STUDENT-ATHLETES QUICK RESPONSE CODE-BASED INCENTIVE SYSTEM FOR RIZAL TECHNOLOGICAL UNIVERSITY

A Capstone Project & Research 1

Presented to the Faculty of the Engineering, Architecture and Technology

RIZAL TECHNOLOGICAL UNIVERSITY

Bgry. Malamig, Boni Avenue

Mandaluyong City

In Partial Fulfillment of the Requirements for the Degree of

Bachelor of Science in Information Technology

Department of Information Technology

by

ADAMERO, MARRY CHRIS M.

CRUZ, ANTONETTE JOY F.

VASIG, MARK JOSEPH T.

YCO, MARY JOY G.

December 2021

Republic of the Philippines
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APPROVAL SHEET

This Capstone Project 1 entitled, **"*STUDENT ATHLETES QUICK RESPONSE CODE-BASED INCENTIVE SYSTEM FOR RIZAL TECHNOLOGICAL UNIVERSITY"*,** prepared and submitted by MARRY CHRIS M. ADAMERO, ANTONETTE JOY F. CRUZ, MARK JOSEPH T. VASIG, MARY JOY G. YCO in partial fulfillment of the course requirements for the degree of BACHELOR OF SCIECNE IN INFORMATION TECHNOLOGY, has been examined and recommended for acceptance and approval for Oral Examination.

ENGR. GRETA M. ROSARIO, MSIT

Adviser

Approved by the Committee of Oral Examination on (Date) with a grade of_____.

Dr. Jaevier Villanueva

Chairman

Mr. Jayson Daluyon   **Prof. Reynaldo Alvez**

Member   Member

Engr. Greta Rosario

Member

Accepted as partial fulfillment of the course requirements for the degree in Bachelor of Science in Information Technology.

ENGR. LORENZO C. CARANGUIAN

Dean, Colloge of Engineering, Architecture and Technology

Date: _____

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ACKNOWLEDGEMENT

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CHAPTER I

INTRODUCTION

Amidst the pandemic, Philippine government adheres the nation to limit public gatherings and regulate movements of residents to prevent the growth of COVID-19 cases. As Coronavirus emerged, face-to-face classes turned into blended learning, whereas the Department of Education and Commission on Higher Education implemented an online learning system. The application of standardized health protocol secures the safety of both students and employees of the universities while continuing the service at their homes. This proposal aims to transform the traditional payments into cashless transactions that may apply to student-athletes of Rizal Technological University.

In this project, clarity will be administered. To lessen the works assigned to the person who monitors the purchases made by student-athletes. The transactions will be stored within the database server to have a record when the cashier exchange their collected points into Philippine peso. Coordination with the authorized personnel in charge of releasing the incentives for students-athletes. Create a system to be used by administrators, student-athletes, and cashiers in both coop and university canteen. Furthermore, designing the security features will be a requirement for the system. To provide efficient workflow and accurate approach of the data for both student-athletes and system administration.

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Student-athletes of Rizal Technological University Boni Campus will benefit from this project. As well as the transaction from the distribution of incentives per week to student-athletes will bring convenience as the system will auto-generate the incentives points.

The project will limit the physical contact during distribution of incentives to student-athletes in non-monetary exchange for food and other necessities. It provides an accounting report to be evaluated by Sports Development Office.

Background of the Study

Rizal Technological University – Boni Campus provides a dormitory whereas the student-athletes can stay and accommodate the rooms for the whole academic year. Distribution of the athletes' incentives once per week is a strenuous activity for the person in charge. Athletes exchange weekly incentives as a food or product that may use for daily life in dormitories. The process of distributions and exchanging of incentives requires physical contact. It cannot be avoided since the incentives comes with a piece of paper labeled as one stub. Athletes often to forget where they put or hide the food stubs, some are torn or soaked. The management also has a problem where the owners of stubs intends to give it to a friend, it violates the general rule. All of these drawbacks can be avoided and improve by the help of virtual payment.

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These stubs can be traded at the University Canteen for food and also in COOP (Cooperative) for food, essential products, and souvenirs like University shirt and jackets. University Canteen and COOP are the two available stores where athletes can exchange incentives. It is a piece of paper labeled as one stub equivalent to 50 Philippine Peso. Athletes received the incentives at the Sports Development Office every Monday for weekly food allowance. It comes with 21 stubs, 3 stubs per day for three main meals. Afterwards, it will be converted to Philippine Peso through the accounting department and have a report to the office for lists of purchases and transactions made by the student-athletes.

The researchers intended to develop a Quick Response Student-Athletes Incentive System for Rizal Technological University that will address the following issues. Creating contactless transactions to receive and exchange weekly incentives. The idea of virtual payment amidst pandemic.

Objectives of the Study

The primary objective of this study is to design and develop an electronic wallet system that will be used by the student-athletes for certain purposes, namely, electronic payment transactions at any related non-monetary exchange of university-based establishments for a faster and secure way of purchase.

Specifically, this aims:

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1. To provide an efficient and secured way of payment transaction for student athletes at any university-based establishments such as University Canteen, and Kawani Multipurpose Cooperative cashiers to claim incentive points through QR code.

2. To develop a Web Application where it helps the student-athletes and related facilitators to monitor the usage of the incentives and manage the users accounts.

3. To allow the administrators to have a real time detailed report of the transactions.

Significance of the Study

The researchers were expected to assist, administer, and provide information about this study which will benefit the following:

Student-Athletes: They can use the Quick Response Code as Payment in any incentive transaction establishment in Rizal Technological University – Main campus.

Administrators: They can track records and increase data accuracy within the system.

School establishments: The result of this study will encourage ease of payment transactions. Reduce time–consuming process, queue and improve data accuracy.

Rizal Technological University-Main Campus: It will contribute to the development of incentives transactions of student-athletes.

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Researchers: This will serve as a tool in motivation and enhance logic, analytical problem-solving, writing, and programming skills.

Future Researchers: This study may serve as an avenue for upcoming researchers as a reference of ideas in discovering problems, designing, developing an Incentive System via Quick Response code that will require data collection in the field of research.

The Information Technology Students: This will serve as a guide and source of information in discovering, investigating problems, and developing a system related to this study.

The Non-information Technology Students: This will serve as an awareness, realization, and motivation. To discover the possibility of unraveling problems and solve them for innovative inventions through programming. To propose a system could exist.

Scope and Limitation

This study focuses on the efficiency and productivity of students and other people whom this study will be significant. This is to reduce the amount of time people have to wait for the product or service that the university provides.

Particularly, this study will cover payment transactions within the university. However, the number of points the account can hold will be limited to avoid misuse.

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Furthermore, they may use their digital wallet to access their student account when purchasing within the school premises.

Scope:

1. The system has 4 major accounts. Sports Development Office, University Canteen and Kawani Multipurpose Cooperative Canteen's cashiers, and the student-athletes.

2. The system admin will be the sports development admin that creates accounts of the student-athletes, stores, and archives records.

3. The system on the cashiers' end has validated numeric input fields and button for saved purchase payment. In addition, it displays the information of the student-athletes and transactions.

4. The sports development admin is the only one who can add points that is equivalent to student-athletes meal and allotted allowance for the week.

5. The student-athlete page has three functions: view balance, QR code, and request.

6. The view balance section lets the student-athletes check their remaining balance and the history of transactions.

7. The student-athlete's view QR code button can be used to download or print the respective QR code.

8. The request points button is to let the student-athlete request to the admins for points allowance.

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Limitations:

1. The system can only give access for those who are officially enrolled and certified as a student - athlete.

2. The system is not designed to provide monetary benefits.

3. The system cannot be used by kiosk vendors and stalls.

4. The system does not support refunds and peer to peer transaction.

Theoretical Framework

This study was based primarily on Modularity Theory, Equity Theory, and Incentive Theory.

Modularity theory (also known as Theory of Interdependence and Modularity) is a framework for explaining how the different components of a product structure are related and therefore affect production and acquisition metrics. When a product or service reliably delivers to customers, individual components and interoperability become standardized. This creates a modularity situation where many providers can compete to deliver one or more modules at a lower cost and faster. Dependence and modularity are not binary ideas; they are part of the process. It is worth emphasizing that the use of modularity or dependence does not determine whether a product is acceptable, but predicts how quickly acquisition will occur (Christensen C., 2021).

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Next, Adam's equity theory says that an employee who perceives inequity in his or her rewards seeks to restore equity. The theory emphasizes equity in the pay structure of employees' remuneration. Employees' perceptions of how they are being treated by their firms are of prime importance to them. The dictum 'a fair day work for fair day pay' a sense of equity felt by employees. When employees perceive inequity, it can result in lower productivity, higher absenteeism, or an increase in turnover (Shawkat J., 2021).

Lastly, the incentive theory of motivation is a behavioral theory that suggests people are motivated by a drive for incentives and reinforcement. The incentive theory also proposes that people behave in a way they believe will result in a reward and avoid actions that may entail punishment (Praveen, S., 2017).

Concerning these theories, the present study aimed to analyze how Incentives for the student-athletes of Rizal Technological University served the purpose of Modularity Theory that delivers a reliable way to the product and service between athletes and cashiers. On the other hand, as suggested by Equity Theory, it is also intended to give equity for all student-athletes, the quality of being fair and impartial must be regulated. In closing, Incentive Theory states that every student-athlete must receive their corresponding incentives from time to time to motivate the behavioral aspect of being dedicated to their passion and career. The web application that the researchers develop will assist and stabilize the transactions.

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Conceptual Framework

The figure showed the conceptual paradigm of the study indicating the Input-Process-Output System.

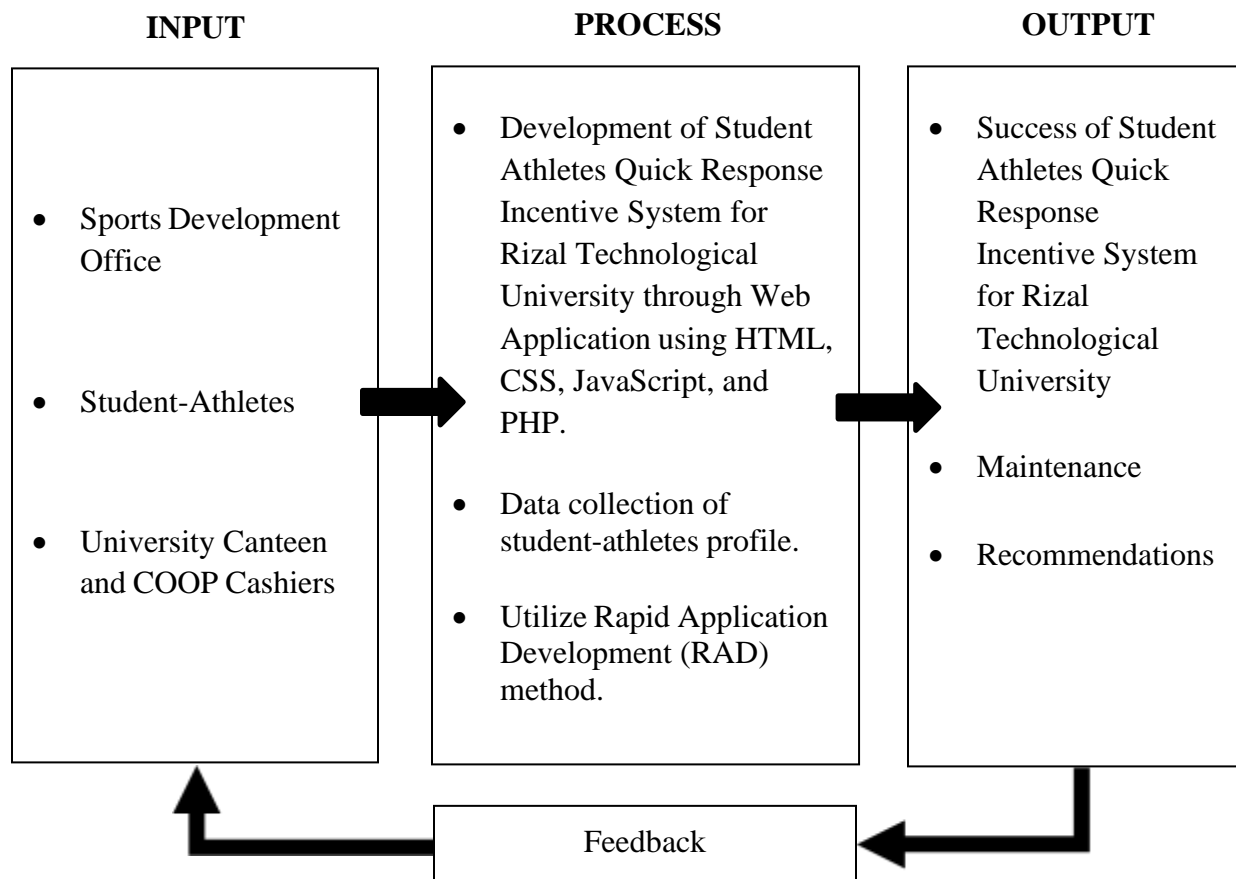| INPUT	PROCESS	OUTPUT
• Sports Development Office • Student-Athletes • University Canteen and COOP Cashiers	• Development of Student Athletes Quick Response Incentive System for Rizal Technological University through Web Application using HTML, CSS, JavaScript, and PHP. • Data collection of student-athletes profile. • Utilize Rapid Application Development (RAD) method.	• Success of Student Athletes Quick Response Incentive System for Rizal Technological University • Maintenance • Recommendations

Feedback

Figure 1.0: Input-Process-Output System

Figure 1.0 shows the Input-Process-Output System. The input contains the important variables needed for the research. The process explains the procedures and the workflow in executing this research. The output is the success of Student Athletes Quick Response Incentive System for Rizal Technological University.

