (3) disagreeing, and two (2) strongly disagreeing. With a weighted mean of 2.7, interpreted as "Agree" this result suggests that record loss is a recognized issue, though not as universally problematic.

Lastly, for the statement, "The pen-and-paper method provides a reliable system for exporting attendance data.", four (4) respondents strongly agreed, six (6) agreed, two (2) disagreed, and none strongly disagreed. The weighted mean of 3.2, corresponding to "Agree" indicates that despite the challenges, many participants view the traditional method as providing some level of reliability.

Overall, the weighted mean of 2.96, interpreted as "Agree" reflects that while the pen-and-paper method can sometimes support reliable data exportation, the associated organizational challenges often hinder its effectiveness.

Table 27

Subject Teachers' Observations Regarding Recording Accuracy with Using the Pen-and-Paper Method for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
The pen-and-paper method accurately reflects student attendance.	3.2	Agree
Discrepancies in attendance records are common with the pen-and-paper method.	3.2	Agree
Correcting errors in attendance records is challenging when using the pen-and-paper method.	2.8	Agree
The pen-and-paper method ensures accurate tracking of tardy, present, or absent students.	3.3	Strongly Agree
Attendance records are prone to missing entries when using the pen-and-paper method.	2.6	Agree
Weighted Mean	**3.02**	**Agree**

For the first statement, "The pen-and-paper method accurately reflects student attendance.", six (6) respondents strongly agreed, four (4) agreed, one (1) disagreed, and one (1) strongly disagreed. The weighted mean of 3.2, interpreted as "Agree.", suggests that most participants believe the manual method captures attendance accurately, though a minority perceives inaccuracies.

For the second statement, "Discrepancies in attendance records are common with the pen-and-paper method.", four (4) respondents strongly agreed, seven (7) agreed, none disagreed, and one (1) strongly disagreed. The weighted mean of 3.2, also interpreted as "Agree.", highlights that inconsistencies in records are a significant issue for many respondents.

The third statement, "Correcting errors in attendance records is challenging when using the pen-and-paper method.", yielded two (2) strongly agreeing, eight (8) agreeing, none disagreeing, and two (2) strongly disagreeing. The weighted mean of 2.8, interpreted as "Agree.", suggests that while error correction is generally seen as difficult, opinions are somewhat divided.

For the fourth statement, "The pen-and-paper method ensures accurate tracking of tardy, present, or absent students.", six (6) respondents strongly agreed, five (5) agreed, none disagreed, and one (1) strongly disagreed. The resulting weighted mean of 3.3, interpreted as "Strongly Agree.", shows confidence in the method's ability to monitor attendance statuses accurately.

Finally, the fifth statement, "Attendance records are prone to missing entries when using the pen-and-paper method.", received one (1) strongly agreeing, seven (7) agreeing, two (2) disagreeing, and two (2) strongly disagreeing. The weighted mean of 2.6, interpreted as "Agree" suggests that missing entries are a moderate concern for respondents.

Overall, the average weighted mean of 3.02, interpreted as "Agree.", reflects general satisfaction with the accuracy of the pen-and-paper method, tempered by challenges in error correction and occasional discrepancies.

Table 28

Subject Teachers' Time Efficiency Observations with Using the Pen-and-Paper Method for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
Recording attendance with pen-and-paper is quick and efficient.	2.7	Agree
The pen-and-paper method does not delay other classroom activities.	2.2	Disagree
The process of recording attendance is consistent and smooth when using the pen-and-paper method.	2.7	Agree
The pen-and-paper method reduces the time I spend on attendance tasks.	1.9	Disagree
The pen-and-paper method reduces time spent on attendance-related tasks.	1.9	Disagree
Weighted Mean	**2.28**	**Disagree**

For the first statement, "Recording attendance with pen-and-paper is quick and efficient." five (5) respondents strongly agreed, one (1) agreed, four (4) disagreed, and two (2) strongly disagreed. This resulted in a weighted mean of 2.7, interpreted as "Agree" suggesting that participants recognize some level of efficiency in the method but with notable reservations.

The second statement, "The pen-and-paper method does not delay other classroom activities.", saw one (1) strongly agreeing, three (3) agreeing, five (5) disagreeing, and three (3) strongly disagreeing. The weighted mean of 2.2 indicates disagreement, but the lower mean reflects concerns about the method's potential to disrupt other activities.

For the third statement, "The process of recording attendance is consistent and smooth when using the pen-and-paper method.", three (3) strongly agreed, three (3) agreed, five (5) disagreed, and one (1) strongly disagreed. The weighted mean of 2.7, interpreted as "Agree" shows mixed opinions on whether the process is smooth or cumbersome.

The fourth statement, "The pen-and-paper method reduces the time I spend on attendance tasks.", received none strongly agreeing, two (2) agreeing, seven (7) disagreeing, and three (3) strongly disagreeing. The weighted mean of 1.9 corresponds to "Disagree" highlighting that most participants feel the method increases the time spent on attendance-related tasks.

Finally, for the fifth statement, "The pen-and-paper method reduces time spent on attendance-related tasks.", no respondent strongly agreed, two (2) agreed, seven

(7) disagreed, and three (3) strongly disagreed. The resulting weighted mean of 1.9, interpreted as "Disagree" reinforces that participants perceive the method as time-intensive.

Overall, the average weighted mean for this table is 2.28, interpreted as "Disagree" with significant concerns about the time-consuming nature of the pen-and-paper approach.

Table 29

Subject Teachers' Evaluation of the Long-term Convenience of Using the Pen-and-Paper Method for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
The pen-and-paper method is convenient for attendance recording over time.	2.6	Agree
The steps involved in the pen-and-paper method are straightforward and simple.	2.9	Agree
Using the pen-and-paper method for attendance recording is simple and manageable.	3.2	Agree
Paper-based records are easy to store and access over time.	2.8	Agree
Paper-based records are efficient to use for managing long-term attendance data.	2.7	Agree
Weighted Mean	**2.84**	**Agree**

For the first statement, "The pen-and-paper method is convenient for attendance recording over time.", two (2) respondents strongly agreed, five (5) agreed, three (3) disagreed, and two (2) strongly disagreed. The weighted mean of 2.6, interpreted as "Agree" indicates that while some find the method convenient, others experience notable difficulties.

The second statement, "The steps involved in the pen-and-paper method are straightforward and simple.", had three (3) strongly agreeing, six (6) agreeing, two (2) disagreeing, and one (1) strongly disagreeing. The weighted mean of 2.9 suggests agreement, with many participants recognizing the simplicity of the method.

For the third statement, "Using the pen-and-paper method for attendance recording is simple and manageable.", five (5) respondents strongly agreed, five (5) agreed, two (2) disagreed, and none strongly disagreed. This yielded a weighted mean of 3.2, interpreted as "Agree" indicating that most participants find the method manageable.

