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OPTIMIZING DATA COLLECTION IN AEMILIANUM COLLEGE INC. ENROLLMENT SYSTEM WITH QUICK RESPONSE CODE INTEGRATION

Diomel J. Canuto
Jeremy L. Gacosta
Leni Girlie M. Idian
Josefina R. Sarmiento

AEMILIANUM COLLEGE INC.
Rizal St., Piot, West District, Sorsogon City, Sorsogon, Philippines

Abstract. This study aimed to design and develop a QR-Enabled Data Collection for Aemilianum College Inc. Enrollment System, which seeks to speed up the current process of data collection during enrollment on the educational institution. The system has an online and offline capability. The offline part of the program involves majority of the process, which includes the management of subjects, management of instructors, management of students and of other system variables. The online part of the system consists mainly of a data collection front where students can input their personal data in advance prior to enrollment, and generate a QR code containing the data, which the admin can scan during the enrollment. The QR code can be printed or saved on a device.

The QR-Enabled Data Collection for Aemilianum College Inc. Enrollment System research study focuses on the implementation of a cutting-edge solution to revolutionize the college's enrollment process. Aemilianum College Inc., a prestigious educational institution, currently faces challenges with its manual data collection system during enrollment. This traditional approach is time-consuming, error-prone, and demands significant resources and manpower. To address these issues, this research study proposes the integration of Quick Response (QR) codes into the college's data collection system. By leveraging QR codes, students will have the convenience of filling out digital forms, eliminating the need for paper forms and subsequent manual data entry. The aim is to enhance the efficiency, accuracy, and overall convenience of the enrollment system, benefitting both students and administrative staff. By streamlining the enrollment process through QR-enabled data collection, Aemillianum College Inc. can reduce errors, minimize delays, optimize resource allocation, and enhance the overall student experience. This research study will delve into the implementation process, assess the effectiveness of the QR-enabled data collection system, and provide recommendations for further improvements and potential future applications. By exploring the potential of this innovative technology, this study contributes to the field of educational technology and administrative process optimization, providing valuable insights for other educational institutions considering similar advancements.

Key Words: Data Collection, Enrollment, Offline, Online, QR-Code

INTRODUCTION

Education plays a crucial role in shaping both individuals and societies, acting as a cornerstone for personal growth, social progress, and economic development. Schools, as primary institutions dedicated to knowledge dissemination, provide an environment and resources necessary for fostering intellectual curiosity, critical thinking, and skill acquisition. Given their ability to cultivate empowered citizens, schools hold significant importance in shaping a nation's destiny.

In the Philippines, education's significance is acknowledged by the 1987 constitution, which prioritizes allocating the highest budgetary resources to it. The government's efforts to make education accessible are evident through the establishment of public elementary, secondary, and tertiary schools, as well as the enactment of various laws and policies. The right to education is an essential tenet of the current constitution, and the private sector also plays a major role in supporting this endeavor. In 2020, the Department of Education reported that approximately 95% of elementary and secondary school students were enrolled in public schools, while 5% attended private institutions. However, the scenario differs when it comes to tertiary education, as more than 50% of college students were enrolled in private institutions in 2020, compared to public universities and colleges. These numbers are expected to rise further as an increasing number of Senior High School graduates pursue higher education.

With an anticipated surge in enrollees, educational institutions are exploring ways to streamline their processes to handle a higher volume of applications and inquiries within shorter timeframes. Technology has emerged as a crucial factor in achieving this goal. More and more educational institutions are embracing technology to enhance their processing capacity and streamline legacy processes that may struggle to handle the growing number of students seeking college education. The pandemic has further accelerated this trend, compelling schools, and colleges to shift their teaching facilities to the internet, adopting full online or blended learning modalities.

However, the transition to technology adoption in education is not without its challenges. Despite improvements in the country's internet infrastructure due to the pandemic, many areas still suffer from intermittent signal or connection loss. A 2021 survey revealed that around 57 to 66 percent of respondents reported their academic performance being affected by intermittent internet connection loss. Others faced limited access to devices or technology required to connect to the internet (Hernando-Malipot, 2021). These cases must be considered while digitalizing processes to improve efficiency and security. A balance needs to be struck to streamline processes through digitalization while ensuring accessibility for those who lack digital infrastructure.