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Operational Definition of Terms

For the better understanding of this study, the following terms will be defined as follows:

Digital Wallet – refers to a software, electronic device, or online service that allows individuals or businesses to make electronic transactions.

Quick Response Code – is a type of barcode that can be read easily by a digital device and which stores information as a series of pixels in a square-shaped grid.

Sports Event - an athletic activity requiring skill or physical prowess, usually competitive in nature and governed by a set of rules.

Student Athletes - a participant in an organized competitive sport sponsored by the educational institution in which he or she is enrolled.

Virtual payment - the purchase of goods and/or services over the internet by the Customer from the Merchant for which authorization has been obtained.

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CHAPTER II

REVIEW OF RELATED LITERATURE AND STUDIES

In this section of the study, the related literature and similar studies were discussed.

FOREIGN

Student-Athlete

According to the findings of this study (Maier, C., et al., 2016), non-monetary rewards are more valuable than monetary rewards. Within an organization, incentives play a critical role in creating a performance-enhancing atmosphere. Elite sports organizations instead of focusing just on the effects of budgets and salaries. Based on this research it is necessary to uncover and examine relevant non-monetary incentives for job satisfaction in the future because money cannot purchase performance.

Quick Response Code

Based on this project system of (Ahmed, B., & Dr. Al-Qaraawi, S. 2019). The program benefits from a mobile, Quick Response code (QR) method and network plan. A QR tag is attached to each item on the market, while the mobile app can be installed on the SmartPhone. Introduced to scan the attached QR tag and send the result to the network system and the network system will process the received data. Brief information will be delivered to the local server website. The system retrieves this information from the main server and uses it on a smartphone screen. Items will be arranged at the post-payment

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location, providing an effective billing system. This program was there designed, implemented, and tested to make the system work achieved with two key points: immediate access to information and network congestion to avoid. Which provides mobile devices convenient living, saving time and cost for the society, and one of these techniques includes QR code. QR code is one of the simple and effective ways to encode and decode a large amount of information quickly. Therefore, this paper utilized it to implement an identity tag system that is used in indoor trade institutions.

As stated by (Petrova, K., et al., 2016), the standard design of the QR code makes it easy and cheaper to create. Also, impossible to identify as a "good" QR code compared to the "dangerous". But there are steps that companies and individuals should consider before simply scanning the QR code we hope you do not introduce malicious or harmful code. Simply means, end-users should not trust any QR code and be aware of where any QR code can direct them. QR Code is a two-dimensional (matrix) code developed in ways that allow companies and individuals to sell or market their products, skills, and events quickly and easily. The code can be used to represent data such as a web address or a map location that can be quickly scanned with a mobile device such as a smartphone. Tracking inventory with advertisers was one of the first uses for QR code users due to its ease of use and low cost of development. While there are many benefits to the use of QR codes, there is a negative side that has led end-users to stop using them.

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Virtual Payment

The paper attested by (Yang, S., & Wen, L. 2020) inferred the creation of a virtual payment system will improve compass payments and the compass card system to a new level, and improve efficiency the level of school information service and product impact; various payment methods and the media resources provided by the school can effectively stimulate the use of teachers and students in the school, and create a quality payment platform to improve the efficiency of school financial management. This analyzes student behavior on a daily basis, enable the school to accurately assess poor students with adequate data usage, and can provide multiple payment channels for teachers and students to pay various bills; automated financial reconciliation, clarification, and resolution can reduce the work of financial personnel; online services such as card handling, refilling, loss report, loss report cancellation, and payment, etc. reduces the workload of staff at the card center, and improves the service knowledge of teachers and students. The virtual payment system has a complete account management system and provides online and offline payment services simultaneously. Cardholders can enjoy compass payment services with cards, QR codes, and other methods, which violate the media limits of compass cards. School service departments, vendors, and third-party applications can easily and quickly access and use payment services.

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LOCAL

Digital Wallet and Payment

As recommended by (Chaves, S.M., Iturralde, E., King, N.K., Mate, M.C., Riano, J.C., & Rosendo, R.J. 2019) Electronic payment instruments should be "interoperable" to create all payment types on a single platform. This means that payment instruments issued or accepted by a specific institution would gain in customer convenience and market efficiency if they were usable as broadly as possible. Compatibility between electronic payment systems, which is beneficial to both users and businesses, will be based mostly on operator agreements. Payment instruments should include the essential safeguards to ensure that they are not used for or in conjunction with illegal activity. From a technical standpoint, it is critical to find solutions that make electronic payment systems as secure as possible; in particular, implementing proper encryption methods, electronic signatures, and other similar techniques, which is essentially the responsibility of service providers. Financial institutions and digital payment providers should improve security to combat the risks of fraudulent use and counterfeiting.

The research of (Cendana, D. I., & Palaoag, T. D.2020) has provided relevant and sufficient information for HEIs to consider adopting Smart-ID in a university setting. The conversion of a student ID into a smart ID, on the other hand, necessitates the participation of individuals who will be crucial in the framework's successful implementation. To ensure a long-term culture of embracing technology in the school, both parents/scholarship

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sponsors and students must be adaptable to using smart cards. Only when parents can transact through banks and students can afford to utilize smart cards instead of cash can ease of use and convenience be assured. As a result, the implementation of smart ID in HEIs may result in favorable adaption among students, school administration, and banks. The study goes on to say that using smart ID could help improve the educational environment by ensuring that school fees are paid on time and instilling a sense of responsibility in students to prioritize their financial duties. One of the requirements for improving payment services in industrialized countries has been cashless payment in educational environments.

Synthesis

The reviewed literature discusses primarily the main point of how the student-athlete must be treated well. Appropriate incentives will drive them to pursue their career. Within an organization, incentives play a critical role in creating a performance-enhancing atmosphere. It is necessary to uncover and examine relevant non-monetary incentives for job satisfaction in the future because money cannot purchase performance. In relation to (Maier, C., et al., 2016).

When it comes to Quick Response code, researchers will develop a system that focuses on the application of Incentives to student-athletes. The system benefits from a website, Quick response code (QR) method, and network. A QR code is generated using

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the web application. The result of the transaction will direct to the network system of the admin and process data. Brief information will be delivered to the local server.

Based on (Ahmed, B., & Dr. Al-Qaraawi, S. 2019) The system retrieves this information from the main server and uses it on a smartphone screen. Items will be arranged at the post-payment location, providing an effective billing system. QR code is one of the simple and effective ways to encode and decode a large amount of information quickly. Therefore, the traditional food stubs in a form of paper will be altered by the QR code system that is used in University institutions.

Following, the virtual payment system will improve compass payments and the traditional food stub system to a new level, enhancing the effectiveness of student-athletes information service and overall impact. According to (Yang, S., & Wen, L. 2020) The virtual payment system has a complete account management system and provides online and offline payment services simultaneously.

Lastly, the web application is based on a digital wallet and payment. The incentives of the student-athletes will store at their corresponding accounts. As recommended by (Chaves, S.M., Iturralde, E., King, N.K., Mate, M.C., Riano, J.C., & Rosendo, R.J. 2019) Electronic payment instruments should be "interoperable" in order to create all payment types on a single platform. This means that payment instruments issued or accepted by a

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specific institution would gain in customer convenience and market efficiency if they were usable as broadly as possible. Keeping a food stub in a form of paper faces a lot of consequences like being soaked, torn or even the student-athletes forget where they hid their food stub. Developing a digital wallet and payment improves the overall management system of incentives.

The present study is similar to the reviewed researches since it deals also with the relationship between the student-athletes and the development of technology. Improving the traditional way of claiming their incentives into a modern and accessible system while the supervision of the Sports Development Office will be a lot easier.

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CHAPTER III

RESEARCH METHODOLOGY

This chapter demonstrates the technical background, methods, requirement analysis and procedures of the proposed system concerning the study's objectives, such as providing an effective and secured way of the payment transaction for student-athletes at any university-based establishments such as University Canteen, and Kawani Multipurpose Cooperative cashiers to claim incentives. Furthermore, discusses the research methodologies that include research designs used, the population frame and sample, the description of respondents, the research instrumentation, and the statistical treatment of data.

TECHNICAL BACKGROUND

Web Application System

The proposed web application will be able to run on different active versions of computers and mobile devices. All of these factors are taken into account in modern responsive design in order to provide the best possible user experience.

Hardware

Computer

A computer is an overall machine that performs different tasks and produces outputs. It is designed to help people for fast and efficient works (Techopedia, 2020). The web application will run on the user's end as long as the device supports the browser and

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is connected to a network. Furthermore, the technology is more innovated than before, the specifications in developing must be at least average or above average. The proponents will use Intel Core I3 and I5 series laptops with 2GB-8GB RAM and at least 500GB HDD/SDD that can run average programming software.

Mobile Device

Smartphones are mobile phones with highly advanced features. A typical smartphone has a high-resolution touch screen display, internet connectivity, web browsing capabilities, and the ability to accept sophisticated applications (Techopedia, 2019). The specifications that any of the smartphones have been enough to make the application run in any web browsers. The proponents will use an Android 4.0 version and above operating system device to test the usability in mobile devices.

Software

Web Browser

A web browser is an application program that provides a way to look at and interact with all the information on the World Wide Web which includes Web pages, videos, and images. The proposed web application will run on any web browser such as Google Chrome, Microsoft Edge, Internet Explorer, Mozilla Firefox, Safari, Opera Internet Browser, and other available browsers.

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Source Code Editor

A text editor that is specialized for writing software. A source code editor may be a stand-alone program or part of an integrated development environment (IDE). They make writing and reading the source code easier by differentiating the elements and routines so programmers can more easily look at their code (PC Mag, 2020). The proponents will use Visual Studio Code and Sublime latest versions.

`Front-end and Back-end

Web design is an important component of web development. A good design allows the user to access and navigate the application with ease. To provide a smooth browsing experience, HTML5, and CSS will be used to design the front-end.

Back-end development focuses on how the web application works. JavaScript, and WampServer which is a Windows web development environment that allows to create web applications with Apache2, PHP, and a MySQL database. Alongside, PhpMyAdmin allows to manage databases easily will be used to make the proposed application dynamic.

Peopleware

The proponents are the web developers, which consist of four individuals, the client users are the Rizal Technological University's Sports Development Office, and the end-users are the Student-Athletes.

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Network

Local Area Network (LAN)

LAN is a network of connected devices that exist within a specific location. LANs may be found in homes, offices, educational institutions, or other areas. A LAN may be wired, wireless, or a combination of the two. A standard wired LAN uses Ethernet to connect devices together. Wireless LANs are typically created using a Wi-Fi signal (TechTerms, 2016).

Wireless Local Area Network (WLAN)

A wireless local area network (WLAN) is a wireless distribution method for two or more devices. WLANs use high-frequency radio waves and often include an access point to the Internet. A WLAN allows users to move around the coverage area, often a home or small office, while maintaining a network connection. (Techopedia, 2020).

Research Method

The researchers will use developmental and descriptive research methods. Developmental research, as opposed to simple instructional development, has been defined as "the systematic study of designing, developing and evaluating instructional programs, processes, and products that must meet the criteria of internal consistency and effectiveness" (Seels & Richey, 1994, p. 127). Developmental research is particularly important in the field of instructional technology. The most common types of developmental research involve situations in which the product-development process is analyzed and described, and the final product is evaluated (Dr. Jaikumar, 2018).

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According to McCombes (2019), Descriptive Research aims to accurately and systematically describe a population, situation, or phenomenon. It can answer what, where, when, and how questions, but not why questions. A descriptive research design can use a wide variety of research methods to investigate one or more variables. Unlike experimental research, the researcher does not control or manipulate any variables but only observes and measures them. It is appropriate when the study aims to identify characteristics, frequencies, trends, and categories.

