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Development of School Forms Generator System for the Department of Education

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ABSTRACT

The School Forms Generator System is specially developed for Puerto National High School located in Puerto Cagayan de Oro City. The main purpose of the system is to address the inefficiencies of the current manual process. The manual system is time-consuming, prone to errors, and can lead to inaccurate records. The researchers used the Modified Waterfall Model in System Development Life Cycle methodology that served as a guide for the development of the system. The system is accessible online via web browser, providing users. The system's effectiveness and usability were determined through testing and evaluation. Therefore, the researchers had concluded that the developed system was effective and addressed the identified problems. The system generates the two major reports that include the student's grades, the school form 9 and school form 10, simplifying the process and improving record accuracy. Additionally, the implementation of this computerized system not only ensures a seamless and organized workflow but also brings about a significant improvement in overall processes and operational effectiveness.

INTRODUCTION

Progress report cards play a vital role in a student's academic journey, serving as a communication tool between schools and parents regarding students' academic performance and classroom behavior. These documents contain subject grades, which are derived from students' scores in various assessments set by teachers and are later transmuted into numerical or letter grades.

In the Philippines, teachers are responsible for preparing and submitting multiple academic documents, including progress report cards (School Form 9) and permanent records (School Form 10), alongside other required school forms. While the Department of Education's Learners Information System (LIS) generates some records, such as attendance and student monitoring, teachers still manually complete these critical forms. This manual process is time-consuming, error-prone, and contributes significantly to teacher workload, particularly in schools with large student populations. Puerto National High School, for example, has 1,600 students and 56 advisers, leading to delays and challenges in grade submission and documentation (Mingoa, 2017).

The LIS, established through DepEd Order 26, S. 2015, was designed to create an accurate registry of students and schools, ensuring data availability for planning and resource allocation (DepEd, 2015). However, its limitations require teachers and registrars to continue handling numerous records manually, adding to administrative burdens. The registrar's office, responsible for maintaining transcripts and curriculum records, also faces difficulties in managing and retrieving large volumes of student data.

To address these challenges, educators are increasingly seeking technological solutions that streamline school management processes. Automated systems for budget and grade management have been recognized as essential tools for improving efficiency (Means, Roschelle, Penuel, Sabelli, & Haertel, 2014). Integrating technology into administrative tasks not only reduces paperwork but also enhances accuracy, timeliness, and overall productivity. As 21st-century education continues to evolve, teachers are expected to leverage technology to maximize their effectiveness (Ertmer & Ottenbreit-Leftwich, 2010).

This study aims to design, develop, and evaluate a computer-based system for Puerto National High School that will provide an efficient platform for teachers to manage students' grades. Specifically, it seeks to:

- Determine and analyze system requirements for development.
- Design a system that automatically consolidates student grades from different subject teachers.
- Develop a computerized system based on user and system requirements.
- Test the system to verify its design.
- Evaluate its functionality and usability in terms of effectiveness and efficiency.

By automating the management of student records, this system aims to alleviate teachers' administrative workload, enhance accuracy in grade processing, and improve overall efficiency in school operations.

TECHNICAL BACKGROUND

Badaza (2020) highlighted the importance of report card management systems for providing accurate and timely information to aid decision-making in secondary schools. Kamugisha et al. (2022) emphasized report cards as key communication tools between advisers, students, and parents, helping to convey students' academic progress.

Lubanga et al. (2018) discussed the shift from paper-based to web-based student information systems, improving efficiency in managing student data. Sterbini (2020) focused on online grading systems, which streamline grading and reduce administrative tasks in educational institutions.

Balinton et al. (2018) demonstrated that computerized systems for generating school forms are more reliable and efficient than manual methods. Bobiles et al. (2019) developed a student information system to automate record-keeping, ensuring data security and reliability. Bustamante et al. (2020) implemented a Student Information System (SIS) that simplified the retrieval and management of student data, while Laroa (2023) introduced an automated grading system to reduce human error and expedite grade reporting.