The fourth statement, "Paper-based records are easy to store and access over time, saw three (3) strongly agreeing, five (5) agreeing, three (3) disagreeing, and one (1) strongly disagreeing. The weighted mean of 2.8, interpreted as "Agree" highlights that while many consider paper-based records accessible, some respondents face challenges with storage and retrieval.

Lastly, for the fifth statement, "Paper-based records are efficient to use for managing long-term attendance data.", two (2) strongly agreed, five (5) agreed, four

(4) disagreed, and one (1) strongly disagreed. The weighted mean of 2.7 reflects agreement but points to mixed experiences in long-term data management.

Overall, the average weighted mean of 2.84, interpreted as "Agree" suggests that while the pen-and-paper method has some advantages in simplicity and manageability, concerns remain about its long-term efficiency and convenience.

Subject Teacher-Respondents' Evaluation of Using the AttenDuino System as the Primary Attendance Recording Method Used in Universidad de Sta. Isabel of Pili, Inc.,

Table 30

Subject Teachers' Issues Faced with Using the AttenDuino System for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
Recording attendance with the AttenDuino is less time-consuming than the pen-and-paper method.	3.8	Strongly Agree
Recording attendance with the AttenDuino system is less prone to mistakes or incomplete data compared to the pen-and-paper method.	3.4	Strongly Agree
Organizing attendance records using the AttenDuino system is straightforward.	3.8	Strongly Agree
Correcting errors in AttenDuino records is manageable and efficient.	3.6	Strongly Agree
Taking attendance with the AttenDuino system rarely disrupts class activities.	3.6	Strongly Agree
Weighted Mean	**3.63**	**Strongly Agree**

For the statement, "Recording attendance with the AttenDuino system is less time-consuming than the pen-and-paper method.", 10 respondents strongly agreed, two (2) agreed, with no responses disagreeing or strongly disagreeing. The weighted mean is 3.8, interpreted as "Strongly Agree" indicating that most participants found the AttenDuino system to be highly time-efficient compared to traditional methods.

The second statement, "Recording attendance with the AttenDuino system is less prone to mistakes or incomplete data compared to the pen-and-paper method.", had five (5) respondents strongly agreeing, seven (7) agreeing, with no responses for disagreeing or strongly disagreeing. The weighted mean of 3.4 suggests that participants recognize the system's capability to minimize errors in attendance recording.

For the statement, "Organizing attendance records using the AttenDuino system is straightforward.", 10 respondents strongly agreed, one (1) agreed, and one (1) disagreed, with no responses for strongly disagreeing. The weighted mean of 3.8, interpreted as "Strongly Agree" highlights the system's user-friendliness in managing attendance data.

The fourth statement, "Correcting errors in AttenDuino records is manageable and efficient.", was rated with seven (7) respondents strongly agreeing, five (5) agreeing, with no responses for disagreeing or strongly disagreeing. The weighted mean of 3.6 reflects participants' confidence in the system's error correction capabilities.

Lastly, for the statement, "Taking attendance with the AttenDuino system rarely disrupts class activities.", nine (9) respondents strongly agreed, two (2) agreed, with no responses for disagreeing, and one (1) strongly disagreeing. The weighted mean of 3.6, interpreted as "Strongly Agree" indicates that the system minimizes disruptions during class time.

Overall, the average weighted mean for this section is 3.6, interpreted as "Strongly Agree" confirming that the AttenDuino system addresses key issues associated with traditional attendance recording methods.

Table 31

Subject Teachers' Data Exportation Experiences with Using the AttenDuino System for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
Attendance data exported by the AttenDuino system is easy to interpret.	3.9	Strongly Agree
Attendance data exported by the AttenDuino system is easy to interpret.	3.4	Strongly Agree
Managing and organizing digital records in the AttenDuino system is efficient.	3.7	Strongly Agree
Retrieving past attendance records from AttenDuino exported files is easier than retrieving paper documents.	3.9	Strongly Agree
Lost or misplaced records are rare with the AttenDuino system.	3.8	Strongly Agree
Weighted Mean	**3.75**	**Strongly Agree**

For the statement, "Attendance data exported by the AttenDuino system is easy to interpret.", 11 respondents strongly agreed, one (1) agreed, with no responses for disagreeing and for strongly disagreeing. The weighted mean of 3.9, interpreted as "Strongly Agree" demonstrates that participants found the exported data clear and easy to understand.

The second statement, "The AttenDuino system minimizes errors in finalized attendance records.", received ratings of five (5) strongly agreeing, seven (7) agreeing, with no responses for disagreeing and for strongly disagreeing. This led to a weighted mean of 3.4, also interpreted as "Strongly Agree" reflecting participants' trust in the system's reliability.

For the statement, "Managing and organizing digital records in the AttenDuino system is efficient.", nine (9) respondents strongly agreed, two (2) agreed, and one (1) disagreed, with no responses for strongly disagreeing. The weighted mean of 3.7 highlights the system's efficiency in record management.

The fourth statement, "Retrieving past attendance records from AttenDuino exported files is easier than retrieving paper documents.", had 11 respondents strongly agreeing, one (1) agreeing, with no responses for disagreeing and for strongly disagreeing. The weighted mean of 3.9, interpreted as "Strongly Agree" underscores the system's ease of access to historical records.

Lastly, for the statement, "Lost or misplaced records are rare with the AttenDuino system.", 10 respondents strongly agreed, two (2) agreed, with no responses for disagreed and for strongly disagreed. The weighted mean of 3.8 further emphasizes the system's reliability in securely managing attendance data.

Overall, the average weighted mean for this section is 3.8, interpreted as "Strongly Agree" indicating strong positive feedback regarding the system's data exportation and management features.

Table 32

Subject Teachers' Observations Regarding Recording Accuracy with Using the AttenDuino System for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
Attendance discrepancies are minimal with the AttenDuino system.	3.5	Strongly Agree
The AttenDuino system is effective at preventing errors in attendance records.	3.6	Strongly Agree
Correcting errors in AttenDuino records is manageable and efficient.	3.6	Strongly Agree
The AttenDuino system ensures accurate tracking of tardy, present, or absent students.	3.5	Strongly Agree
Attendance records generated by the AttenDuino system are complete and free from missing entries.	3.4	Strongly Agree
Weighted Mean	**3.52**	**Strongly Agree**

For the statement, "Attendance discrepancies are minimal with the AttenDuino system.", seven (7) respondents strongly agreed, four (4) agreed, and one (1) disagreed, with no responses for strongly disagreeing. The weighted mean of 3.5, interpreted as "Strongly Agree" reflects participants' confidence in the system's accuracy.