Population Frame and Sampling Scheme

The population for this research includes the selected faculty, student-athlete, and I.T. practitioners of Rizal Technological University, Boni Avenue Campus. A total of twenty respondents comprised the total population of the study. Fifteen percent (15%) of the total population were faculty who will use the Student-Athletes Quick Response Code-Based Incentive System through Web Application, while seventy percent (70%) were student-athletes who will also use the application. The remaining fifteen percent (15%) of the respondents were the I.T. practitioners who will test the Student-Athletes Quick Response Code-Based Incentive System through Web Application and evaluate it. All students currently enrolled as student-athletes were chosen as the respondents; hence, purposive sampling will be used.

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Table 1

Population Frame of the Respondents

Designation	f	%
Faculty	3	15%
Students	14	70%
IT Practitioners	3	15%
TOTAL	20	100%

Description of Respondents

To evaluate the Student-Athletes Quick Response Code-Based Incentive System through Web Application in terms of functionality, reliability, usability, efficiency, maintainability, and portability, twenty respondents will be chosen. Three of them must be faculty members at the Sports Development Office for more than ten years now. Further, three I.T. practitioners who have been working in different industries for not less than seven years will evaluate the application. All of these I.T. practitioners also have teaching experiences that even made them evaluate the application from different perspectives. Meanwhile, all fourteen student-athletes enrolled in the university will be among the respondents. These student-athletes can be in any course, sports event, and year or level. The knowledge and outputs that they had on the aforementioned characteristics made them capable respondents to evaluate the Student-Athletes Quick Response Code-Based Incentive System through Web Application.

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Research Instruments

The research instruments will be used in this study were a survey questionnaire and document analysis.

The researchers will use an adapted-modified questionnaire checklist to determine the level of acceptability of the Student-Athletes Quick Response Code-Based Incentive System through Web Application using the six criteria of functionality, reliability, usability, efficiency, maintainability, and portability. The contents of the questionnaire will be disseminated using the Google Forms Evaluation. The name of the application will only be integrated into the checklist. Experts will validate the modified checklist to ensure the validity of the instrument. The computed data will be interpreted using the five-point Numerical Rating Scale method: (5) Highly Acceptable, (4) Acceptable, (3) Moderately Acceptable, (2) Less Acceptable, and (1) Not Acceptable.

Data Gathering Procedure

The researchers sought permission to conduct research and study from the Sports Development Office of Rizal Technological University, Boni Avenue campus, which will be secured through a letter requesting permission. The researcher pursued the data gathering after the grant of permission to conduct the study. The adapted, modified questionnaire checklist will be validated to be able to properly respond to the objectives of the study. Before that, the researchers will give access to the participants to test the

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developed Student-Athletes Quick Response Code-Based Incentive System through Web Application. The results will be computed according to the frequency of items checked by the participants. The results of the data will be interpreted using various statistical tools. The results of which served in the formulation of conclusions and recommendations.

Statistical Treatment of Data

The data collected in this study were subjected to certain statistical treatments. The data were coded, tallied, and tabulated using the following statistical tools:

1. To determine the respondent's evaluation of the Student-Athletes Quick Response Code-Based Incentive System through Web Application in terms of functionality, reliability, usability, efficiency, maintainability, and portability, the weighted mean will be used.

   Formula:
   $$\overline{WX} = \frac{\sum fx}{\sum f}$$

   Wherein: $\overline{WX}$ = Weighted Arithmetic Mean

   $\sum fx$ = sum of all the products of f and x, where f is the frequency of each weight and x is the weight.
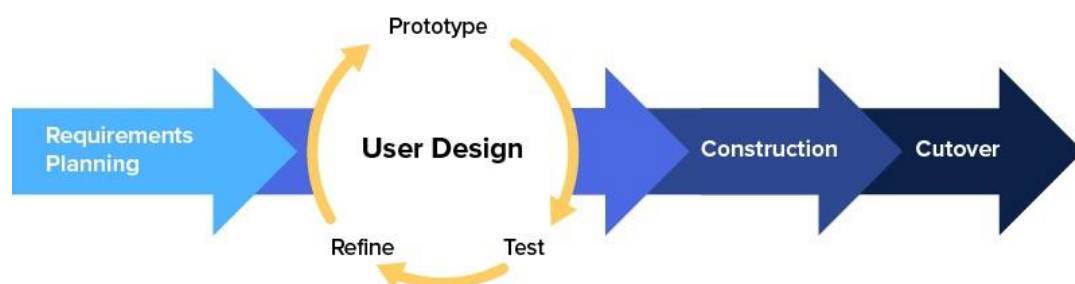
   $\sum f$ = sum of all the subjects/respondents/case

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The researchers will use the five-point Numerical rating scale, a rating scale that requires the subject to indicate his or her degree of acceptance or non-acceptance to a statement using the scale below to determine the corresponding descriptive equivalent and the responses of the respondents.

Development Method

The development of the Student-Athletes Quick Response Code-Based Incentive System will follow the Rapid Application Development Life Cycle Method to analyze the problems and determine a feasible report of solutions that will be used throughout the process. Additionally, this is to be utilized by the researchers due to its rapid prototype releases and iterative method, wherein it allows the researchers to continue certain procedures concurrently when they notice some valuable changes to be done.

Source: https://www.yeeflow.com/

Figure 3.0 *Rapid Application Development*

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Requirement Analysis

The requirement analysis determines the system's behavior and its limitation. To identify the problems and solutions, this section provides the detailed necessary requirements for the overall process of the system. The following are set of analyzed system requirements for the functionality of the student-athletes quick response code-based incentive system:

For Payment Transaction

Input

- Student information specifically the student I.D. number, through scanning the student QR code.

- Authentication credentials manually inputted by the student, such as username and password.

Process

- Checks redeemed points of and by the student.

- Allows the student to pay in university-based establishments cashless.

- Update and store the non-monetary transaction history of the student.

Output

- Display non-monetary transaction receipt indicating the total amount paid, university-based establishment's name, and date.

- Digital storage of transaction history of the student-athlete.

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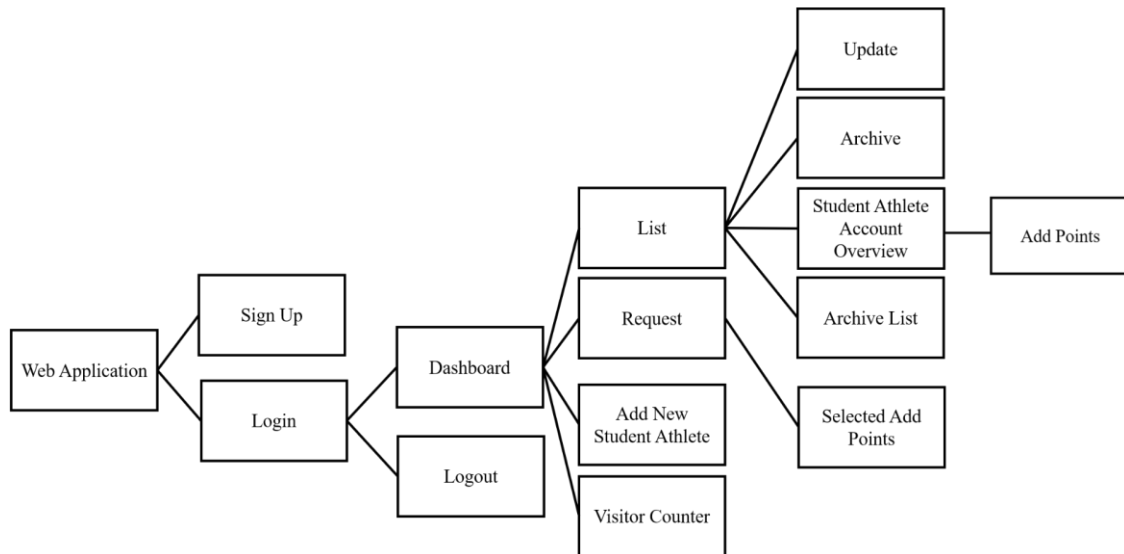**Operational Feasibility**

Admin

Figure 3.1 *Block Diagram of Admin E-Wallet Process System*

Student-Athletes
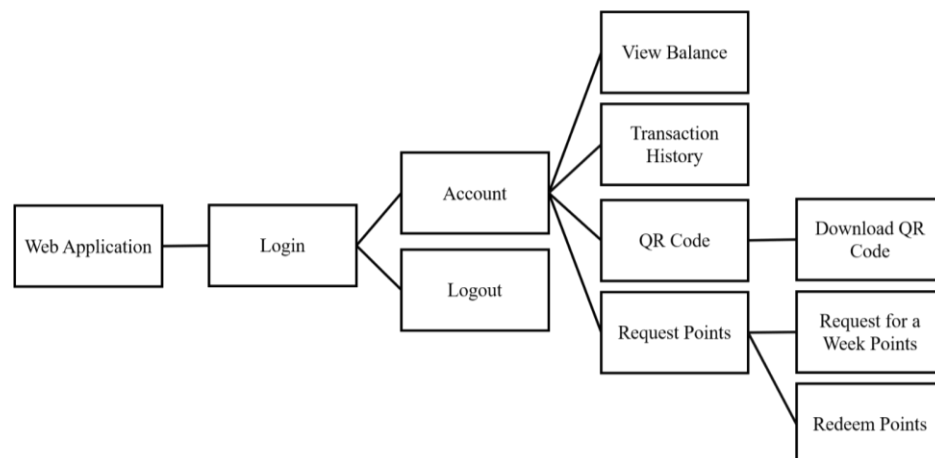
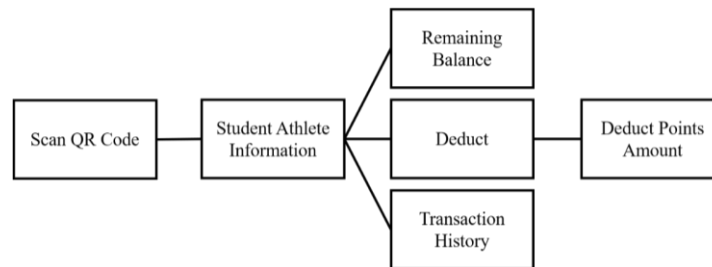**Figure 3.2** *Block Diagram of Student-Athlete E-Wallet Process System*

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Cashier

Figure 3.3 *Block Diagram of Cashier E-Wallet Process System*

Figure 3.3 above shows the block diagram of the Student-Athletes Quick Response Code-Based Incentive System on how it will function with the step-by-step features. The admin can monitor the existing records and new student-athletes records and accounts. Admin will also add the corresponding points to the student athlete's wallet. The student-athletes can log in to the given account from the admins and view their balance and transaction history. Additionally, they can view their QR Code and request points to the admin in case the wallet did not replenish.

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Technical Feasibility

Table 2: Technical Requirements for Web and Mobile

WEB		MOBILE	INTERNET CONNECTION
Hardware	Software		
Microprocessor: Intel Core I3 or I5 and above. 2.8 GHz processor (3.5 GHz recommended).	Visual Studio Code, WAMP Server Version 3.2.3, Lucid chart, Figma.	Android 5.0 and above and IOS	Broadband Cable or Fiber Optics Internet Connection, 4G/LTE or 5G Mobile Data
Memory: atleast 4GB RAM and above			
Storage: atleast 256GB SSD above	Operating System: Windows 8.1 above	Browser: Chrome, Opera, Safari etc.	
Monitor, Mouse, Keyboard			
QR Code Scanner			

The proposed web application requires a minimum hardware specification of Intel Core Series or higher, the RAM will be at least 4GB RAM and above. The storage is at least 256GB SSD and above. This will run in any software specification as it only requires any browser and network connectivity. The computer will be the platform of the researchers in designing and programming the proposed web application using Visual Studio Code. To run the web application, any web browser of the personal computer and mobile phone will be needed.

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Schedule Feasibility

<div align="center">Table 3: Gantt Chart</div>

Phase	Activity	A.Y. 2021-2022									
		Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Strategy, Planning and Documentation	Brainstorming for Possible Topics	■									
	Presenting the Proposed Topics		■								
	Proposal		■								
	Acceptance Letter for Adviser			■							
	Capstone Preliminaries & Chapter 1			■							
	Capstone Chapter 2			■							
	Capstone Preliminaries Chapter 1-3			■							
	Capstone Chapter 4					■					
	Capstone Chapter 5					■					
System Design	Prototype			■							
	Wireframe			■							
	Web and Mobile UI Design			■	■						
Development	Web Application Development					■	■	■	■		
	Reviewing & Revisions								■		
Testing	System Testing									■	

Table 3 above shows the timetable featuring the estimated specific quantifications of the maximum intended program implementation.