Plata (2020) created a web-based Pupils' SCHOOL FORM 10-E Information System to simplify the management of student academic records. Agapito (2022) explored online grading systems that enable professors to efficiently submit grades and access records. The proposed system aligns with these studies by automating grade management and reducing administrative workload, improving accuracy and efficiency in handling student records and grades.

MATERIALS AND METHODS

In this part of the study, the researcher used the System Development Life Cycle (SDLC) to ensure all necessary steps were taken to develop the computerized system. This process involved several phases, including gathering and analyzing requirements, design, development, testing and evaluation, and deployment. By following this process, it ensured that all necessary steps were taken to create a fully functional, effective system.

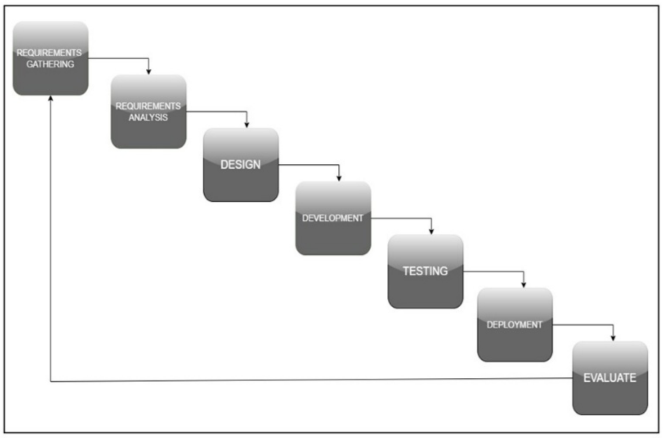

Figure 1. Modified Waterfall Model of SDLC

Requirements Gathering and Analysis Phase

In this phase, the researcher collected information that was important in the development of the computerized system. Requirement gathering and analysis is the first and important step in software development activities. To achieve this, the researcher prepared a letter of intent that was addressed to the Principal of Puerto National High School. The researcher also prepared a set of guide questions to conduct interviews with the advisers. The researcher analyzed the responses from the interviews. The purpose of these interviews was to identify any problems the advisers had encountered. The problems that were identified during the interview were addressed through the implementation of the system.

Design Phase

In the design phase, the researcher provided a detailed design of the system that helped users understand the entire concept of the system. During this phase, a context-level diagram was used to depict the system's flow and define how the user and the system interacted. The context level diagram gave the researchers an idea of what the system was all about and helped them understand how it worked. To do this, the researcher used a few other diagrams, such as the Entity- Relationship Diagram (ERD), which showed how different things in the system were connected, a Use-Case Diagram, which showed how different users would use the system, and the Data Flow Diagram, which showed how data moved through the system, including how it got in and out.

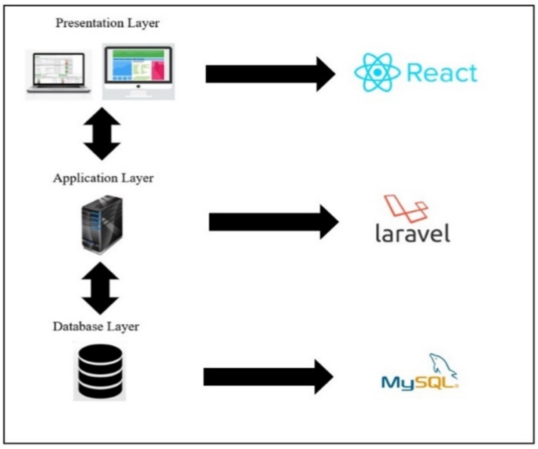

Figure 2. Architectural Design

Development Phase

In this phase, the system's architectural design was developed, as it is only accessible online. A web hosting was configured for the ICT administrator to manage the system. To design the presentation layer, the researchers used ReactJS Framework and CSS to create a visually appealing graphical design. Additionally, they applied the Laravel Framework for the application layer, which is the second layer of the system. Finally, to store and retrieve data, the researcher used the MySQL database for the Data Layer.