Aemilianum College Inc., a renowned Catholic educational institution located in Sorsogon province, offers a diverse range of degree programs tailored to meet industry demands. Their programs include the Juris Doctor Program, Master in Information Technology (MIT), Bachelor of Science in Electronics and Communication Engineering (BSECE), Bachelor of Science in Computer Science (BSCS), Bachelor of Science in Information

Technology (BSIT), Bachelor of Science in Industrial Technology (BSIT) with a specialization in Automotive Technology, Bachelor of Elementary Education (BSEE), Bachelor of Secondary Education (BSEd), Bachelor of Arts in Office Administration (BSOA), Bachelor of Arts in Communication (BACom), and Bachelor of Arts in Political Science (ABPolSci). Since its establishment in 1985, the institution has produced numerous graduates, including engineers, lawyers, and teachers. In recent years, ACI has adopted a mixed type of enrollment system, with most processes being conducted on-site. While computerized enrollment exists, the encoding of student data, particularly during periods with insufficient manpower, often leads to delays. Migrating a significant portion or the entirety of the process online could alleviate this problem, but the school's location also experiences intermittent internet connection.

Therefore, the proposed QR-enabled data collection system aims to revolutionize the enrollment process by leveraging technological advancements and the prevalence of smartphones while considering the inconsistent connection conditions faced by students and on-campus. By incorporating QR codes into the system, students can easily input their information through a user-friendly online interface. Once submitted, the system generates a unique barcode that contains the student's data. This barcode can be printed or displayed on a mobile device for subsequent enrollment processes, eliminating the need for manual data entry and minimizing errors.

To accommodate various scenarios, the system caters to both online submissions and walk-in enrollments. In cases where the QR code is unreadable or if students prefer traditional data entry, the system provides textboxes for convenient input of necessary information. This flexibility ensures that the system can adapt to different circumstances, guaranteeing a seamless and inclusive enrollment experience.

Furthermore, the proposed system includes an offline C# application located within the school's administrative office. This application acts as the central hub for enrollment management, allowing administrative staff to scan and parse QR codes, automatically populating relevant student information into appropriate textboxes. Administrators can then review and edit the data, if necessary, assign students to different classes, and generate enrollment forms for printing, serving as tangible proof of enrollment.

By implementing this QR-enabled data collection system, Aemilianum College Inc. aims to optimize their enrollment procedures, reduce administrative burdens, and enhance overall efficiency.

Specific Objectives
Specifically, the study aimed to:

1. Develop QR-Enabled Data Collection for Aemillianum College Inc. Enrollment System with the following features:
    1.1. Admin Features (Offline Program):
        1.1.1. Student Management
            1.1.1. a. Manage Student Data

1.1.1. b. Enroll Students to Subject

1.1.1. c. Print White Forms

1.1.2. Subject Management

1.1.2. a. Manage Subject Lists

1.1.2. b. Inactivate or Activate Subjects

1.1.2. c. Assign schedule on Active Subjects

1.1.3. Instructor Management

1.1.3. a. Manage Instructor Data

1.1.3. b. Assign Instructors to Active Subject

1.1.4. Setting Variables

1.1.4. a. Manage System Variables

1.2. Student/Enrollee Features (Online Program):

1.2.1. Register and Update Data

1.2.1. a. Print QR Code

2. To adopt the usage of the following technologies in the implementation of the system, namely:

2.1 QR Scanner

2.2 Internet

Requirements and Planning

In this phase of the study, the current processes of the College especially those involving enrollment and data collection were observed and scrutinized. This is to identify which phases of the enrollment causes the congestion or delays. Taking this into consideration, data collection was done to gather all necessary information that is required in order to develop a system that will seek to solve this problem.