The second statement, "The AttenDuino system effectively prevents errors in attendance records.", had seven (7) respondents strongly agreeing, five (5) agreeing, with no responses for disagreed and for strongly disagreed. The weighted mean of 3.6 highlights the system's ability to maintain error-free records.

For the statement, "Correcting errors efficiently in the AttenDuino system is possible.", eight (8) respondents strongly agreed, three (3) agreeing, and one (1) disagreed, with no responses for strongly disagreeing. The weighted mean of 3.6, interpreted as "Strongly Agree" underscores the system's effectiveness in resolving errors.

The fourth statement, "The AttenDuino system ensures accurate tracking of tardy, present, or absent students.", received six (6) respondents strongly agreeing, six (6) agreeing, with no responses for disagree and for strongly disagreeing responses. The weighted mean of 3.5 confirms the system's reliability in tracking student attendance statuses accurately.

Finally, for the statement, "Attendance records generated by the AttenDuino system are complete and free from missing entries.", five (5) respondents strongly agreed, seven (7) agreeing, with none answering for disagreeing and for strongly disagreeing responses. The weighted mean of 3.4, interpreted as "Strongly Agree" affirms the system's consistency in generating complete records.

Overall, the average weighted mean for this section is 3.5, interpreted as "Strongly Agree" indicating that the AttenDuino system ensures high accuracy in attendance recording.

Table 33

Subject Teachers' Time Efficiency Observations with Using the AttenDuino for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
Recording attendance with the AttenDuino system is quick and effective.	3.8	Strongly Agree
The AttenDuino system does not delay other classroom activities.	3.8	Strongly Agree
The process of recording attendance is consistent and smooth with the AttenDuino system.	3.8	Strongly Agree
The AttenDuino system reduces the time I spend on attendance tasks.	3.7	Strongly Agree
The AttenDuino system reduces time spent on attendance-related tasks.	3.8	Strongly Agree
Weighted Mean	**3.78**	**Strongly Agree**

For the statement, "Recording attendance with the AttenDuino system is quick and effective.", 10 respondents strongly agreed, two (2) agreed, with no responses for disagree and for strongly disagreeing. The weighted mean of 3.8, interpreted as "Strongly Agree" highlights that the system is highly efficient in recording attendance promptly.

The second statement, "The AttenDuino system does not delay other classroom activities.", had 10 respondents strongly agreeing, two (2) agreeing, with no disagree and strongly disagreeing responses. This yielded a weighted mean of 3.8, reflecting the system's ability to minimize disruptions during teaching sessions.

For the statement, "The AttenDuino system reduces time spent recording attendance compared to the pen-and-paper method.", 10 respondents strongly agreed, two (2) agreed, and none disagreed or strongly disagreed. The weighted mean of 3.8 suggests that the system significantly improves time management in attendance recording.

The fourth statement, "Attendance recording with the AttenDuino system is consistent and smooth.", was rated with nine (9) respondents strongly agreeing, two (2) agreeing, and one (1) disagreeing, with no responses for strongly disagreeing. The weighted mean of 3.7, interpreted as "Strongly Agree" emphasizes the system's reliability in providing a smooth and uninterrupted process.

Lastly, the statement, "The AttenDuino system minimizes interruptions to teaching time.", received 10 respondents strongly agreeing, one (1) agreeing, and one

(1) disagreed, with no responses for strongly disagreeing. The weighted mean of 3.8 highlights the system's effectiveness in maintaining classroom focus.

Overall, the average weighted mean for this section is 3.78, interpreted as "Strongly Agree" confirming that the AttenDuino system significantly enhances time efficiency in attendance recording.

Table 34

Subject Teachers' Evaluation of the Long-term Convenience of Using the AttenDuino System for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
The AttenDuino system is convenient for attendance recording over time.	3.8	Strongly Agree
The steps involved in the AttenDuino system are straightforward and simple.	3.8	Strongly Agree
Using the AttenDuino system for attendance recording is simple and manageable.	3.8	Strongly Agree
Digital-based records are easy to store and access over time.	3.8	Strongly Agree
Digital-based records are efficient to use for managing long-term attendance data.	3.7	Strongly Agree
Weighted Mean	**3.77**	**Strongly Agree**

For the statement, "The AttenDuino system is convenient for attendance recording over time.", 10 respondents strongly agreed, one (1) agreed, and one (1) disagreed, with no responses for strongly disagreeing. The weighted mean of 3.8, interpreted as "Strongly Agree" indicates the system's long-term practicality for managing attendance.

The second statement, "The steps in the AttenDuino system are simple and manageable.", had 10 respondents strongly agreeing, two (2) agreeing, with no disagree and strongly disagreeing responses. This resulted in a weighted mean of 3.8, reflecting participants' positive perception of the system's ease of use.

For the statement, "Using the AttenDuino system for attendance recording is simple and efficient.", 10 respondents strongly agreed, two (2) agreeing, with no responses for disagree and for strongly disagreeing. The weighted mean of 3.8, interpreted as "Strongly Agree" emphasizes the system's usability for sustained attendance management.

The fourth statement, "Digital-based records are easy to store and access over time." had nine (9) respondents strongly agreeing, three (3) agreeing, with no responses for disagree and for strongly disagreeing. The weighted mean of 3.8 highlights the system's practicality in maintaining accessible records for extended periods.

Lastly, for the statement, "The AttenDuino system is efficient for managing long-term attendance data.", nine (9) respondents strongly agreed, two (2) agreeing, and one (1) disagreed, with no responses for strongly disagreeing. The weighted mean of 3.6 underscores the system's reliability in handling attendance data over time.

Overall, the average weighted mean for this table is 3.8, interpreted as "Strongly Agree" confirming that the AttenDuino system is a sustainable solution for long-term attendance recording.

Table 35

Subject Teachers' Declaration of Preference of Using Either the Pen-and-Paper Method or AttenDuino System for Attendance Recording

STATEMENTS	μ	VERBAL DESCRIPTIONS
I find the AttenDuino system easier to use than the pen-and-paper method.	3.8	Strongly Agree
I find the AttenDuino system easier to use than the pen-and-paper method.	3.8	Strongly Agree
I prefer using the AttenDuino system over the pen-and-paper method.	3.8	Strongly Agree
The AttenDuino system saves more time compared to the pen-and-paper method.	3.8	Strongly Agree
The AttenDuino system provides more accurate attendance data than the pen-and-paper method.	3.8	Strongly Agree
Weighted Mean	**3.75**	**Strongly Agree**

For the statement, "I find the AttenDuino system easier to use than the pen-and-paper method.", nine (9) respondents strongly agreed, three (3) agreed, with no responses for disagree and for strongly disagreeing. The weighted mean of 3.8, interpreted as "Strongly Agree" reflects participants' strong preference for the system's ease of use.