Testing Phase

During the testing phase of the system, the developed system was tested for its functionality to check for any faults and failures. Any bugs that were discovered during this process were addressed and fixed before moving on to the next stage. All of the modules developed in the implementation phase were tested individually, and they were integrated into the complete system. The system was then tested to ensure that all modules worked together seamlessly. During the testing phase, faults or failures in the system were identified and addressed promptly. After solving all issues, the entire system was tested again to ensure that it functioned smoothly and met the necessary requirements.

Evaluation Phase

In this phase, the system was tested and evaluated to determine its consistency. The researcher invited five random advisers to use the system, while an ICT administrator acted as a user for the admin. Each user evaluated the system's usability using the System Usability Scale, a standardized metric, to help the researcher identify and verify the system's usability. The ICT administrator and advisers asked if the overall functionalities had been met. The researcher provided guidance and instructions on the appropriate usage of each functionality. The evaluation was necessary to test the system and meet the users' expectations initially. The system was open for necessary changes, adjustments, and enhancements to address any particular problem. The researcher used various testing methods to conduct the evaluation.

Deployment Phase

Several steps were taken during the deployment phase. The system was first packaged for distribution. In order to make it simple for users to install the software, all required files, dependencies, and documentation were put together. The system was complete and ready to be accessed on users' devices through the packaging process. Once packaging was finished, there were various ways to distribute the system. It might have been made available online or sent directly to people via email or another form of contact.

In addition to the distribution process, it was essential to provide training and documentation to the users. This ensured that they understood how to use the system effectively and maximized its benefits. Training was conducted through the manual that was given to the ICT administrator and adviser. Based on this feedback, necessary adjustments and improvements were made to address any issues, bugs, or feature requests that were not identified during the testing phase.

RESULTS AND DISCUSSION

Requirements
Gathering

An interview was conducted to gather user requirements. The Interview was attended by the school principal, a teacher, and a staff member from the registrar's office. The researcher asked for the different school forms used in the school, like the school form 10, which is the permanent record of the student, and the school form 9, which contains the grade of the student per school year or per semester. The researcher also asked for the school's registration form, which is used when a student enrolls in the school. The principal gave the researcher a template of the different school forms. The information gathered by the researcher was used to formulate the system requirements involved in the study. The data that were gathered were the data that were fed to the system.

Process Definition

For the school form 9 manual process, the teacher inputs all students' grades for each subject, then inputs learners' grades for the grading period, and calculates the GPA (Grade Point Average). The teacher comments on students' academic performance and behavior, inputs all the students' details, and finally signs the report card before it is released. Next, for the school form 10, all the grades of the students are gathered from each subject for all the school years. The teacher inputs learners' grades for all the grading periods and calculates the WAG (Weighted Average Grade). The teacher inputs all the students' details, signs the report card, and finally, the school form 10 will be released. These forms will be given to the parent or guardian of the student.

Requirement Analysis
Functional Requirements

Functionality requirements serve as the fundamental capabilities of the system. The functional requirements of each user involved in the system are shown in Table 1 for the ICT Administrator and Table 2 for the Adviser. The functional requirements list for each user is included in these tables along with the requirements name and a brief summary.

Table 1. Functional Requirement for ICT Administrator

Requirement Name	Description
Login	ICT Admin shall input username and password to access the system.
Load list	The ICT administrator can view the load list
Manage Sections	The system allows the ICT admin to update, add, and view sections. Also, it can add students and set subject details.
Grade Settings	The system allows the ICT administrator to lock and unlock specific quarter or section.
Manage Students	The system allows the ICT admin to update, view, add, and delete students.
Manage Subjects	The ICT admin can update, view, and add, subjects.
Manage School Year	This system allows ICT admin to manage the school year. ICT admins can view a list of all users in the system and their school year coverage.
Manage Rooms	The ICT admin can update, view, and add, rooms.
Manage Account	The ICT Admin can update and view the details of his/her profile in the settings.
View Analytics	The administrator can view the analytics

Table 1 shows the functional requirements for the ICT administrator. The login requirement shall require the input of username and password to access the system. The system shall allow the ICT admin to add, view, and update the student's information. In the functional requirements, the system shall allow the ICT admin to add a new student to the system; the ICT administrator would need to create a new student record. This would include the student's name, contact information, and other relevant information. To create a new section for a new class, the ICT administrator would need to create a new section record. This would include the name of the section, the adviser's name, and the subject being taught. Also, it can import subjects, update, and view the existing subjects in the list. The system shall allow for managing rooms by viewing what rooms are assigned to each section, and can add and change rooms. In managing the school year, the system shall allow the ICT admin to view a list of all accounts in the system and their school year coverage. The system will allow managing accounts that can view, update, and add accounts, as well as their roles as admin or adviser. Lastly, to manage the profile of the ICT admin, who can update and view the details of the profile in the settings.