After a series of observation and document analysis, the researchers were able to identify the areas in the enrollment phase that needs to be improved to speed up and streamline the process. This resulted to the researchers proposing and developing a QR-Enabled Data Collection for Aemillianum College Inc. Enrollment System. During this phase, the researchers also formulated the scope and delimitation of the study, and identify the primary beneficiaries of it, namely: the school registrar, the students, and the institution.
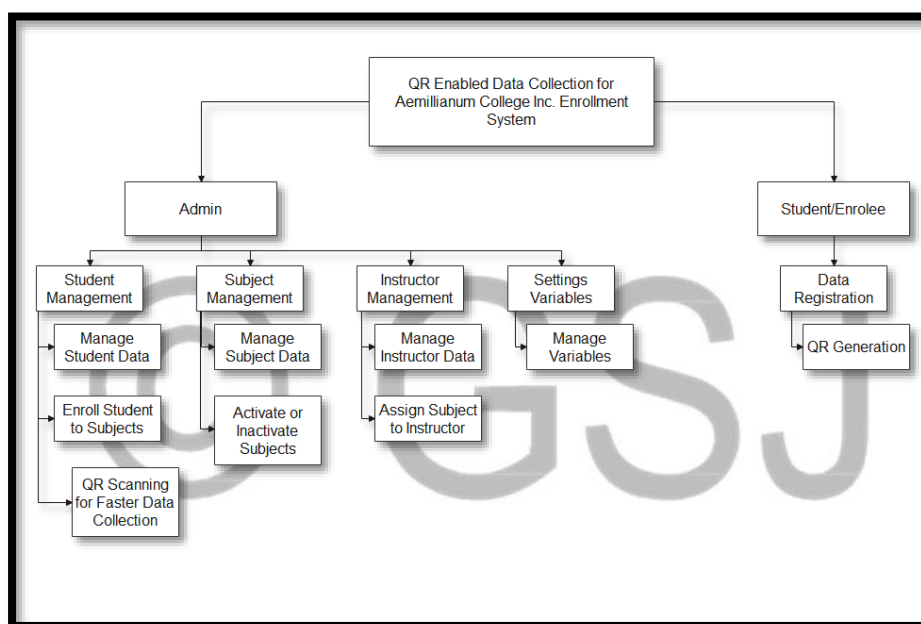
Functional Decomposition Diagram

The functional decomposition diagram is a visual representation that showcases the breakdown of complex systems into more manageable and comprehensible units and sub-units. This decomposition helps in understanding the various tasks and functions involved in the proposed system. By breaking down the system into smaller components, it becomes easier to analyze and identify the different units responsible for specific tasks within the system.

The diagram allows for a clear visualization of the system's structure, highlighting the interrelationships between different units and how they work together to achieve the

system's objectives. Each unit represents a specific function or task, and the diagram shows how these units interact and collaborate to ensure the smooth operation of the system.

The functional decomposition diagram plays a crucial role in system design and development. It aids in identifying dependencies and interactions between different components, allowing for a more organized and efficient system architecture. Additionally, the diagram serves as a valuable tool for communication and collaboration among stakeholders involved in the system development process.

The figure below shows the different task units involved in the proposed system.

Figure 1 – Functional Decomposition of System

The functional decomposition of the system QR-Enabled Data Collection for Aemillianum College Inc. Enrollment System, as depicted in Figure 1 above, shows the primary features and divisions of capabilities provided by the system. It also shows the two primary users of the system: the administrator, the one who manages the enrollment data collection and processing, which might be the registrar, registrar's staff, or any other authorized personnel, and the students, whose data could be collected faster via QR.

The functional decomposition of the QR-Enabled Data Collection system for Aemilianum College Inc. Enrollment System, outlines the key features and divisions of capabilities offered by the system. This decomposition provides a clear understanding of the