The second statement, "The AttenDuino system is more convenient than the pen-and-paper method.", had 10 respondents strongly agreeing, one (1) agreeing, and one (1) disagreed, with no responses for strongly disagreeing. The resulting weighted mean of 3.8 highlights the system's practicality in comparison to traditional methods.

For the statement, "I prefer using the AttenDuino system over the pen-and-paper method.", 10 respondents strongly agreed, one (1) agreed, and one (1) disagreed, with no responses for strongly disagreeing. The weighted mean of 3.8, interpreted as "Strongly Agree" emphasizes participants' clear preference for the system.

The fourth statement, "The AttenDuino system saves more time compared to the pen-and-paper method.", had 10 respondents strongly agreeing, one (1) agreeing, and one (1) disagreed, with no strongly disagreeing responses. The weighted mean of 3.8 reflects the time-saving benefits of the system.

Lastly, for the statement, "The AttenDuino system provides more accurate attendance data than the pen-and-paper method.", nine (9) respondents strongly agreed, three (3) agreed, with no responses for disagree and for strongly disagreeing. The weighted mean of 3.8, interpreted as "Strongly Agree", underscores the system's superior accuracy.

Overall, the average weighted mean for this table is 3.75, interpreted as "Strongly Agree", confirming participants' preference for the AttenDuino system over the traditional pen-and-paper method.

Statistical Comparison of Subject Teacher-Respondents' Overall Evaluation of Using the AttenDuino System as an Alternative Attendance Recording Method to the Pen-and-Paper Method Used in Universidad de Sta. Isabel of Pili, Inc.

Table 36

Subject Teachers' Experiences with Using Either Methods in Terms of Issues Faced

STATISTICS	VALUE
Pretest Mean	2.92
Posttest Mean	3.63
Mean Difference ($\bar{d}$)	0.37
Standard Deviation (S_d)	3.079
T-Statistics (t)	0.421
P-Value	<0.05
Conclusion	$\mathbf{H_0}$

Section 1 examines challenges in attendance recording with the AttenDuino system compared to traditional methods. The pretest mean score (M = 2.92, SD = 3.079) indicates inefficiencies and difficulties commonly faced using the pen-and-paper method. The posttest mean score (M = 3.63, SD = 3.079) reflects improvements in addressing these challenges when using the AttenDuino system. A paired t-test revealed a mean difference of 0.37 and a t-statistic of 0.42, revealing that the

AttenDuino system does not significantly mitigate issues encountered in traditional attendance methods.

Table 37

Subject Teachers' Experiences with Using Either Methods in Terms of Data Exportation

STATISTICS	VALUE
Pretest Mean	2.96
Posttest Mean	3.75
Mean Difference ($\bar{d}$)	0.41
Standard Deviation (S_d)	0.54
T-Statistics (t)	2.622
P-Value	<0.05
Conclusion	**H_1**

Section 2 evaluates the efficiency of exporting attendance data. The pretest mean score (M = 2.96, SD = 0.54) highlights inefficiencies in managing manual data. The posttest mean score (M = 3.75, SD = 0.54) demonstrates substantial improvement with the AttenDuino system, showcasing its ability to streamline data management and exportation processes. The t-test results revealed a mean difference of 0.41 and a t-statistic of 2.622, indicating a statistically significant enhancement in data exportation efficiency.

Table 38

Subject Teachers' Experiences with Using Either Methods in Terms of Recording Accuracy

STATISTICS	VALUE
Pretest Mean	3.02
Posttest Mean	3.52
Mean Difference ($\overline{d}$)	0.25
Standard Deviation (S_d)	0.51
T-Statistics (t)	1.713
P-Value	<0.05
Conclusion	**H_0**

Section 3 focuses on recording accuracy. The pretest mean score (M = 3.02, SD = 0.51) reflects the potential for errors in manual attendance recording. The posttest mean score (M = 3.52, SD = 0.51 indicates improved accuracy with the AttenDuino system. A paired t-test revealed a mean difference of 0.25 and a t-statistic of 1.713, showing that the system does not necessarily significantly improve accuracy in attendance recording.

Table 39

Subject Teachers' Advantage of Using the AttenDuino for Attendance Recording in Terms of Time Efficiency

STATISTICS	VALUE
Pretest Mean	2.28
Posttest Mean	3.78
Mean Difference ($\overline{d}$)	0.78
Standard Deviation (S_d)	0.93
T-Statistics (t)	2.915
P-Value	<0.05
Conclusion	**H_1**

Section 4 assesses the impact of the AttenDuino system on time efficiency. The pretest mean score (M = 2.28, SD = 0.93) underscores the inefficiencies of the traditional method, which often disrupts class activities. The posttest mean score (M = 3.78, SD = 0.93) shows a significant improvement, with participants reporting faster and smoother attendance processes. The t-test results revealed a mean difference of 0.78 and a t-statistic of 2.915, confirming that the AttenDuino system enhances time efficiency significantly.

Table 40

Subject Teachers' Advantage of Using the AttenDuino for Attendance Recording for Long-Term Convenience

STATISTICS	VALUE
Pretest Mean	2.84
Posttest Mean	3.77
Mean Difference ($\overline{d}$)	0.45
Standard Deviation (S_d)	0.89
T-Statistics (t)	1.768
P-Value	<0.05
Conclusion	**H_0**

Section 5 evaluates the system's practicality for long-term use. The pretest mean score (M = 2.84, SD = 0.89) highlights the limitations of the traditional method in managing attendance data over extended periods. The posttest mean score (M = 3.77, SD = 0.89) demonstrates the AttenDuino system's ability to manage and store records efficiently. The paired t-test results revealed a mean difference of 0.45 and a t-statistic of 1.768, revealing that the system does not significantly improve reliability for long-term attendance management.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The study aimed to develop an efficient and accurate attendance tracking system using Arduino Uno, integrating key hardware components such as the RFID scanner module, SD card module, RTC module, and I2C LCD display. The prototype was designed using Tinkercad to model circuit connections before assembly. During the hardware development phase, jumper wires and a breadboard were used to establish the circuit, ensuring proper communication between components. The system automated student attendance recording, stored data in CSV format, and provided real-time feedback on an LCD display. Attendance records were easily retrieved and organized in Microsoft Excel, allowing for efficient monitoring and analysis.

The software system of the AttenDuino played a critical role in managing input, processing, output, and control functions. To ensure seamless operation, the system was developed in three main stages. First, the Arduino Integrated Development Environment (IDE) was installed as the primary platform for coding, compiling, and uploading programs to the Arduino microcontroller. Second, the RFID scanner, SD card module, RTC module, and LCD module were programmed to function as a cohesive system, each with a designated role. The RFID scanner detected and verified student ID inputs, while the RTC module provided real-time timestamps for attendance logging. The SD card module stored attendance data in CSV format, making retrieval and organization efficient, and the LCD module displayed immediate feedback to confirm attendance status. Lastly, the exportation of attendance data was facilitated through the SD card, allowing attendance logs to be uploaded and formatted in Microsoft Excel. Conditional formatting was applied to highlight student tardiness and absences, streamlining attendance monitoring for teachers. These software components worked together to automate attendance-taking, reduce human errors, and ensure reliable data storage and retrieval.