Table 2. Functional Requirement for Adviser

Requirement Name	Description
Login	Adviser shall input username and password to access the system.
View Section	The adviser can view the assigned section.
Upload Attendance	The system allows the adviser to upload a file that contains attendance data for their students.
Upload Behavioral	The system allows the adviser to upload a file that contains behavioral data about their students.
Upload Grades	The adviser can upload grades and total attendance data to track student progress and generate reports.
Update Profile	The user/adviser can update and view the details of his/her profile in the settings.
Print 138 form	The system allows the adviser to print the school form 9 for students.
View Load	The adviser can view the assign subject.

Table 2 shows the functional requirements for the Adviser. The login requirement shall require the input of username and password to access the system. The system shall allow the Adviser to update, view, and delete the student's information. In the functional requirements, the system shall allow the adviser to manage a student's section that can view the section's students. In uploading grades, the adviser will track the total attendance data to see the student's progress and generate reports. In managing the profile of an adviser, they can update and view the details of their own profile settings. And lastly, the system will allow the adviser to print the 137/138 form for students.

Non-Functional Requirements

In this part, the researchers illustrated the non-functional requirements of the system. A brief description of each non-functional requirement is shown in Table 3.

Table 3. Non-Functional Requirements of the System

Requirement Name	Description
Accessibility	The system is a web-based application which can be accessed over a network connection using https.
Availability	The system will be available anytime, if there is a stable internet connectivity.
Reliability	The system should be reliable and available 24/7.
Security	The system should be secure and protect user data from unauthorized access.
Usability	The system should be easy to use for both ICT administrators and advisers.

Documentation	The system should be well-documented so that users and developers can easily understand how to use it.
Training	The system should come with training materials so that users can learn how to use it.

System Design

This part shows the design of the system to illustrate the process flow with the use of flow charts, context level diagrams, use case diagrams, and database designs. The figure below depicts the Flowchart Diagram for the ICT Administrator. Before using the system, the administrator must first log in with their username and password. The system checks the ICT Administrator's credentials to make sure they are valid. If the credentials are valid, the system logs the ICT Administrator in and displays the dashboard. The dashboard contains a menu of options that the ICT Administrator can select to perform different actions, such as manage users, account settings, manage sections, manage section students, import students, manage school year, and the admin can also assign subjects, an adviser, and update grades.

DATA FLOW DIAGRAM

The figure below shows the flow of data in the system. The entities involved are the advisers and the ICT Administrator. The common process of the two is the Login process.