system's structure and functionality. The system primarily caters to two key users: the administrator and the students. The administrator, who could be the registrar, registrar's staff, or any authorized personnel, is responsible for managing the enrollment data collection and processing. By utilizing the QR-enabled data collection system, the administrator can streamline the process, reduce manual efforts, and improve the accuracy of data entry. On the other hand, students benefit from the system by being able to provide their data quickly and conveniently through QR codes. This eliminates the need for paper forms and manual input, enabling a faster and more efficient enrollment process. By catering to the needs of both administrators and students, the QR-Enabled Data Collection system enhances the overall effectiveness and user experience of the Aemilianum College Inc. Enrollment System.
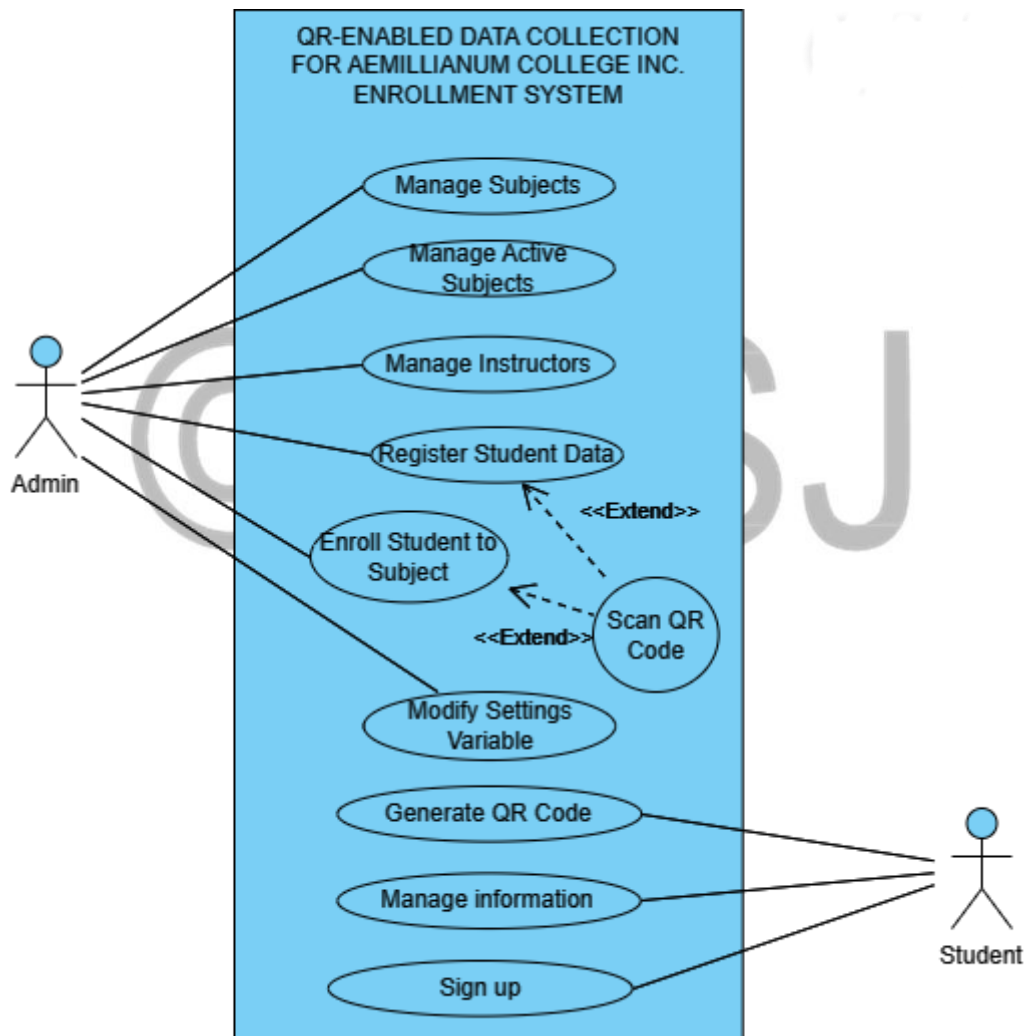

Figure 2 - Use Case Diagram

Majority of the functions of the program, as show in Figure 2, is for the use of the Admin. Under the administrator account, he/she has control of the management of the

subjects' database, the activation of which subjects are being actively offered, the management of the instructors' data, the management of the student data and their enrollment to the available subjects. On the other hand, the students need only to login to the online component of the system to register or update their information and generate the QR code equivalent to that of their registered data.