The following is the summary of the data gathered from the Class Secretary-Respondents:

1. The AttenDuino system significantly improved attendance tracking efficiency for class secretaries. It reduced the time spent recording attendance, minimized class disruptions, and automated data entry, making it more efficient than the pen-and-paper method.
2. Class secretaries reported fewer errors and discrepancies in attendance records. The RFID scanning method ensured accurate and real-time data logging, leading to higher reliability in attendance tracking compared to manual methods.
3. The system was highly effective in managing attendance data. Digital records were easier to store, organize, and retrieve than paper-based logs, improving the accessibility and accuracy of past attendance records.
4. Usability ratings for the AttenDuino system were high among class secretaries. The LCD display provided clear and immediate feedback, and the automated logging process simplified attendance-taking.

5. Long-term maintainability was perceived as moderate to high. While the hardware components required minimal upkeep, class secretaries noted that proper management of RFID cards, SD card storage, and system calibration was necessary for consistent performance.

The following is the summary of the data gathered from the Subject Teacher-Respondents:

1. Subject teachers had mixed responses regarding efficiency improvements. While the AttenDuino system reduced the time spent on attendance tracking, some teachers still found the transition from pen-and-paper to digital recording an adjustment, leading to a more moderate rating for time efficiency.
2. The accuracy of attendance records improved for subject teachers, but not as significantly as it did for class secretaries. Teachers noted that while RFID scanning minimized errors, issues such as students forgetting to scan or card-sharing remained a concern.
3. Data exportation and retrieval were seen as beneficial but not widely utilized. Teachers appreciated the ability to store and retrieve digital attendance records, but some preferred traditional record-keeping methods alongside the system.
4. Usability ratings among teachers varied. While many found the LCD feedback and RFID scanning system easy to use, others required additional familiarization before fully integrating it into their workflow.

5. Long-term maintainability was seen as a potential challenge by some teachers. Concerns were raised regarding students forgetting or losing RFID cards and the need for regular system updates or maintenance.

Conclusion

After developing and testing the AttenDuino prototype, the researchers were able to gather data using the pretest and posttest survey questionnaires to obtain necessary information to evaluate the overall performance of the AttenDuino and its acceptability as an alternative attendance recording method to the Pen-and-Paper method. After interpreting all the data gathered, the researchers conclude that;

1. The AttenDuino prototype was properly and successfully configured to perform its functions and accommodate the users' needs.
2. The AttenDuino was able to address issues faced by class secretaries and subject teachers when using the pen-and-paper method for attendance recording.
3. The AttenDuino was able to export complete and accurate data in an efficient and convenient manner.
4. The AttenDuino was concluded to be significantly advantageous to both class secretaries and subject teachers in terms of the attendance recording accuracy and efficiency as opposed to the traditional pen-and-paper method. Thus, supporting the alternative hypothesis of this research study.

5. The AttenDuino was reported to be favored by both class secretaries and subject teachers as the attendance recording method used in Universidad de Sta. Isabel of Pili, Inc. instead of the traditional pen-and-paper method.

Recommendations

The researchers of this study offer five (5) key recommendations to improve the functionality and performance of the AttenDuino. These recommendations are also aimed toward sharing valuable insights for the improvement of future research related to this study or to the further development of the AttenDuino and its implementation to the school setting.

1. Incorporate an ESP8266 WiFi module or GSM module into the AttenDuino prototype for integrating online attendance updates or real-time parent notifications/texts.
2. Develop flexible configurations to adapt the system to various classroom sizes, schedules, and attendance policies such as by incorporating a programmed Arduino-compatible TFT Touch Screen which may allow the users to select certain settings.
3. Conduct longer testing periods to test the device's durability and sustainability as well as its system's ability to perform over a long period of attendance recording.

4. Develop a more efficient way of registering student information to the device instead of manually editing the code such as by utilizing the other recording features of Microsoft Excel.
5. Conduct training sessions for teachers and secretaries to ensure that they are comfortable with using the AttenDuino system and can maximize its features whilst avoiding technical errors.

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CERTIFICATION

This is to certify that the research paper of NEZEL T. BAYNOSA, PAUL ANGELO A. BIARES, JANSSEN J. HUGO, XYMON JAN NARCEL V. LOPEZ, and NISHA NICOLE B. TOLENTINO entitled **"A QUASI-EXPERIMENTAL COMPARISON OF ATTENDUINO VERSUS PEN-AND-PAPER FOR ATTENDANCE RECORDING AT UNIVERSIDAD DE STA. ISABEL OF PILI, INC."** was edited by the undersigned.

Issued upon request of the interested party for reference and whatever purposes it may serve on February 12, 2025 in the Pili, Camarines Sur, Republic of the Philippines

MR. JOHN ERIC R. VILLAREAL, LPT
Grammarian

Reviewed and Approved:

MR. PAUL DAREL B. GUMBA, LPT
Practical Research 2, Teacher

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C E R T I F I C A T I O N

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Issued upon request of the interested party for reference and whatever purposes it may serve on February 12, 2025 in the Pili, Camarines Sur, Republic of the Philippines

MR. KARLO H. NABOR, LPT
Statistician

Reviewed and Approved:

MR. PAUL DAREL B. GUMBA, LPT
Practical Research 2, Teacher

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LETTER FOR RESEARCH ADVISER

August 21, 2024

Dear Ma'am;

Greetings of Peace!

We, the Grade 12 students from the Universidad de Sta. Isabel of Pili, Inc. under the **SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS (STEM)** strand are currently having a quantitative research in the subject, Practical Research 2. In the present time, our research is about to begin after a few finalizations and approval with the proposed title **"A QUASI-EXPERIMENTAL COMPARISON OF ATTENDUINO VERSUS PEN-AND-PAPER FOR ATTENDANCE RECORDING AT UNIVERSIDAD DE STA. ISABEL OF PILI, INC."**.

Therefore, we respectfully request your assistance to be our research adviser for our research. We think that your knowledge will be beneficial and would significantly advance our work. We appreciate your thoughtfulness and sincerely hope you can grant our request.

Respectfully yours,
Baynosa, Nezel T.
Biares, Paul Angelo A.
Hugo, Janssen J.
Lopez, Xymon Jan Narcel V.
Tolentino, Nisha Nicole B.