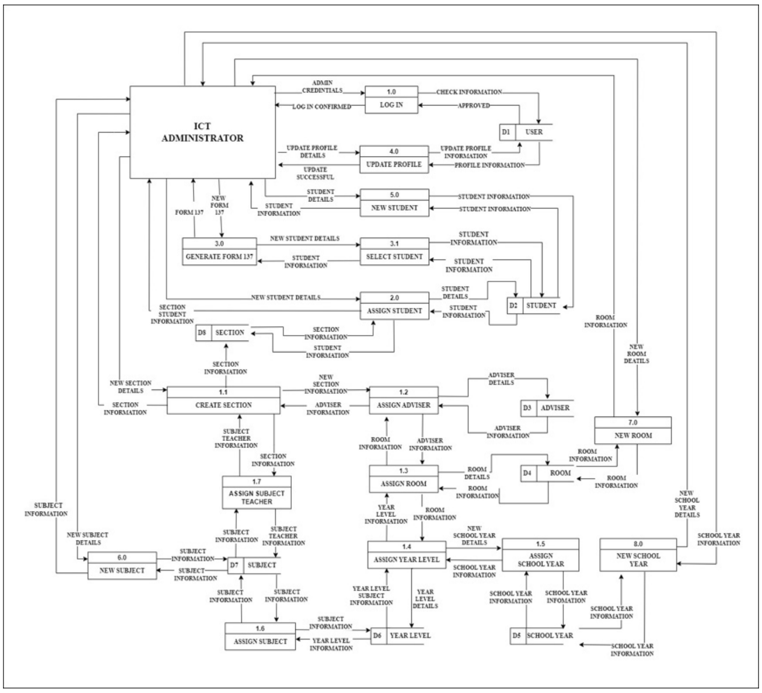

Figure 3. Data Flow Diagram for ICT Administrator

The figure above depicts the Data Flow Diagram for the ICT Administrator. To begin, the ICT administrator must log in. If the account exists in the user database, the administrator will allow access to the system. Once logged in, the administrator can create a section. To create a section, first, assign an advisor. Select a specific advisor for every section and assign a room. Then, assign a schedule and school year. Finally, assign the quarter and student. Once these steps are complete, the section will be created.

Next, to update a grade, the ICT administrator needs to have the student information, quarter information, and subject information. Once this information is gathered, the administrator can update the grade. Additionally, the ICT administrator can also update profiles.

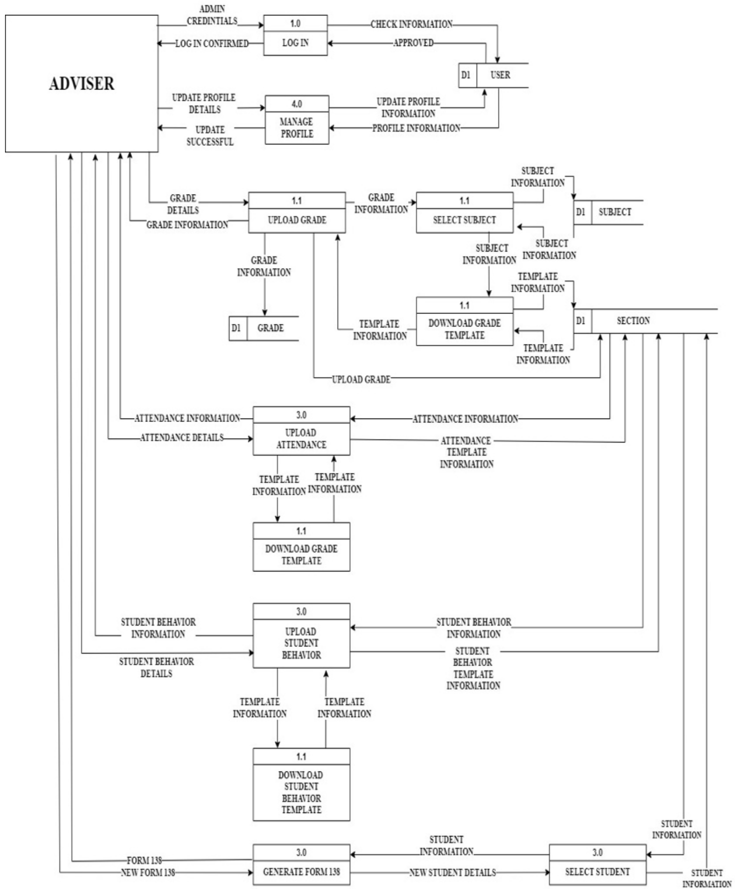

Figure 4. Data Flow Diagram for Adviser

The figure above illustrates the Data Flow Diagram for the Adviser. To begin, the adviser must log in. If the account exists in the user database, the adviser will be allowed access to the system. Once logged in, the adviser can perform various tasks. To generate forms 137 and 138, the adviser will need student information, subject information, and grade information. Once this information is gathered, the forms will be generated and printed. To upload grades, the adviser will need student information, subject information, and grade information. Once this information is gathered, the grades can be uploaded to the system. To upload attendance, the adviser will need to select the student. Once the student is selected, the attendance can be uploaded.