Requirement Documentation

Cost Analysis

This section contains a detailed estimated cost analysis of the entire system development of the project. It should compare the cost to implement such an application with the benefits delivered by the application. It should also demonstrate the values added to the given institution by the application of the project. The provided analysis may appear costly, but it will improve productivity and efficiency for both student-athletes and the university. The following are the list of product, service, and labor costs:

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Table 4: Estimated Hardware Cost

Recommended Requirements	Quantity	Unit Price	Cost
Processor	2	PHP 12,000.00	PHP 24,000
Memory	2	1,700.00	3,400
Storage	2	2,000.00	4,000
Monitor	2	5,500.00	11,000
Keyboard and Mouse Bundle	2	550.00	1,100
QR Code Scanner	2	2,800.00	5,600
Thermal Printer	2	2,500.00	5,000
PRODUCT TOTAL			PHP 54,100.00

Source: www.acmtechnologies.net

Table 5: Estimated Service/Labor Cost

SERVICE/LABOR	DURATION		Total
	No. of Months	No. of Years	
Installation	N/A	N/A	PHP 25,000.00
Maintenance	24	2	240,000.00
SERVICE/LABOR TOTAL			PHP 265,000.00
TOTAL PRODUCT AND SERVICE/LABOR			PHP 319,100.00

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Control and Security

Upon installation of the software program, the system will prompt which function payment transaction is necessary to be installed depending on the university-based establishments.

- Student-athlete control: the system will prompt the student-athlete to select which function the user may utilize: payment transaction, view QR, view balance, or request points. After selection, the student-athletes QR code is then scanned through a QR code scanner.

- Student Manual Control: if cases the student-athlete QR code is unavailable, the student number can be entered manually.

- Balance control: only students and administrators can check the remaining non-monetary balance. The unused points are intended for payment transactions as desired by the student-athlete.

- Username and password are required, automatically created by the system and modifiable limited as of the student-athlete only which will be used to sign in for payment transactions.

- Only the authorized personnel can access the system extending the database; the data stored in the database will remain confidential and within the responsibility of the institution.

- Data specifically, payment transaction history stored in the system and the database are non-modifiable.

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- The non-monetary points added by the SDO administrator can only be accessed by and with the authorization of the student-athlete and exclusively used in purchase and payment.

The following are the software and hardware specifications for server-based and client-based workstations, respectively. If these requirements are met, it should enable the system to process the function for a QR code-based incentive system.

Table 6 shows the list of software requirements that are needed to be to operate a server workstation for the system. The minimum and recommended specifications determine the compatibility and efficiency of the system. Moreover, devices with recommended specifications will perform significantly faster than devices with minimum specifications.

Table 6: Software Requirement

Software	Minimum	Recommendation
Operating System	Microsoft Windows 8.1	Microsoft Windows 10
Database Software	MySQL version 5.7.31 2020 WAMP Server version 3.2.3	
Programming Software	Visual Studio Code 1.61.2	Visual Studio Code 1.62.0
Programming Language	HTML, CSS, JavaScript, and PHP	

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Table 7: Hardware Requirement Specification

Hardware	Minimum	Recommendation
Processor	Intel Core i3; 2.8 GHz	Intel Core i5; 3.5 GHz above
Memory	4GB RAM	8GB and above
Storage	256GB SSD	512GB SSD
Monitor	Acer EB162Q LED 15.6" Monitor	Acer EB162Q LED 15.6" Monitor
Keyboard and Mouse Bundle	A4Tech KRS-8572	A4Tech KRS-8572
QR Code Scanner + NFC Scanner + RFID Reader	ZKTeco ZK-QR-500	ZKTeco ZK-QR-500
Thermal Printer	JP-58H Thermal Receipt Mini Printer	JP-58H Thermal Receipt Mini Printer

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Design of Software, Systems, Product, and Processes

System Architecture
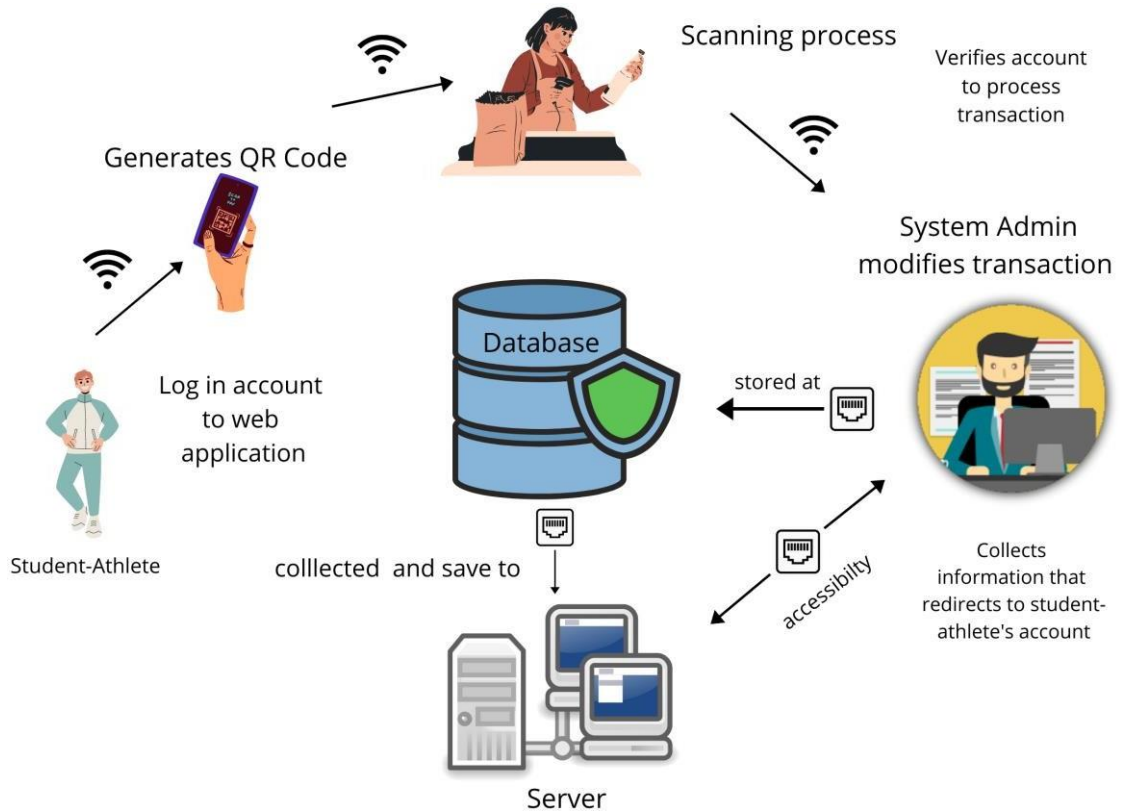
Figure 3.4 *System Architecture*

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Data Dictionary

Table 8: Payments Processing

Data	Description
Complete Name	Whom to address the receipt or transaction
Amount to pay	How much there is to pay
Time and Date	When did the recipient made the transaction
Purpose of payment	What is the recipient paying for
Store facility	Where did the recipient made the transaction

Table 9: QR Code Generation

Data	Description
Certificate of Registration	The needed information is name, student number, department, course, and sports event; and also, to confirm that the student-athlete is currently enrolled.
Picture	A picture of the student-athlete submitted to the Sports Development Office upon registration of information.

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Table 10: Item/Meal Purchase Processing

Data	Description
Receipt/s	To confirm that the student already paid
Complete Name	Who is going to purchase
Department and Course	To know what college and level the student-athlete belongs, and to to confirm that the student-athlete is currently enrolled.
Items/Meals	What sets of items/meals the student is going to buy
Time and Date	When did the student acquired the items
Store Facility	To confirm and authenticate the acquisition

Problem Areas

The following are the problems that the researchers determined by collecting information from requirement analysis:

- **Inconvenient.** The current university system requires transferring to different establishments to do certain tasks or process documents.

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- **Segregated.** Although the current system is computerized, subsystems present in each establishment of the university is not fully integrated with one another.

- **Time-consuming.** The limited manpower of the current system results to a long queue of the students therefore, consumes most of their time queuing.

- **Physical contact.** The current situation of pandemic reducing risk of exposure to the coronavirus.

Table 11: User Table

Field Name	Data Type	Size	Description
user_id	Int auto increment	7	Indicates the User ID
first_name	Varchar	30	Indicates the First Name
last_name	Varchar	30	Indicates the Last Name
sexual_orientation	Varchar	30	Indicates the Sexual Orientation of the User

Table 12: Admin Table

Field Name	Data Type	Size	Description
employee_id	String	12	Indicates the Employee ID
user_id	Int auto increment	7	Indicates the User ID
employee_position	Varchar	20	Indicates the Employees Position
employee_department	Varchar	50	Indicates the Employees Department

Table 13: Student Athlete Table

Field Name	Data Type	Size	Description
student_id	String	12	Indicates the Student ID
user_id	Int auto increment	7	Indicates the User ID
sports_event	Varchar	20	Indicates the Sport Event
college_department	Varchar	50	Indicates the College Department

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course	Varchar	30	Indicates the Student Athlete Course
athlete_position	Varchar	20	Indicates the Student Athlete Position on their Sports Event
picture_id	Binary	max	Indicates the Student Athlete Photo

Table 14: Cashier Table

Field Name	Data Type	Size	Description
cashier_id	String	12	Indicates the Cashier ID
user_id	Int auto increment	7	Indicates the User ID
facility	Varchar	20	Indicates the Store Facility

Table 15: Account Table

Field Name	Data Type	Size	Description
account_id	String	12	Indicates the Account ID
user_id	Int auto increment	7	Indicates the User ID
student_id	String	12	Indicates the Student ID

Table 16: Points Table

Field Name	Data Type	Size	Description
points_id	String	12	Indicates the Points ID
used_points	Int	4	Indicates the Used Points
remaining_points	Int	4	Indicates the Remaining Points
unused_points	Int	4	Indicates the Unused Points

Table 17: Items Table

Field Name	Data Type	Size	Description
item_id	String	12	Indicates the Item ID
user_id	Int auto increment	7	Indicates the User ID
facility	varchar	20	Indicates where a student athlete purchase from university store

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Table 18: QR Table

Field Name	Data Type	Size	Description
qr_id	String	12	Indicates the QR ID
student_id	String	12	Indicates the Student ID

Entity Relationship Diagram (ERD) Model
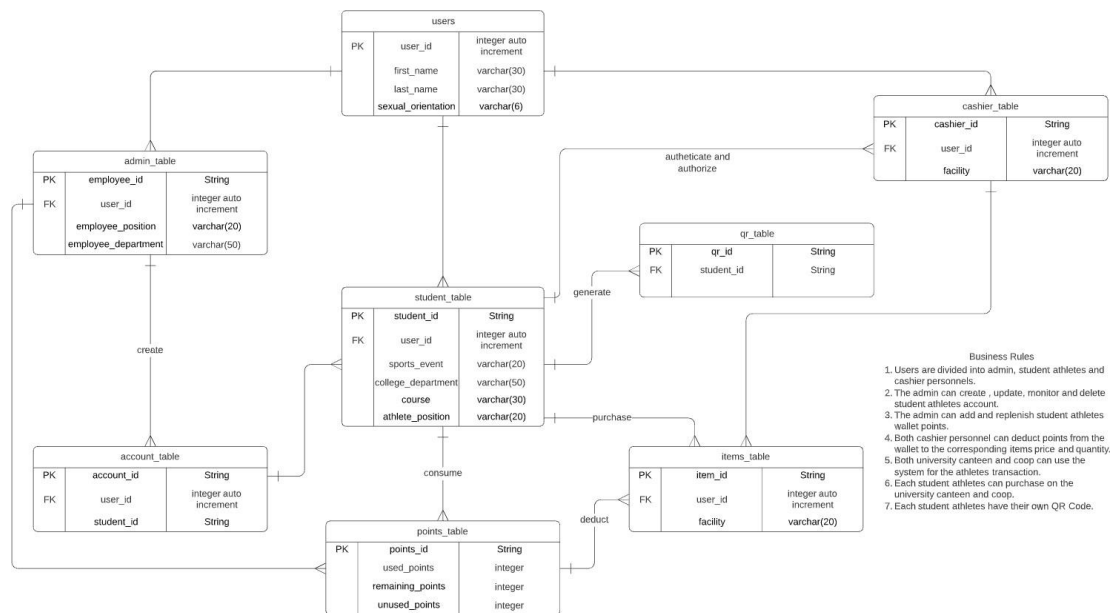
Figure 3.5 *Entity Relationship Diagram of Student-Athletes Incentives Web*