User Design
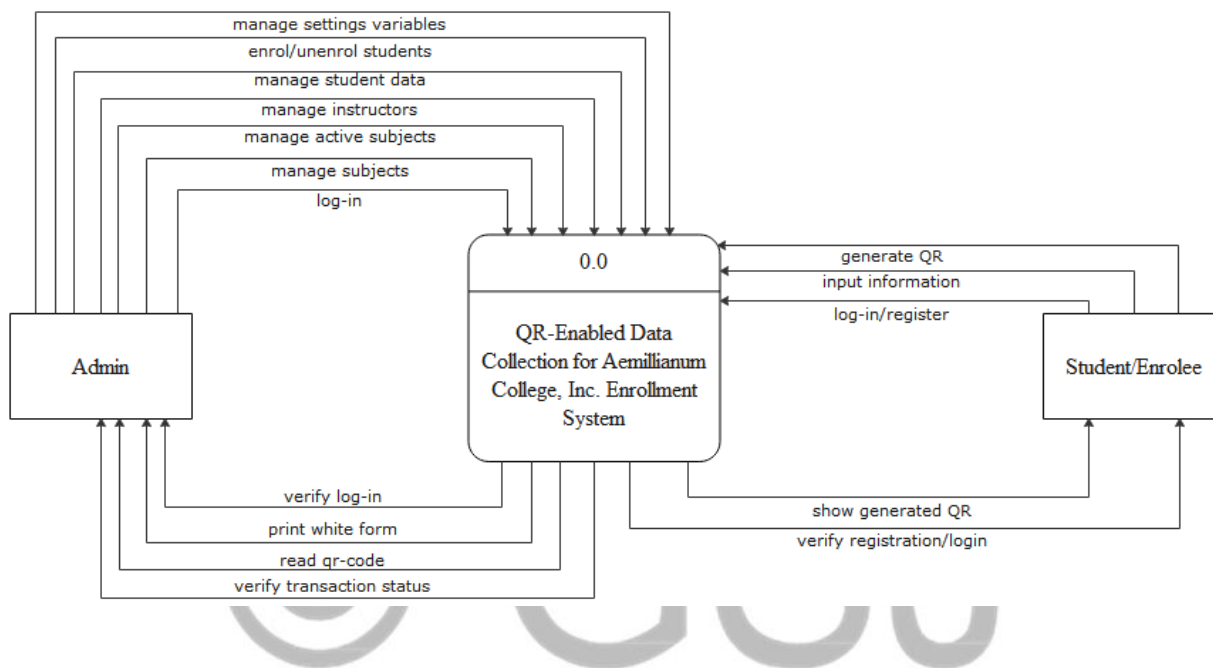
Figure 3 - System Context Diagram

Figure 3 showed the Level 0 Data Flow Diagram of the QR-Enabled Data Collection for Aemillianum College Inc. Enrollment System. This diagram presents an over-all look on the activities and processes that each target user can perform in the system, together with the outputs the system can generate for the target user.

To present a more specific visualization of how data flows through the system, data flow diagrams are one of the most used. The following diagrams then shows a more zoomed-in view of the processes for both two primary users of the system, and how data is transformed and stored throughout the program.
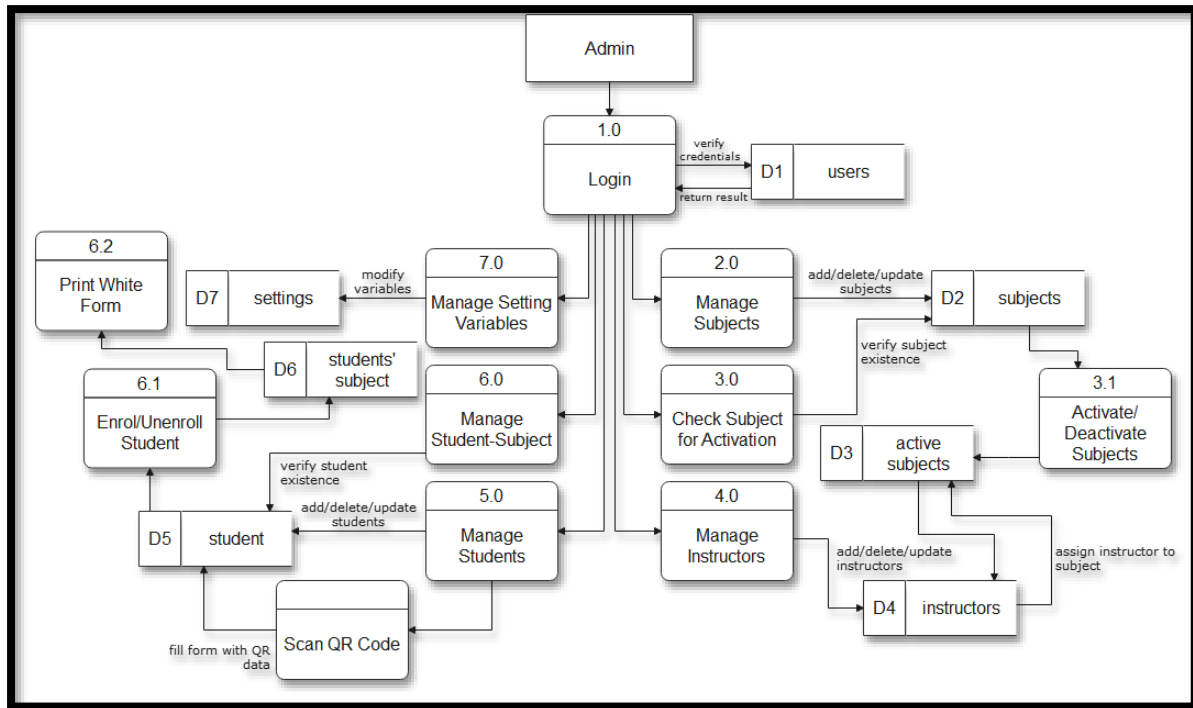
Figure 4 - Data Flow Diagram for the Admin