The figure above depicts the Use Case Diagram for Adviser. For the actor Adviser, they should log in first to the system to gain access. Afterwards, the adviser can now have access to the main functionalities, namely: Manage section students, Print School form 10 and 138, Account settings. In the Manage section students, the adviser can view section students and upload grades which can upload the total attendance of the students. In the Account settings, the adviser can also view their profile and update their details.

DATABASE DESIGN

The researcher illustrated an Entity-Relationship Diagram to represent the system's entities and their relationships using the Firebase real-time database. See the presented figure below:

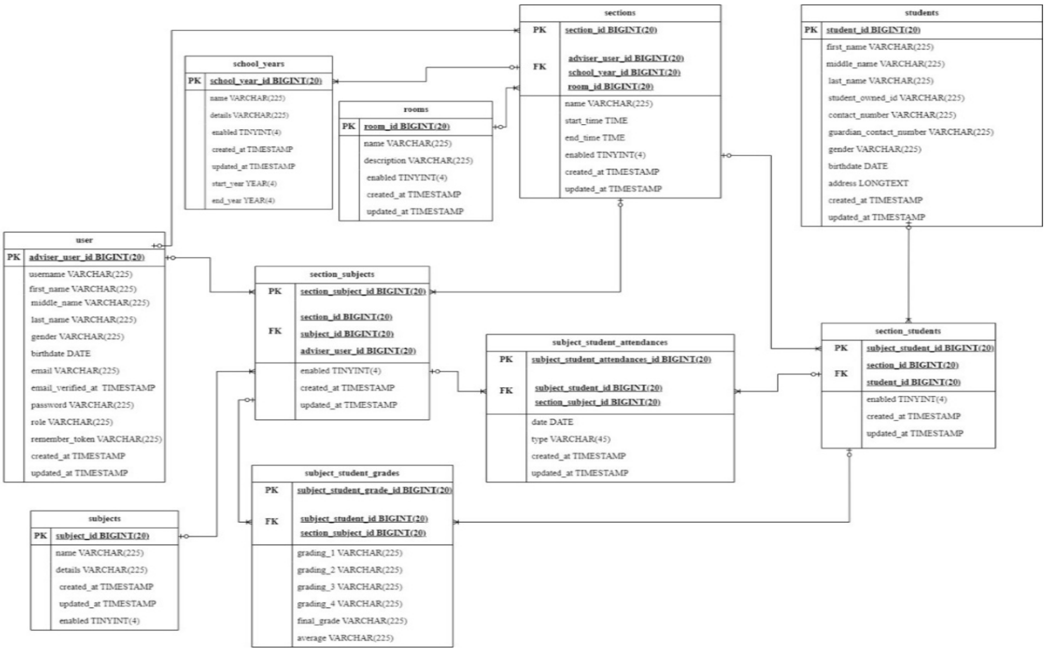

Figure 5. Logical Entity Relationship Diagram

The figure above shows the Logical Entity Relationship Diagram. The admin and adviser have accounts, and the admin can assign the adviser to have a section. Then, the section has a subject that has a specific year level, school year, and a room. The subject has students and has a grade, while the grade is uploaded by the adviser.