Application System

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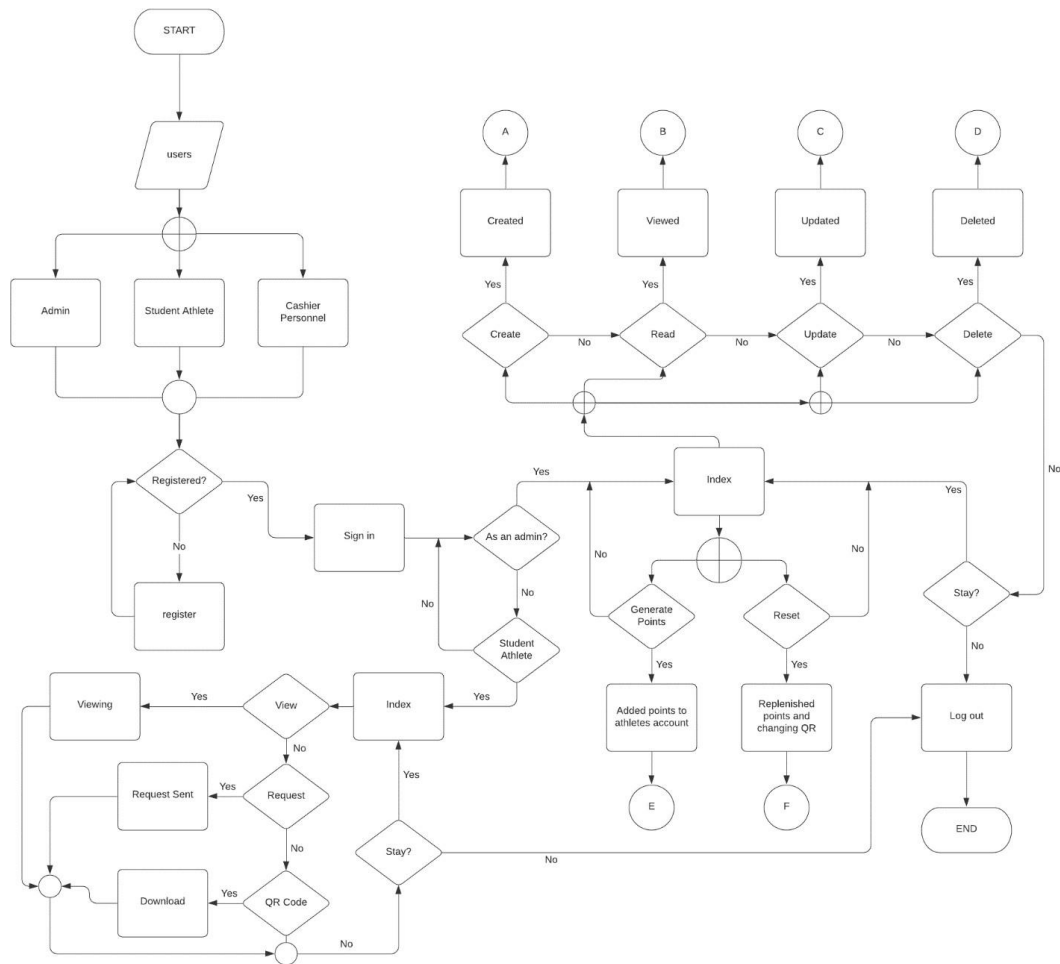
Flowchart Diagram

Figure 3.6 *Flowchart Diagram of Student-Athletes Incentives Web Application System*

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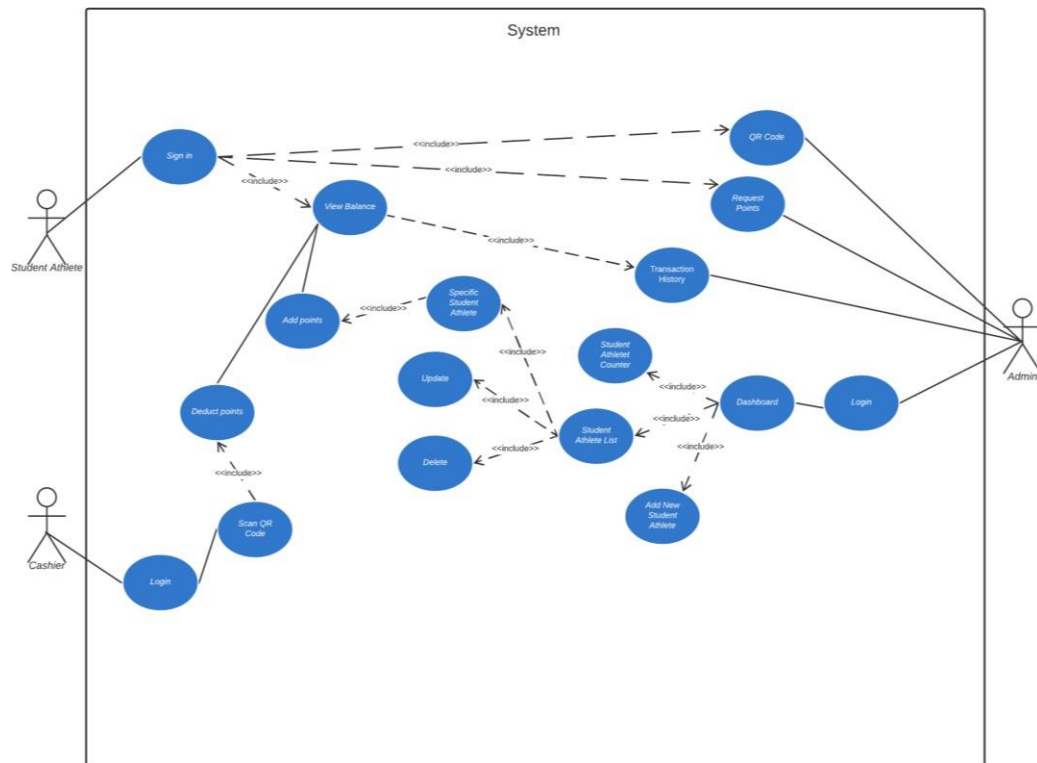
Use Case Diagram

Figure 3.7 *Use Case Diagram of Student-Athletes Incentives Web Application System*

The figure graphically shows the Use Case Diagram for the Web Application of Student-Athletes System. It has three users namely the student-athlete, cashier, and administrator. Each user has their own set of actions that they could do. A student-athlete can view their balance, transaction history, QR Code, and request points to the administrator. A cashier can log in and can deduct points only when the student makes a purchase. An administrator can log in, manage the records and add points to the student-athlete's wallet.

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Conceptual Operation

The Conceptual Operation in this chapter utilizes a Data Flow Diagram that manifests the course of information through the system and the activities that process all this information. This model enables a more comprehensive diagram, provides the overall view of the system, and a more detailed breakdown and description of the activities that are easier to understand.
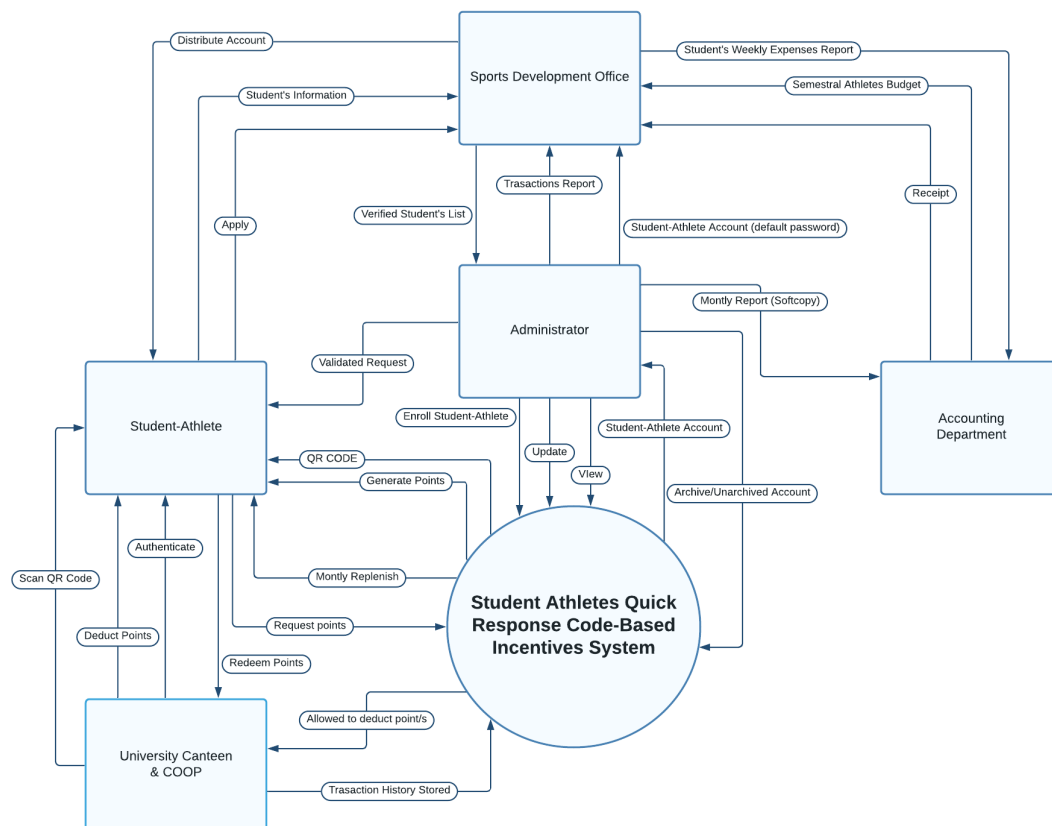
Figure 3.8 *Level 0: Data Flow Diagram*

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Data Flow Diagram
Level 1: Points Redemption
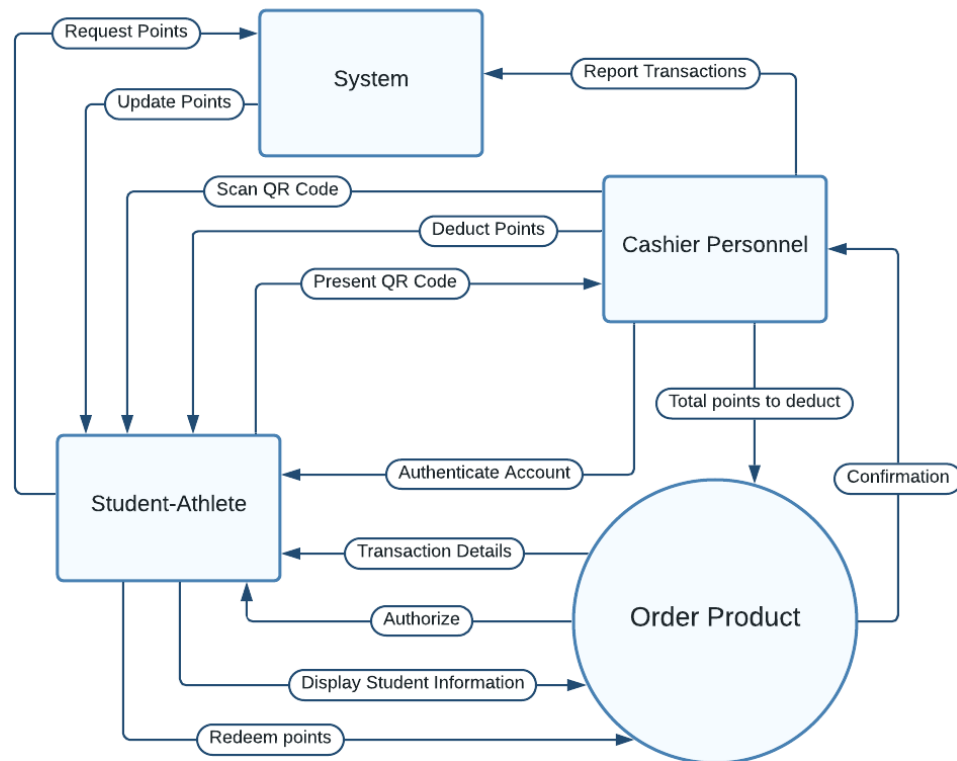
Figure 3.8.1 *Level 1: Points Redemption*