Figure 4 presents the different processes involved for the admin user type. It depicts the different processes of the system, and the movement of the data in between the different processes. From viewing the diagram, one can see the processes involved for the admin account, which is in the offline windows-based part of the program. Processes include managing subjects, where admin can add, update, or delete subjects; checking of available subjects, and the activation or deactivation of specific subjects, which is necessary due to the required updating of subjects offering as mandated by the Commission on Higher Education, which could lead to the implementation of two different curriculums in some specific years; the managing of instructor data, which includes the adding, updating and deleting of instructor data, and their assignment to the activated subjects; management of student data, which includes the adding, updating and removal of their information, which is crucial especially as the Data Privacy Act of 2012 requires every data collector to keep the information in their systems as accurate as possible; the registration or unenrollment of student to specific subjects; and the succeeding printing of white form as evidence of enrollment. There is also the management of the variables necessary for keeping the information of the system up-to-date and accurate.

This data flow diagram for the admin side of the QR-Enabled Data Collection for Aemillianum College Inc. Enrollment System also shows the different database tables and the flow of how data is stored in the system. Some parts of the necessitates checking data in

another table in order to proceed, which is vital in making sure all necessary data dependencies are indeed functioning.
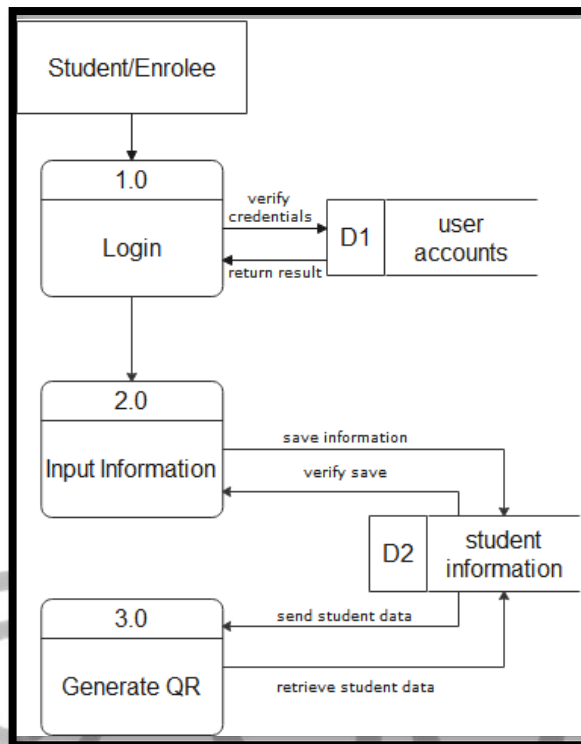
Figure 5 –Data Flow Diagram of Student/Enrollees