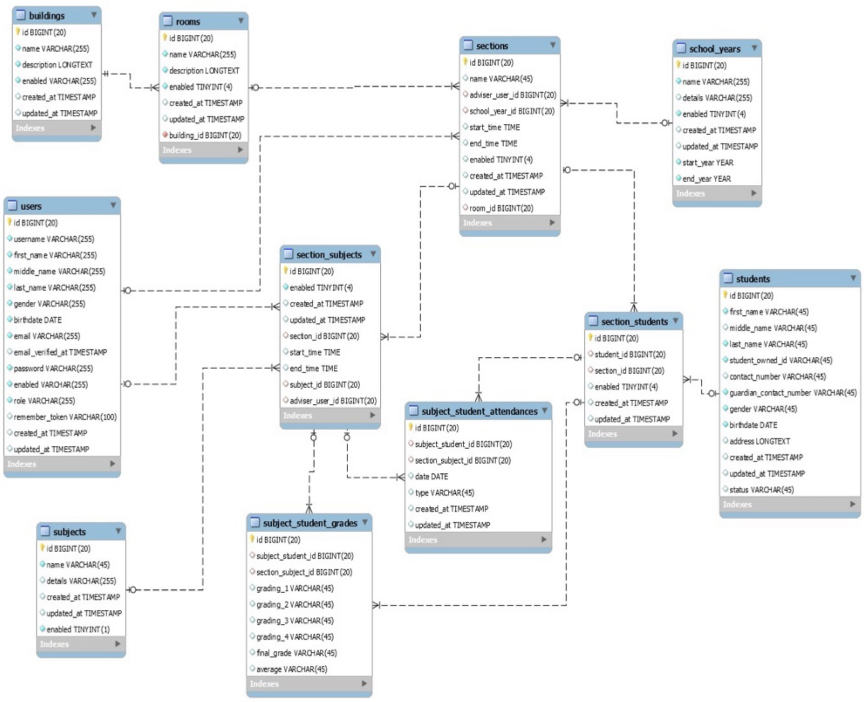

Figure 6. Physical Entity Relationship Diagram

Development

In this phase, the architectural design of the system is presented since the system is only accessible online. A web hosting was configured for the ICT administrator to manage the system. To design the presentation layer, the researchers used React JS Framework and CSS to create a visually appealing graphical design. Additionally, they applied the Laravel Framework for the application layer, which is the second layer of the system. Finally, to store and retrieve data, the researcher used the MySQL database for the Data Layer.

Testing and Evaluation

In order for the system to be evaluated, a demonstration deployment was conducted. This is to simulate the system on a selected group of participants, ensure that the functionalities conform to user requirements, and evaluate how usable the system is. The usability of the system was measured by measuring its effectiveness, efficiency, and satisfaction. A standardized metric was used for measuring the usability of the system, the System Usability Scale.

A usability study plan was drafted, and the plan served as a guide during the usability testing. The results of the usability testing are presented below. To assess the system's usability rating, the testing was carried out using a total of 6 respondents for Advisers and two respondents for ICT Admin. The values of the testing results are graded from 1 to 5 (Strongly Disagree – Strongly Agree). The raw score of the System Usability Scale is shown in Table 6; meanwhile, Table 7 is the computed score of the System Usability Scale.

Table 6. SUS Raw Score

		Participants							
Item #	School form 10 and 138 Generator System for Secondary School	P-1	P-2	P-3	P-4	P-5	P-6	P- 7	P- 8
1	I think that I would like to use this system frequently	5	5	3	5	4	4	5	5
2	I found the system unnecessarily complex	4	2	2	1	1	1	1	4
3	I thought the system was easy to use	5	5	4	4	5	5	5	3
4	I think that I would need the support of a technical person to be able to use this system	4	1	4	2	1	1	3	5
5	I found the various functions in this system were well integrated	5	5	4	4	5	5	4	1
6	I thought there was too much inconsistency in this system	2	1	2	3	1	1	1	2
7	I would imagine that most people would learn to use this system very quickly	5	5	3	5	5	5	4	2
8	I found the system very cumbersome to use	2	2	3	3	1	1	1	3
9	I felt very confident using the system	4	5	3	3	5	5	5	3
10	I needed to learn a lot of things before I coulc get going with this system	2	1	2	3	1	1	3	4
	TOTAL	**38**	**32**	**30**	**33**	**29**	**29**	**32**	**32**

Legend: (Strongly Disagree); 2(disagree); 3(Neutral); 4(Agree) 5(Strongly Agree)