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Wireframe

Figure 3.9 *Student-Athlete Mobile View Wireframe*

Figure 3.9.1 *Student-Athlete Desktop View Wireframe*
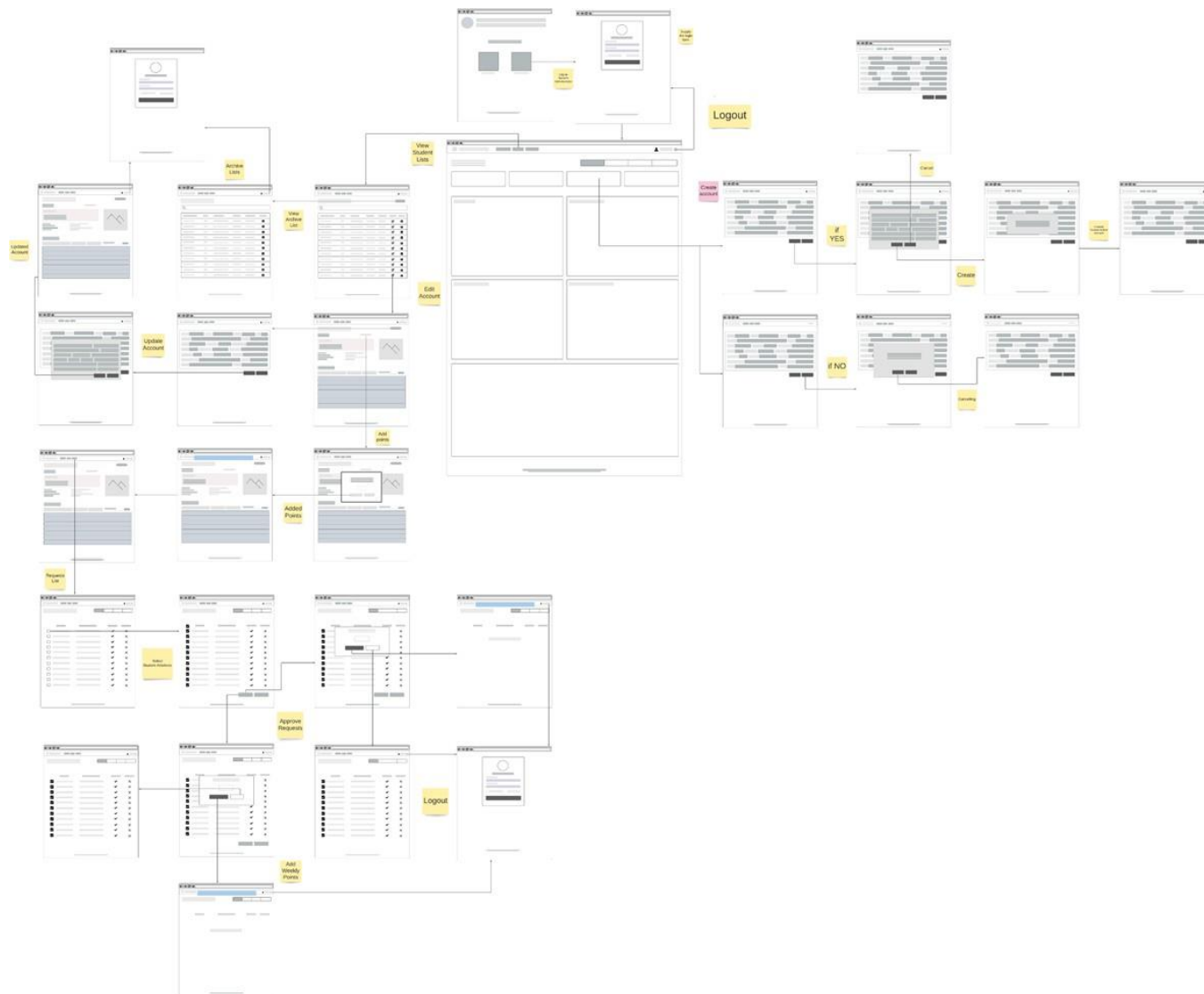
Figure 3.9.2 *SDO Administrator Desktop View Wireframe*

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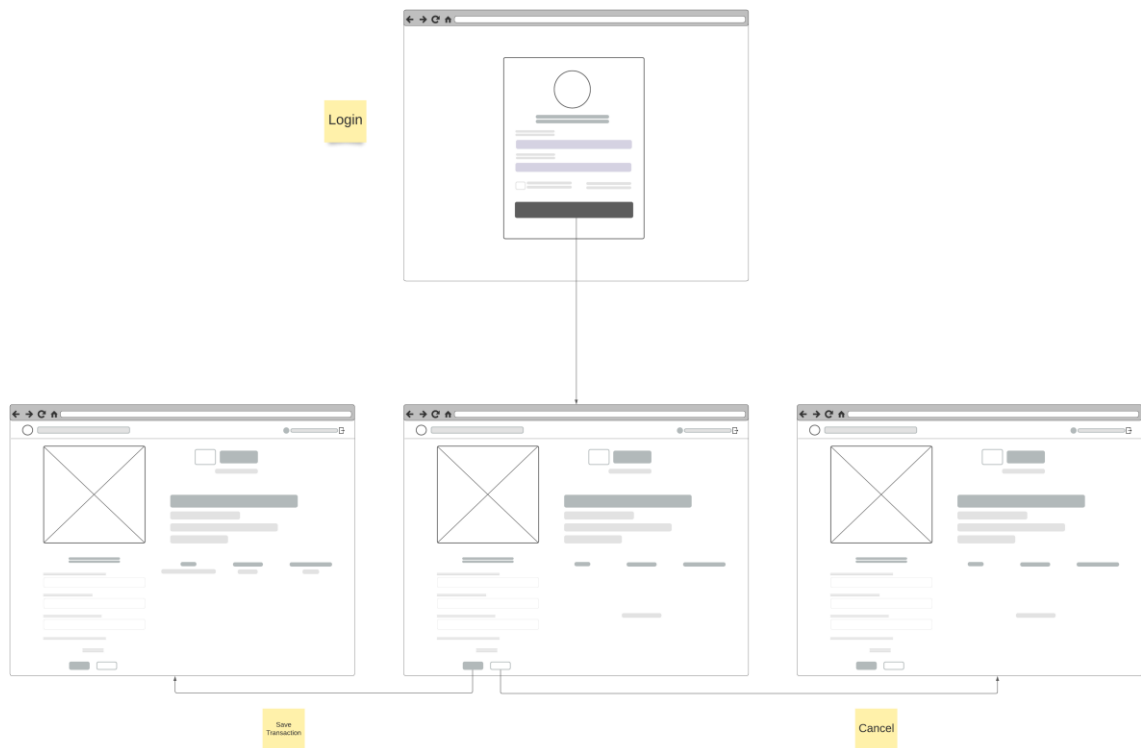
Figure 3.9.3 *Cashier Desktop View Wireframe*

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Development and Testing

1. Functionality – The U.I. is simple, user-friendly, and responsive design.

2. Reliability – The Student-Athletes Quick Response Code-Based Incentive System for Rizal Technological University is operated and controlled by the administrator appointed by the Director of Sports Development.

3. Efficiency – The Quick Response Code-Based Incentive System gets rid of paper-based incentives, energy, time, and effort of both students claiming stubs and the person in charge of releasing incentives and writing the transactions made.

4. Maintainability – The system can easily be maintained by the admin and can be maintained for the meantime by the proponents if the case can't handle by the admin.

5. Usability – The Quick Response Code-Based Incentive System test by the client and student-athletes of Rizal Technological University.

6. Accuracy – The Quick Response Code-Based Incentive System can operate the correctness in all inputted and processed details in the system.

7. Portability - The Quick Response Code-Based Incentive System can be operated in any version of windows. Web Applications can operate in any version of android.

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DEVELOPMENT

Coding

The phase in which the developer of the proposed system would program the source code. The source code specifies the actions to be performed by the computer. It will be translated into binary machine code. The binary machine code will instruct directly to the central processing unit and translate it into human-readable language. Coding is a crucial phase because it plays a vital role in the development of the system. Indeed, the coding phase, the designing phase, the writing, the testing, the debugging, and maintaining the source code are being done.

Hardware Specification

The hardware specification required in the design and development of Student-Athletes Quick Response Code-Based Incentive System for Rizal Technological University.

Table 19: Hardware Specification

Android Based Application	CPU: at least 1,500 MHz or Higher
	Wi-Fi Connection: at least Wi-Fi 4 enabled
	O.S.: at least Android 5.0 – 5.1.1 (Lollipop) or Higher
	Phone Memory: at least 4 G.B. or Higher
	Phone Storage: at least 16 G.B. or Higher

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Web-Based Application	CPU: Intel Core Series or Higher Memory: at least 4 G.B. or Higher Internet LAN Connection: capable for 10/ 100mbps or Gigabit Wi-Fi Connection: at least Wi-Fi 4 enabled O.S.: at least Microsoft Windows 8.1 or Higher

Software Specification

The software specification plays a vital role in developing and designing Student-Athletes Quick Response Code-Based Incentive System for Rizal Technological University.

Table 20: Software Specification

Web Server	Apache version 2.4.51 or Higher
Web Development Tool	OutSystems Service Studio 11
Database	Wamp Server version 3.2.3
Text Editing Tool	Visual Studio Code version 1.62

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Image Editing Tool	Adobe Photoshop CS3 or Higher
Android Development Tool (ADT) plugin	Latest version
Android API level	5.0 – 5.1.1 (Lollipop) or Higher

Programming Environment

Front-End on Web-Based

In creating a system, the Hypertext Mark-up Language is used as the front-end application. Because it has minimal programmatic functionality, it is classified as a Markup Language rather than a programming language. HTML's primary goal is to present facts or material to the user in a visually appealing manner. The bulk of HTML instructions aid the developer in the arrangement and modification of text, images, and multimedia displays.

Back-End on Web-Based

In the development of a system, the Database Management System serves as the back-end application. It stores databases on the server and administers them. The database management system (DBMS) is the most significant software component in the entire system. Utilities, application development tools, design aids, report writers, and a transaction manager are all included. Depending on the type of application, Wamp Server is a database management system (DBMS). It is a portion of the management software database that's utilized all over the world, both by the general public (mostly through web apps) and by professionals.

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Test Plan

Student-Athletes Quick Response Code-Based Incentive System is a web application that will be used by the intended users. To guarantee that the web application functions as planned, the proponent has decided to use unit testing. Integration testing will also be used by the proponents to check the system's functional, performance, and reliability requirements. The proponents will utilize system testing to verify the system's compliance with its set requirements after unit and integration testing. Acceptance testing will be the last step in the process to ensure that a system fulfills mutually agreed-upon requirements.

TESTING

Unit Testing

Unit testing will be conducted to ensure that the functionality of the Student-Athletes Quick Response Code-Based Incentive System has achieved the goals of each function and to test if they are working properly according to specifications and expected output of the functions. Each unit will be tested to confirm that each function of the proposed unit will achieve its expected result.

Integration Testing

After unit testing, integration testing will be performed. During integration testing, each function will be combined to work as a single unit, delivering the desired output as

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specified by each function's specifications. Every output will be utilized to communicate with other functions so that the anticipated output can be achieved.

System Testing

System testing will be used to evaluate the system's compliance with its specified requirements and to verify if the Student-Athletes Quick Response Code-Based Incentive System has complied with the necessary quality and of all the functional and non-functional requirements.

Acceptance Testing

Acceptance testing will be used to ensure that the system meets mutually agreed-upon requirements. It will also ensure that the system is completed successfully, and all criteria are met.

Alpha Testing

Alpha testing is simulated or actual operational testing conducted at the developers' location by possible users/customers or an independent test team. The Student-Athletes Quick Response Code-Based Incentive System will undergo alpha testing with its intended

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users to ensure that it meets all of its functional and non-functional requirements. Additionally, to determine whether the suggested system would deliver the desired output.

Beta Testing

Following alpha testing, beta testing will take place. This is done to determine the proposed system's feedback. This routine will be performed to determine whether the system requires revision as well as the bugs and weaknesses of the proposed system. And, thanks to beta testing, we can quickly learn what the users expect versus what the developers expect.

Core Performance Testing Activities:

Activity 1. Identify the Test Environment. Determine the physical test and production environments, as well as the test team's equipment and resources. Hardware, software, and network configurations all comprise the physical environment. Early on in the project, having a complete grasp of the overall test environment allows for more effective test design and planning and early identification of testing difficulties. This approach may need to be addressed regularly during the project's life cycle in various circumstances.

Activity 2. Identify Performance Acceptance Criteria. Determine the goals and limits for response time, throughput, and resource use. In general, users are concerned about reaction time, businesses are concerned about throughput, and systems are concerned about resource utilization. Identify project success criteria that aren't

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covered by those goals and limitations, such as utilizing performance tests to determine which combination of configuration settings will result in the best performance characteristics.

Activity 3. Plan and Design Tests. Determine essential situations, determine variability among representative users and how to simulate it, define test data, and determine metrics to be collected. Consolidate this data into one or more system usage models that may be implemented, tested, and analyzed.

Activity 4. Configure the Test Environment. As new features and components become available for testing, prepare the test environment, tools, and resources needed to execute each approach. Check to see if the test environment needs to be instrumented for resource monitoring.

Activity 5. Implement the Test Design. Execute the performance tests following the test design.

Activity 6. Execute the Test. Conduct and evaluate your tests. Validate the tests, the data collected during the testing, and the results gathering. Analyze data using established tests while monitoring the test environment.

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Activity 7. Analyze Results, Report, and Retest. Integrate and distribute data from outcomes. Analyze data both independently and collaboratively. Restructure and re-run the remaining tests if necessary. When all metric values are within acceptable ranges, no defined thresholds are crossed, and all needed information is gathered, you have completed testing that particular scenario on that particular setup.

Description of the Prototype

This capstone project aims to create a unique web application that focuses on all student-athletes enrolled at the university. The initial prototype is designed based on the gathered information for a quick response (QR) code-based incentive system. However, the aim was not to make a finite solution. Instead, the objective is to get ideas from users to achieve the development of the prototype.