The above QR-Enabled Data Collection for Aemillianum College Inc. Enrollment System Data Flow Diagram of Student/Enrollees depicts the processes included in the online-part of the program, which is designed for use of the second user of the system, which are the student/enrollees. This diagram presents an overview of the features available to the target user. For the student/enrollment side, the only process involved is the encoding of enrollment data, which could be done on the internet by the student itself in order to reduce time spent on-campus during enrollment. Then, in order to be able to use that information during their on-site enrollment, they can generate a QR code containing all that information, which the admin could easily scan in the offline part of the system.
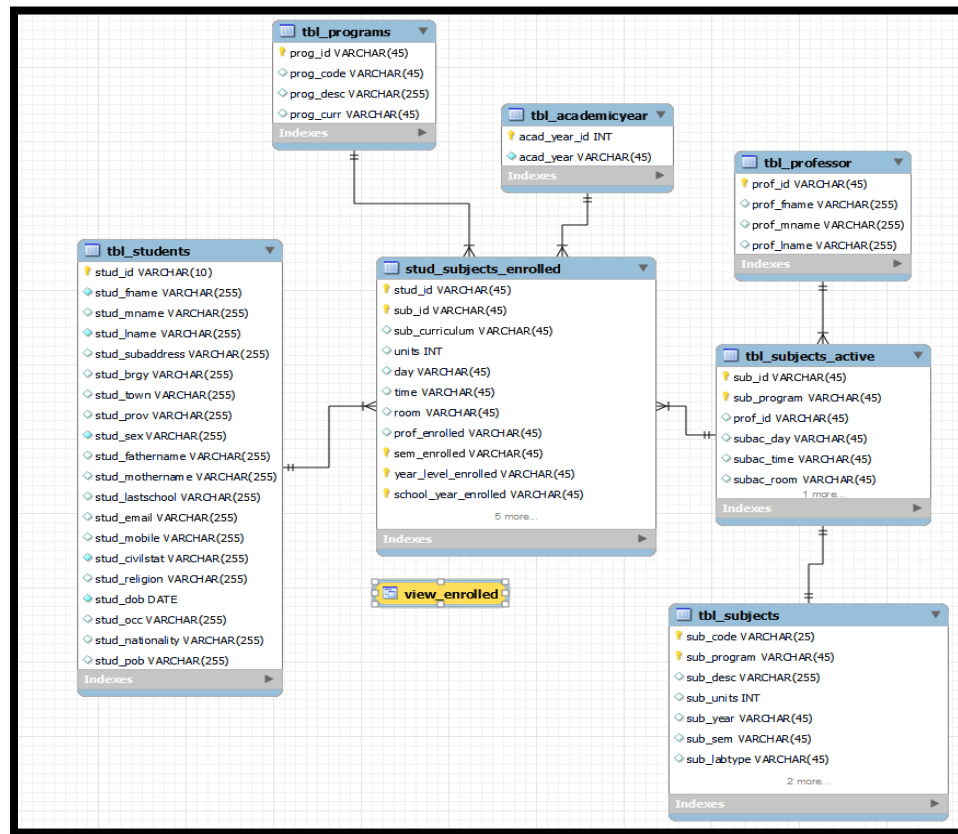
Figure 6 – Entity Relationship Database Diagram

Figure 6 referred to the Entity Relationship Diagram of the Application of Multiple Technologies in a Cloud-Based Voting System for Aemilianum College Inc. Each table and entity were accurately designed to meet the requirements of the system specification. The diagram represented the backend flow of the system which showed the relationship from one table to another.

Figure 6 shows the Entity Relationship Database Diagram of the QR-Enabled Data Collection for Aemillianum College Inc. Enrollment System. The figure represents all of the tables used to store the different categories of data that the system uses on the backend. The figure also depicts the relationship between tables, and the modality and cardinality of each relationship per table, which is essential in keeping the data accurate and clean, producing less redundancy unless in very necessary scenarios.

Summary of Findings

The following findings has been established after the development of the proposed system:

1. The QR-Enabled Data Collection for Aemillianum College Inc. Enrollment System was developed as an online and offline solution to expedite the data encoding process during enrollment. Students were able to encode their personal data online and generate QR codes for efficient data collection. Furthermore, the system accommodated regular enrollment procedures to ensure usability even in the absence of an internet connection. This dual functionality enhanced the overall speed and convenience of the enrollment process while providing continuous access to the system regardless of online connectivity.

2. The adoption of technologies such as QR codes and the internet was essential in achieving the objective of a streamlined data collection process during enrollment.

Conclusion

Based on the findings of this study the following conclusions are formulated:

1. The developed program played a vital role in expediting the data collection phase of the enrollment system by enabling users to encode their data remotely through the internet. Additionally, the program effectively maintained student data and other enrollment information in a centralized system, minimizing the risk of data loss. The system's adaptability ensured continued usability, even in situations where an internet connection was unavailable.

2. The incorporation of additional technologies was imperative to enhance the efficiency of the system. The chosen technologies were user-friendly and did not require complex knowledge, considering the limited resources available to users.

Recommendations

Based on the conclusion, the following recommendation is hereby offered:

1. Additional features should be added to the system, in order to convert it into a full-fledged enrollment system or allow its integration thereto. Additional features such as the automatic computation of total payment according to current fee structure can be included in the white form. The inclusion of payment processing, generation of reports on enrollment and master lists, and the addition of settings variables to allow customization of values such as fees, faculty and staff names, and other non-constant values in the white form and reports could also be added.

2. It is recommended that the online phase of the program be implemented to an online hosting site instead of being self-hosted on campus, since the site does not necessarily save very important user data, and only serves to generate QR code that users can use to speed up the encoding of their information. This is to ensure the availability of the site, even when internet connection is not available in the campus.

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