Table 7. SUS Computed Score

		Participants							
Item #	**School form 10 and 138 Generator System for Secondary School**	**P-1**	**P-2**	**P-3**	**P-4**	**P-5**	**P-6**	**P- 7**	**P- 8**
1	I think that I would like to use this system frequently	4	4	3	3	4	2	4	4
2	I found the system unnecessarily complex	1	4	4	4	4	3	3	1
3	I thought the system was easy to use	2	4	4	4	3	3	4	4
4	I think that I would need the support of a technical person to be able to use this system	0	2	4	4	3	1	4	1
5	I found the various functions in this system were well integrated	0	3	4	4	3	3	4	4
6	I thought there was too much inconsistency in this system	3	4	4	4	2	3	4	3
7	I would imagine that most people would learn to use this system very quickly	1	3	4	4	4	2	4	4
8	I found the system very cumbersome to use	2	4	4	4	2	2	3	3
9	I felt very confident using the system	2	4	4	4	2	2	4	3
10	I needed to learn a lot of things before I couk get going with this system	1	2	4	4	2	3	4	3
	TOTAL	16	34	39	39	29	24	38	30
	AVERAGE SCORE	78							

Legend: (Strongly Disagree); 2(disagree); 3(Neutral); 4(Agree) 5(Strongly Agree)

Table 8. Grades and Adjectives to Describe SUS Score

Grade	SUS	Adjectival Rating	Acceptable/Not Acceptable
A+	84.1-100	Best Imaginable	Acceptable
A	80.8-84.0	Excellent	Acceptable
A-	78.9-80.9		Acceptable
B+	77.2-78.8		Acceptable
B	74.1-77.1		Acceptable
B-	72.6-74.0		Acceptable
C+	71.1-72.5	Good	Acceptable
C	65.0-71.0		Marginal
C-	62.7-64.9		Marginal
D	51.7-62.6	OK	Marginal
F	25.1-51.6	Poor	Not Acceptable
F	0-25	Worst Impossible	Not Acceptable

The System Usability Scale (SUS) score is shown in Table 8. The score was calculated by subtracting one from each odd-numbered question's score, subtracting the even-numbered question scores from five, summing these, and multiplying by 2.5. The final usability score is 78, indicating the system is highly usable with a good rating. The highest average score of 38, from the first adviser, reflects their ease with technology. The lowest average score of 29, from the second adviser and one ICT admin, is due to unfamiliarity with the system and numerous suggestions for improvement. Success rates and task efficiency are detailed in the tables below. Admin 2's usability study results in Table 16 show difficulties in system access, account creation, updating, finding the download template for grades and attendance, and printing School Form 9. However, Admin 2 completed all tasks after thorough exploration.

Open-ended questions were used in order to understand more about the reactions and opinions of the participants straight from themselves. The majority of the participants like the user friendliness of the system, especially the interface, but some are a bit confused about the functionality since it is unfamiliar and new to them. Also, most respondents using the system have suggestions because there are some features that they want to be automated. However, the majority of the participants felt happy in using the system because it can make their job easier. Overall, they appreciate the system, especially in generating the School form 9 and 137. Also, a comparison test was conducted in which the manual process of creating the forms and the computerized system were compared.

Deployment

Several steps were taken during the deployment phase. The system was first packaged for distribution. In order to make it simple for users to install the software, all required files, dependencies, and documentation were put together. The system was complete and ready to be accessed on users' devices through the packaging process. Once packaging was finished, there were various ways to distribute the system. It might have been made available online or sent directly to people via email or another form of contact.

In addition to the distribution process, it was essential to provide training and documentation to the users. This ensured that they understood how to use the system effectively and maximized its benefits. Training was conducted through the manual that was given to the ICT administrator and adviser. Based on this feedback, necessary adjustments and improvements were made to address any issues, bugs, or feature requests that were not identified during the testing phase.

CONCLUSION

In conclusion, the Development Department Education School’s form 10 and 137 Generator System for Secondary School successfully addressed the challenges faced by advisers and ICT administrators in the manual process of handling student records. By adopting a design and development approach, the study meticulously gathered data, designed interfaces, implemented these designs, and rigorously tested the system's functionalities. This iterative process ensured that the system met all necessary requirements.

The usability study, which resulted in a score of 78, indicated that the application is effective, efficient, and well-accepted by users, despite some initial navigation challenges. Comparisons between the system and the manual process demonstrated significant improvements in addressing errors, inconsistencies, and time management.

Finally, the web-based application provides a robust solution for advisers and subject teachers, enhancing their productivity and making their tasks easier to accomplish. The system has met and even exceeded its objectives, showcasing a clear improvement in time efficiency and productivity for its users.

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