From this, the mockup was created, static yet realistic renderings of what a feature will look like and how it will be used. A mockup is frequently used as a topic of discussion in situations such as interviews. However, the mockup in this project was used as a prototype. A prototype is a more or less functional model of the imagined product that enables stakeholders to engage with it. Thus, the target users may test the prototype in realistic circumstances, causing the proponents to become aware of elements they had not considered previously. A prototype is highly beneficial during the design phase since it forces designers to explore entirely new issues when transforming something from the imaginations into something concrete.

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The web application has two primary tabs: The Student-Athlete Login and the Admin Login; in the student-athlete interface, there are three functions, View balance, in which the user can view their corresponding points and the transaction history. Second is the QR Code generated and can be used by the student-athlete, and lastly, the Request Points page, which the student-athlete can use to request points to the administrator in case of failed replenishment on the wallet.

Student Athlete Incentive System Prototype
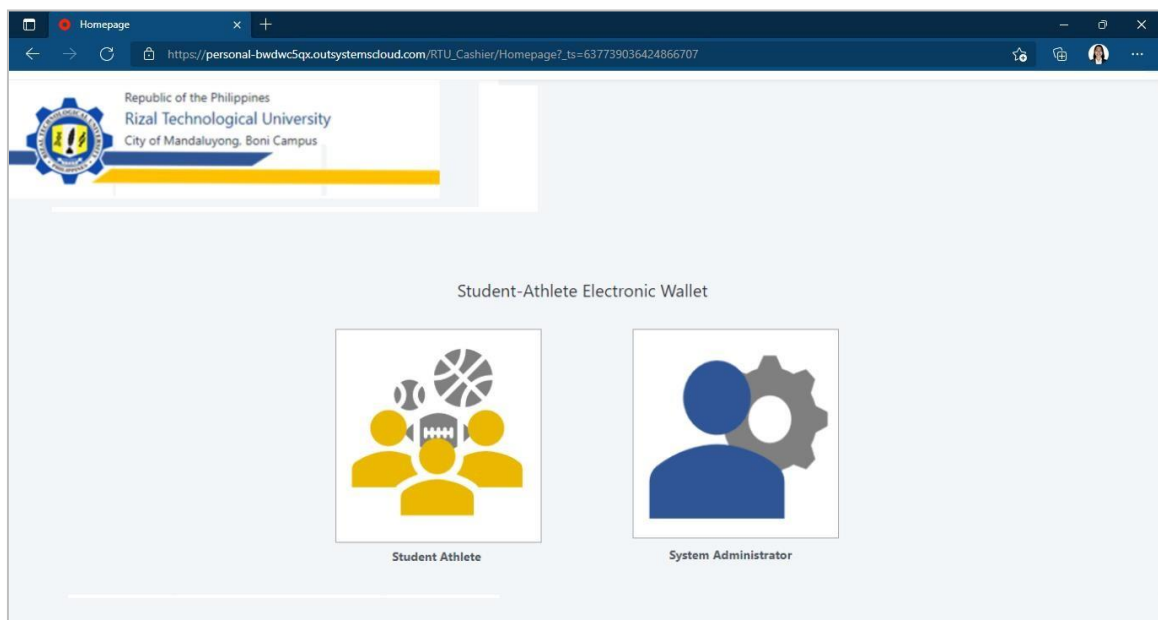
Figure 3.10 *User Selection*

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Student-Athlete User Interface
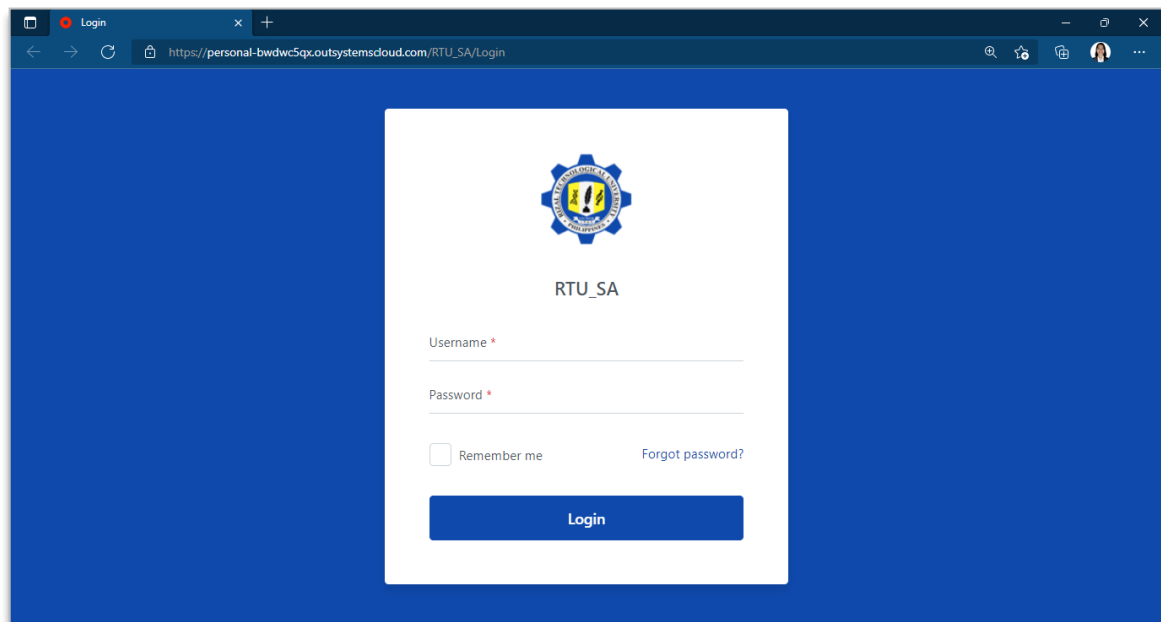
Figure 3.11 *Login Form (Desktop and Mobile View)*

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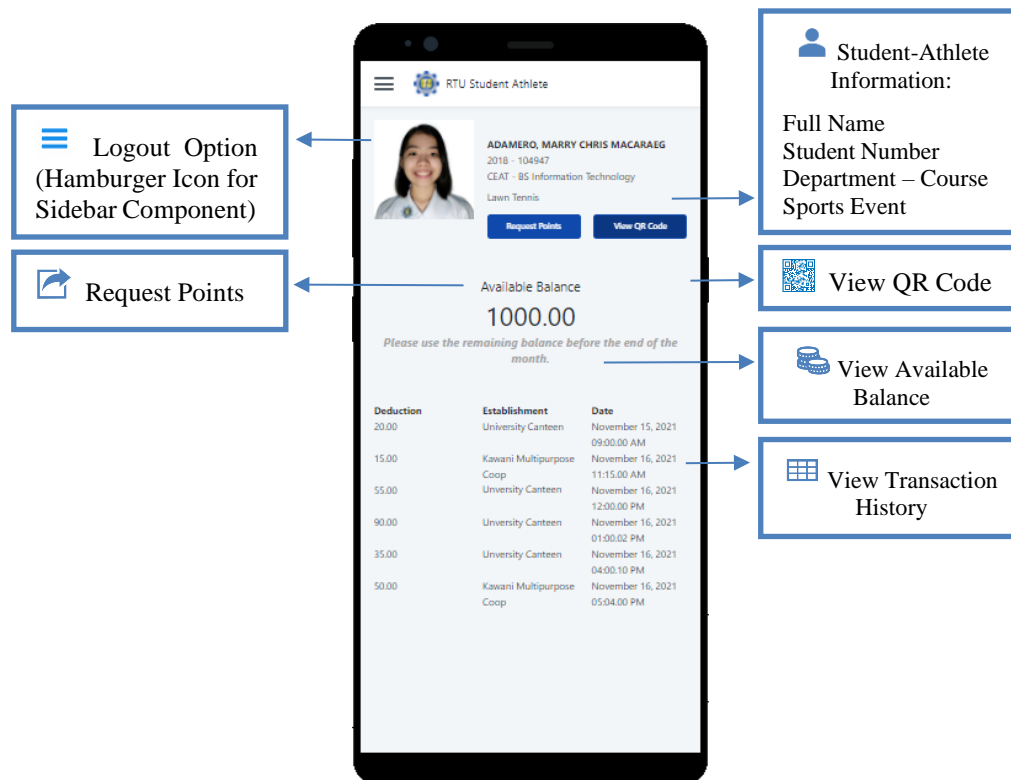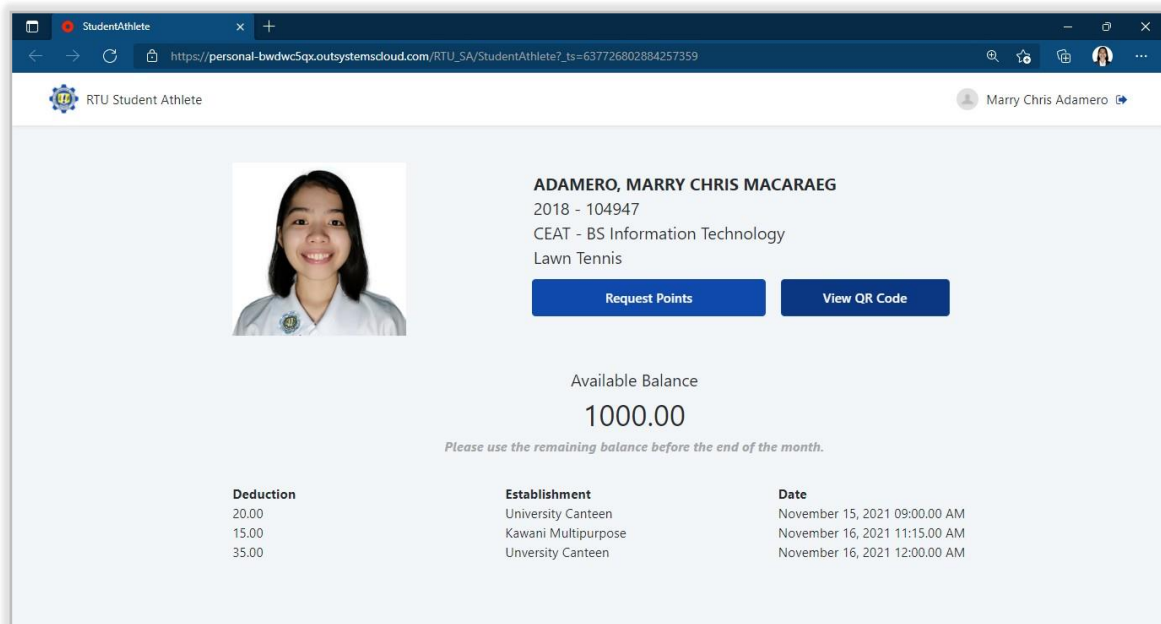
Figure 3.11.1 *Student-Athlete Account Interface*