MR. PAUL DAREL B. GUMBA, LPT
Practical Research 2, Teacher

UNIVERSIDAD DE STA. ISABEL OF PILI, INC.
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I am aware that by taking on a student and acting as a mentor, I consent to:

V. I will make an effort to give every student under supervision a setting that is interesting intellectually, emotionally comforting, secure, and free from harassment.

VI. I will also foster the student's professional confidence and encourage critical thinking, skepticism, and creativity. I will also be supportive, accessible, encouraging, and respectful.

VII. In an effort to help the students become future members of the academic community, I shall be dedicated to mentoring them and to their training.

VIII. I promise to dedicate myself to assisting the student with planning and directing their research project. I will also set attainable goals and a deadline for the project.

MS. JOELYPHINE F. REYES, LPT
Research Adviser

UNIVERSIDAD DE STA. ISABEL OF PILI, INC.
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Member: Daughters of Charity - St. Louise de Marillac Educational System (DC-SLMES)

L E T T E R F O R G R A M M A R I A N

August 21, 2024

Dear Sir;

Greetings of Peace!

We, the Grade 12 students from the Universidad de Sta. Isabel of Pili, Inc. under the **SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS (STEM)** strand are currently having a quantitative research in the subject, Practical Research 2. In the present time, our research is about to begin after a few finalizations and approval with the proposed title **"A QUASI-EXPERIMENTAL COMPARISON OF ATTENDUINO VERSUS PEN-AND-PAPER FOR ATTENDANCE RECORDING AT UNIVERSIDAD DE STA. ISABEL OF PILI, INC."**.

Therefore, we respectfully request your assistance to be our research grammarian for our research. We think that your knowledge will be beneficial and would significantly advance our work. We appreciate your thoughtfulness and sincerely hope you can grant our request.

Respectfully yours,
Baynosa, Nezel T.
Biares, Paul Angelo A.
Hugo, Janssen J.
Lopez, Xymon Jan Narcel V.
Tolentino, Nisha Nicole B.

Noted by:
MR. PAUL DAREL B. GUMBA, LPT
Practical Research 2, Teacher

Approved by:
MR. JOHN ERIC R. VILLAREAL, LPT
Grammarian

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LETTER FOR STATISTICIAN

August 21, 2024

Dear Sir;

Greetings of Peace!

We, the Grade 12 students from the Universidad de Sta. Isabel of Pili, Inc. under the **SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS (STEM)** strand are currently having a quantitative research in the subject, Practical Research 2. In the present time, our research is about to begin after a few finalizations and approval with the proposed title **"A QUASI-EXPERIMENTAL COMPARISON OF ATTENDUINO VERSUS PEN-AND-PAPER FOR ATTENDANCE RECORDING AT UNIVERSIDAD DE STA. ISABEL OF PILI, INC."**.

Therefore, we respectfully request your assistance to be our research statistician for our research. We think that your knowledge will be beneficial and would significantly advance our work. We appreciate your thoughtfulness and sincerely hope you can grant our request.

Respectfully yours,
Baynosa, Nezel T.
Biares, Paul Angelo A.
Hugo, Janssen J.
Lopez, Xymon Jan Narcel V.
Tolentino, Nisha Nicole B.

Noted by:	Approved by:
MR. PAUL DAREL B. GUMBA, LPT	**MR. KARLO H. NABOR, LPT**
Practical Research 2, Teacher	Statistician

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December 4, 2024

MR. RONALD D. VALERIO, MA
School Principal
San Agustin, Pili, Camarines Sur

Dear **Mr. Valerio**;

We, the Grade 12 STEM students of Universidad de Sta. Isabel of Pili, Inc. from Grade 12 Our Lady of Prompt Succor, are conducting a research study titled **"A Quasi-Experimental Comparison of AttenDuino versus Pen-and-Paper for Attendance Recording at Universidad de Sta. Isabel of Pili, Inc."** as part of our Practical Research 2: Quantitative Research subject for the 1st semester of SY 2024-2025.

Relative to this, we humbly seek your permission to conduct data gathering through two survey phases: pretest and posttest, starting today, December 4, 2024. All data collected will be treated with strict confidentiality and used solely for academic purposes. Respondents' informed consent will also be obtained prior to participation.

Thank you very much for your time and for your kind approval on this request.

Sincerely,

Xymon Jan Narcel V. Lopez   **Nezel T. Baynosa**   **Paul Angelo A. Biares**

Nisha Nicole B. Tolentino   **Janssen J. Hugo**

Noted by:

Ms. Joelyphine Reyes
Research Adviser

Mr. Paul Darel B. Gumba, LPT
Practical Research 2, Teacher

Approved by:

Mr. Ronald D. Valerio, MA
School Principal

UNIVERSIDAD DE STA. ISABEL OF PILI, INC.
San Agustin, Pili, Camarines Sur, 4418 Philippines
Contact Number: (054) 884-2551
Member: Daughters of Charity - St. Louise de Marillac Educational System (DC-SLM

To the Respondent;

Greetings of Peace!

The researchers are currently conducting their research study entitled "A Quasi-Experimental Comparison of AttenDuino versus Pen-and-Paper for Attendance Recording at Universidad de Sta. Isabel of Pili, Inc.".

The purposes of the research are to evaluate the efficacy of the AttenDuino system in accurately and efficiently recording student attendance compared to the traditional pen-and-paper method, to identify the advantages and disadvantages of using the AttenDuino system versus the pen-and-paper method, and to determine the preferred attendance recording method among class secretaries and subject teachers at Universidad de Sta. Isabel of Pili, Inc., between both electronic and traditional approaches.

Thus, the researchers of the research study are humbly asking for your willing participation by accomplishing this research questionnaire with your most honest and accurate possible evaluation/assessment of the statements indicated in the questionnaires.

The consent form will be valid and applicable for both the pretest survey questionnaire and the posttest survey questionnaire. By signing the consent form, you are also consenting to continuing your participation in the research study for the posttest phase wherein the researchers will follow-up with the posttest survey questionnaire. Thank you and God Bless!

PARTICIPANT'S CONSENT FORM

I, ________________________, consent to participate in the study titled **"A Quasi-Experimental Comparison of AttenDuino versus Pen-and-Paper for Attendance Recording at Universidad de Sta. Isabel of Pili, Inc."** conducted by Grade 12 STEM students *Xymon Jan Narcel V. Lopez, Nisha Nicole B. Tolentino, Paul Angelo A. Biares, Nezel T. Baynosa, and Janssen J. Hugo*. By signing this form, I agree to participate in both the pretest and posttest phases and allow the researchers to administer the surveys face-to-face. I understand that my participation is voluntary, my identity will remain confidential, and my responses will be used solely for this study.

____
Signature Over Printed Name of the Participant
Kind of Participant: ______________________
Date Signed: ___________________________

Noted by:

____
Research-Surveyor(s)

UNIVERSIDAD DE STA. ISABEL OF PILI, INC.
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Contact Number: (054) 884-2551
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RESEARCH QUESTIONNAIRE
Phase 1: Pretest
"A Quasi-Experimental Comparison of AttenDuino versus Pen-and-Paper for Attendance Recording at Universidad de Sta. Isabel of Pili, Inc.".

PART 1: Profile of the Respondents (Participant no. ___)

KIND OF PARTICIPANT:	☐ Class Secretary (Grade & Section: ____-______________________________) ☐ Subject Teacher (Subject Handled: ___________________________________)
DATE:	

DIRECTIONS: The following statements are about your evaluation of using the pen-and-paper method as the primary attendance recording method in Universidad de Sta. Isabel of Pili, Inc. Please choose the rating corresponding to your evaluation by checking (/) on the box appropriate.
The ratings are as follows:

4 - Strongly Agree 3 - Agree 2 - Disagree 1 - Strongly Disagree

PART 2: Pretest Questionnaire (About the Pen-and-Paper Method)

STATEMENTS	RATINGS			
	4	3	2	1
Section 1: Issues Faced				
1. Recording attendance with pen-and-paper is time-consuming.				
2. Recording attendance with the pen-and-paper method is prone to mistakes or incomplete data.				
3. Organizing attendance sheets using the pen-and-paper method can be confusing.				
4. Correcting attendance errors in the pen-and-paper records is messy and tedious.				
5. Taking attendance with pen and paper often interrupts class activities.				

Section 2: Data Exportation				
1. The pen-and-paper method allows for easily finalized attendance sheets without errors.				
2. Managing and organizing attendance records with pen and paper requires significant effort.				
3. I find it difficult to retrieve past attendance records when using the pen-and-paper method.				
4. Records using the pen-and-paper method are often lost or misplaced.				
5. The pen-and-paper method provides a reliable system for exporting attendance data.				
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Section 3: Recording Accuracy				
1. The pen-and-paper method accurately reflects student attendance.				
2. Discrepancies in attendance records are common with the pen-and-paper method.				
3. Correcting errors in attendance records is challenging when using the pen-and-paper method.				
4. The pen-and-paper method ensures accurate tracking of tardy, present, or absent students.				
5. Attendance records are prone to missing entries when using the pen-and-paper method.				
Section 4: Time Efficiency				
1. Recording attendance with pen-and-paper is quick and efficient.				
2. The pen-and-paper method does not delay other classroom activities.				
3. The process of recording attendance is consistent and smooth when using the pen-and-paper method.				
4. The pen-and-paper method reduces the time I spend on attendance tasks.				
5. The pen-and-paper method reduces time spent on attendance-related tasks.				
Section 5: Long-term Convenience				
1. The pen-and-paper method is convenient for attendance recording over time.				
2. The steps involved in the pen-and-paper method are straightforward and simple.				
3. Using the pen-and-paper method for attendance recording is simple and manageable.				
4. Paper-based records are easy to store and access over time.				
5. Paper-based records are efficient to use for managing long-term attendance data.				

Comments/Suggestions:___________________
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RESEARCH QUESTIONNAIRE
Phase 2: Posttest
"A Quasi-Experimental Comparison of AttenDuino versus Pen-and-Paper for Attendance Recording at Universidad de Sta. Isabel of Pili, Inc.".

PART 1: Profile of the Respondents (Participant no. ___)

DATE:	

DIRECTIONS: The following statements are about your evaluation of using the pen-and-paper method as the primary attendance recording method in Universidad de Sta. Isabel of Pili, Inc. Please choose the rating corresponding to your evaluation by checking (/) on the box appropriate.
The ratings are as follows:

4 - Strongly Agree 3 - Agree 2 - Disagree 1 - Strongly Disagree

PART 2: Posttest Questionnaire (About the AttenDuino System)

STATEMENTS	RATINGS			
	4	3	2	1
Section 1: Issues Faced				
1. Recording attendance with the AttenDuino is less time-consuming than the pen-and-paper method.				
2. Recording attendance with the AttenDuino system is less prone to mistakes or incomplete data compared to the pen-and-paper method.				
3. Organizing attendance records using the AttenDuino system is straightforward.				
4. Correcting errors in AttenDuino records is manageable and efficient.				
5. Taking attendance with the AttenDuino system rarely disrupts class activities.				
Section 2: Data Exportation				
1. Attendance data exported by the AttenDuino system is easy to interpret.				
2. The AttenDuino system minimizes errors in finalized attendance records.				
3. Managing and organizing digital records in the AttenDuino system is efficient.				
4. Retrieving past attendance records from AttenDuino exported files is easier than retrieving paper documents.				
5. Lost or misplaced records are rare with the AttenDuino system.				
Section 3: Recording Accuracy				
1. Attendance discrepancies are minimal with the AttenDuino system.				

1

2. The AttenDuino system is effective at preventing errors in attendance records.				
3. Correcting errors in AttenDuino records is manageable and efficient.				
4. The AttenDuino system ensures accurate tracking of tardy, present, or absent students.				
5. Attendance records generated by the AttenDuino system are complete and free from missing entries.				
Section 4: Time Efficiency				
1. Recording attendance with the AttenDuino system is quick and effective.				
2. The AttenDuino system does not delay other classroom activities.				
3. The process of recording attendance is consistent and smooth with the AttenDuino system.				
4. The AttenDuino system reduces the time I spend on attendance tasks.				
5. The AttenDuino system reduces time spent on attendance-related tasks.				
Section 5: Long-term Convenience				
1. The AttenDuino system is convenient for attendance recording over time.				
2. The steps involved in the AttenDuino system are straightforward and simple.				
3. Using the AttenDuino system for attendance recording is simple and manageable.				
4. Digital-based records are easy to store and access over time.				
5. Digital-based records are efficient to use for managing long-term attendance data.				
Section 6: Comparison of Methods				
1. I find the AttenDuino system easier to use than the pen-and-paper method.				
2. The AttenDuino system is more convenient than the pen-and-paper method.				
3. I prefer using the AttenDuino system over the pen-and-paper method.				
4. The AttenDuino system saves more time compared to the pen-and-paper method.				
5. The AttenDuino system provides more accurate attendance data than the pen-and-paper method.				

Comments/Suggestions:__________________
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BUDGET SUMMARY

"A Quasi-Experimental Comparison of AttenDuino Versus Pen-And-Paper for Attendance Recording at Universidad de Sta. Isabel of Pili, Inc."

AttenDuino Prototype Development

PRIMARY COMPONENTS

PARTICULARS	PROJECTED COST	ACTUAL COST
Arduino Uno	₱449.00	₱0.00
RFID MFRC522 Reader Kit	₱129.00	₱129.00
16x2 LCD Module with I2C	₱149.00	₱0.00
Micro SD Card Reader Module	₱25.00	₱25.00
Micro SD Card	₱72.00	₱0.00
Real-Time Clock (RTC) Module	₱61.00	₱61.00
DuPont Wires	₱90.00	₱90.00
Breadboard	₱49.00	₱0.00
Resistors	₱10.00	₱10.00
Subtotal	₱1,034.00	₱315.00

POWER SOURCE

PARTICULARS	PROJECTED COST	ACTUAL COST
18650 3.7V Li-ion Battery	₱185.00	₱185.00
Battery Holder	₱89.00	₱89.00
TP4056 Charging Module	₱29.00	₱29.00
Battery Level Indicator	₱89.00	₱89.00
SX1308 Step-Up Converter	₱29.00	₱29.00
SPST Switch	₱7.00	₱7.00
Subtotal	₱154.00	₱154.00

TOTAL PLOT OF COSTS

PARTICULARS	IF REPLACEABLE BATTERY
Primary Components	₱315.00
Power Source	₱154.00
Proposed Contribution (each)	₱100.00

BUDGETARY INCLUSIONS

INCLUDED	NOT INCLUDED
Primary Components	Printing and Binding of Paper
Power Source	Allowance for Error
	Unanticipated Expenses
	Materials for Prototype Container
	Contributions for Panelists' Food and Tokens
	Meeting Expenditures

CURRICULUM VITAE

PERSONAL BACKGROUND

Name	Baynosa, Nezel T.
Sex	Female
Birth Date	April 14, 2006
Place of Birth	Naga City, Camarines Sur
Nationality	Filipino
Religion	Iglesia Ni Cristo
Permanent Address	Block 6, Lot 11 Capitol Plains Subd., San Agustin, Pili, Camarines Sur
Email Address	nezeltumapangbaynosa@gmail.com
Academic Club	Table Tennis
Religious Club	Society of Saint Vincent de Paul (SSVP)

EDUCATIONAL BACKGROUND

Evangelical Christian School, Inc. **(2011-2013)**
San Jose, Pili, Camarines Sur — Nursery to Kindergarten

Evangelical Christian School, Inc. **(2013-2019)**
San Isidro, Pili, Camarines Sur — Grade 1 to Grade 6

Saint Joseph School **(2019-2022)**
Carnation St, Barangay Triangulo, Naga City, Camarines Sur — Grade 7 to Grade 9

Universidad de Sta. Isabel of Pili, Inc. (USI Pili) **(2012-2025)**
San Agustin, Pili, Camarines Sur — Grade 10 to Grade 12

CURRICULUM VITAE

PERSONAL BACKGROUND

Name	Biares, Paul Angelo A.
Sex	Male
Birth Date	July 22, 2006
Place of Birth	Pili, Camarines Sur
Nationality	Filipino
Religion	Roman Catholic
Permanent Address	Zone 7, San Jose, Pili, Camarines Sur
Email Address	paulangelobiares@gmail.com
Academic Club	Red Cross Youth Council (RCYC)
Religious Club	Society of Saint Vincent de Paul (SSVP)

EDUCATIONAL BACKGROUND

Barangay San Jose, Pili **(2011-2013)**
San Jose, Pili, Camarines Sur — Nursery to Kindergarten

Pili Central School (PCS) **(2013-2019)**
New San Roque, Pili, Camarines Sur — Grade 1 to Grade 6

Universidad de Sta. Isabel of Pili, Inc. (USI Pili) **(2019-2025)**
San Agustin, Pili, Camarines Sur — Grade 7 to Grade 12

CURRICULUM VITAE

PERSONAL BACKGROUND

Name	Hugo, Janssen J.
Sex	Male
Birth Date	September 21, 2007
Place of Birth	Naga City, Camarines Sur
Nationality	Filipino
Religion	Roman Catholic
Permanent Address	Zone 3, Tagbong, Pili, Camarines Sur
Email Address	hugojanssen.edu@gmail.com
Academic Club	Basketball
Religious Club	Society of Saint Vincent de Paul (SSVP)

EDUCATIONAL BACKGROUND

Montessori Children's House of Learning Inc. **(2011-2013)**
New San Roque, Pili, Camarines Sur — Nursery to Kindergarten

Montessori Children's House of Learning Inc. - Pili **(2013-2019)**
Canuto Street, San Antonio, Pili, Camarines Sur — Grade 1 to Grade 6

Universidad de Sta. Isabel of Pili, Inc. (USI Pili) **(2019-2025)**
San Agustin, Pili, Camarines Sur — Grade 7 to Grade 12

CURRICULUM VITAE

PERSONAL BACKGROUND

Name	Lopez, Xymon Jan Narcel V.
Sex	Male
Birth Date	September 04, 2007
Place of Birth	Naga City
Nationality	Filipino
Religion	Roman Catholic
Permanent Address	Zone 3, Palestina, Pili, Camarines Sur
Email Address	sxyimon@gmail.com
Academic Club	Red Cross Youth Council (RCYC); Board Games
Religious Club	Vincentian Chorale

EDUCATIONAL BACKGROUND

Blessed Name of Mary College, Inc. (BNOM) **(2011-2013)**
San Isidro, Pili, Camarines Sur
Nursery to Kindergarten

Montessori Children's House of Learning Inc. **(2013-2015)**
Old San Roque, Pili, Camarines Sur
Grade 1 to Grade 2

Blessed Name of Mary College, Inc. (BNOM) **(2015-2019)**
San Isidro, Pili, Camarines Sur
Grade 3 to Grade 6

Universidad de Sta. Isabel of Pili, Inc. (USI Pili) **(2019-2025)**
San Agustin, Pili, Camarines Sur
Grade 7 to Grade 12

CURRICULUM VITAE

PERSONAL BACKGROUND

Name	Tolentino, Nisha Nicole B.
Sex	Female
Birth Date	May 15, 2007
Place of Birth	Modern Village, San Jose, Pili, Camarines Sur
Nationality	Filipino
Religion	Roman Catholic
Permanent Address	Zone 3, Anayan, Pili, Camarines Sur
Email Address	nntolentino.acads@gmail.com
Academic Club	Council for Student Affairs (CSA); Debate Society (DebSoc); Red Cross Youth Council (RCYC)
Religious Club	The Association of Saint Louise de Marillac (LUISAS)

EDUCATIONAL BACKGROUND

Central Bicol State University of Agriculture (CBSUA) **(2011-2013)**
San Jose, Pili, Camarines Sur — Nursery to Kindergarten

Blessed Name of Mary College, Inc. (BNOM) **(2013-2019)**
San Isidro, Pili, Camarines Sur — Grade 1 to Grade 6

Universidad de Sta. Isabel of Pili, Inc. (USI Pili) **(2019-2025)**
San Agustin, Pili, Camarines Sur — Grade 7 to Grade 12