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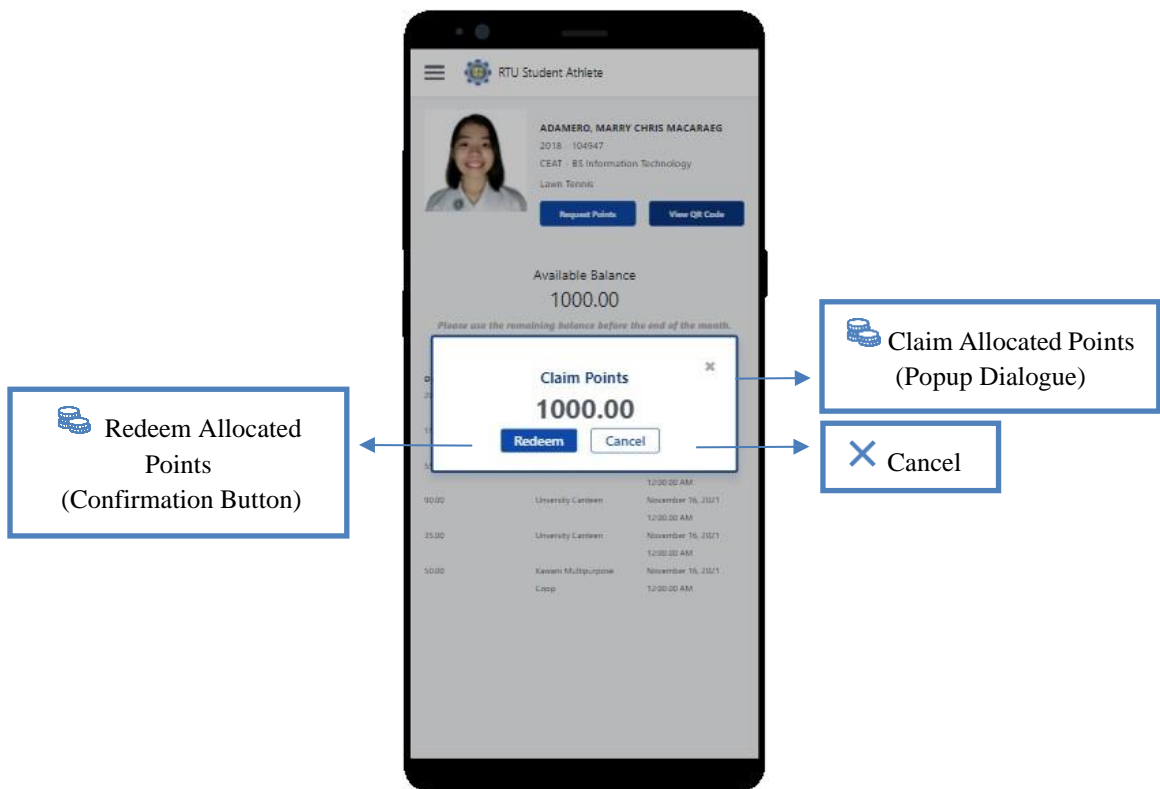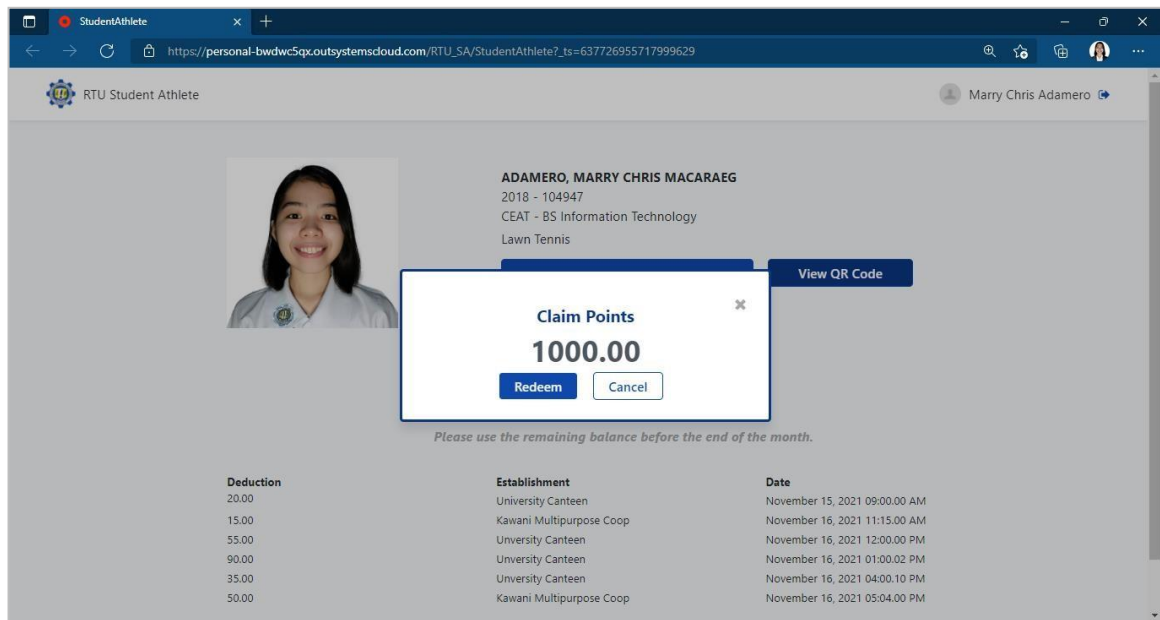
Figure 3.11.2 *Claim Points (Prompt Box)*

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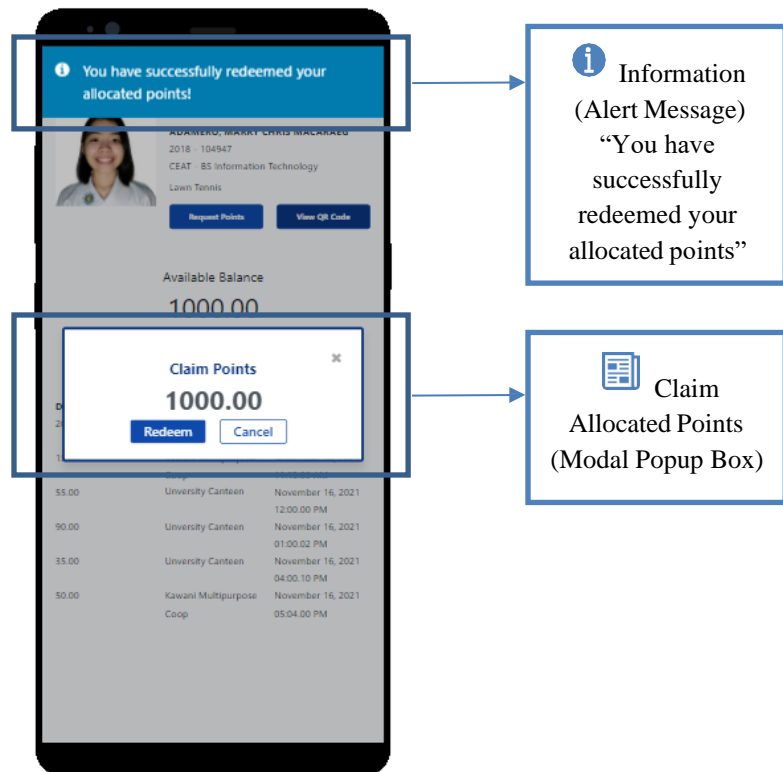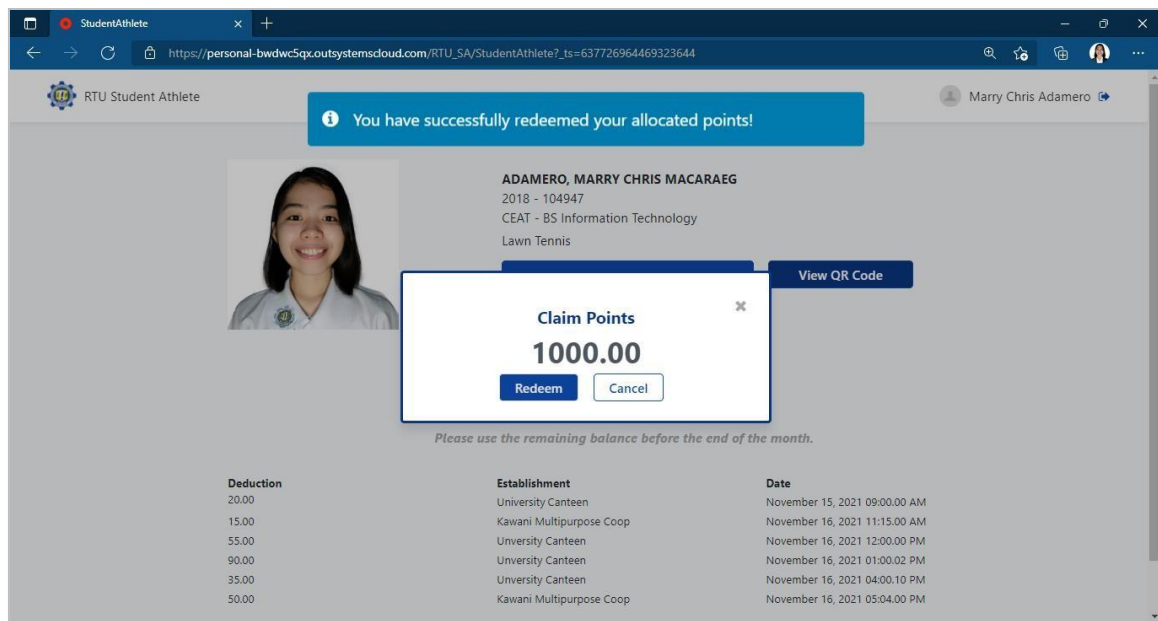
Figure 3.11.3 *Confirmation Message*

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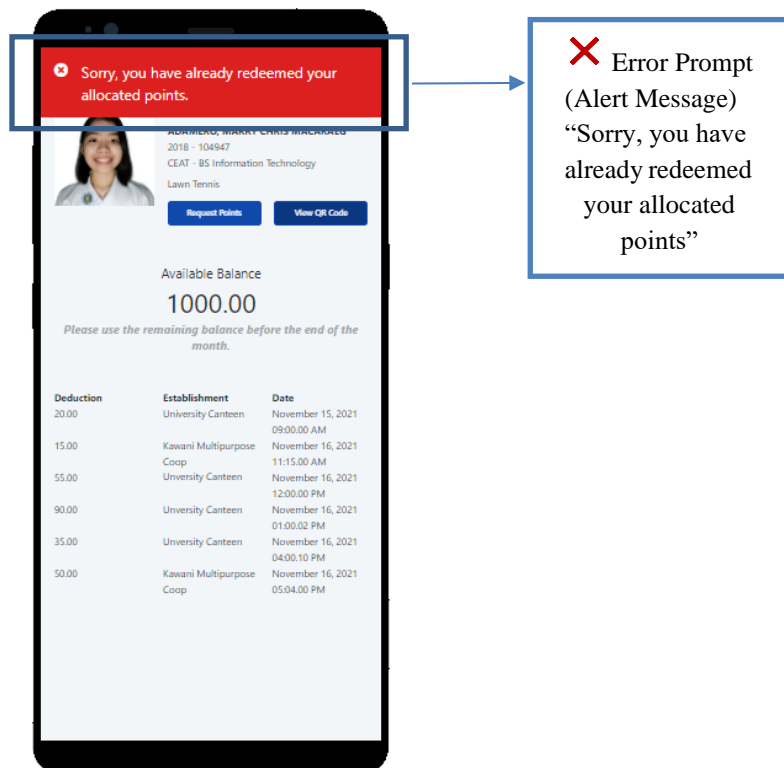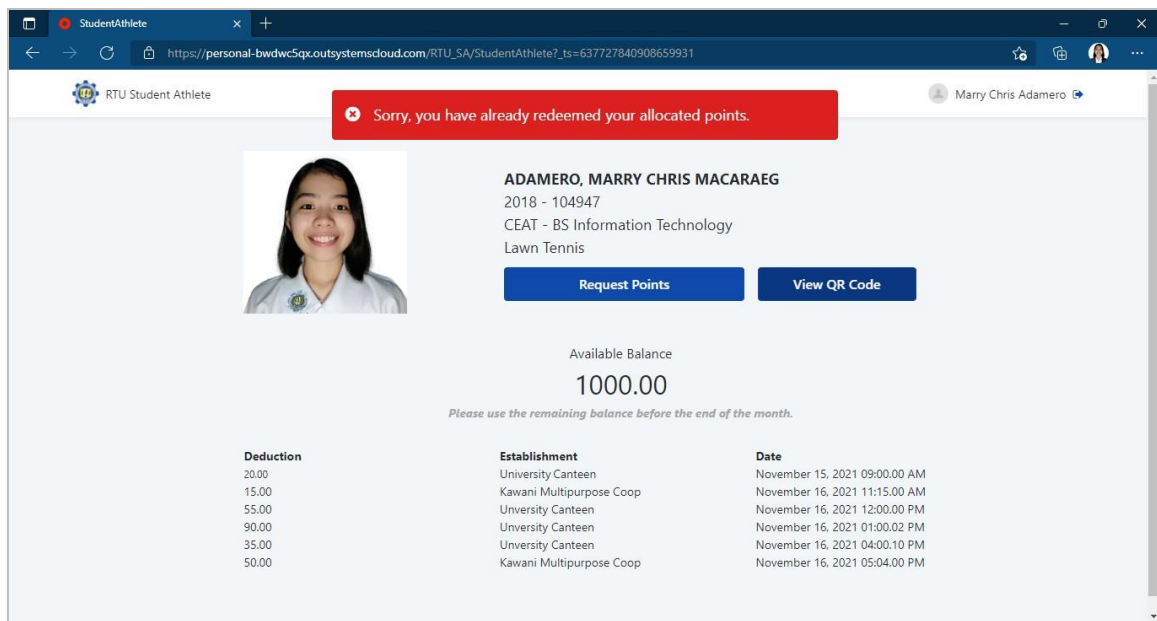
Figure 3.11.4 *Redeem Alert Message*

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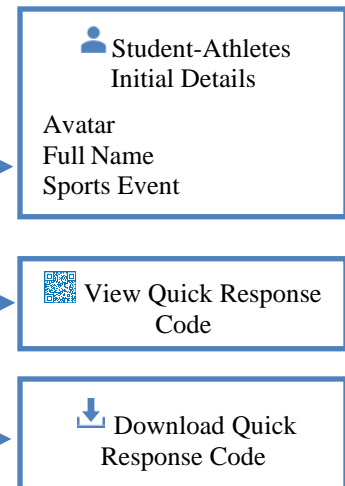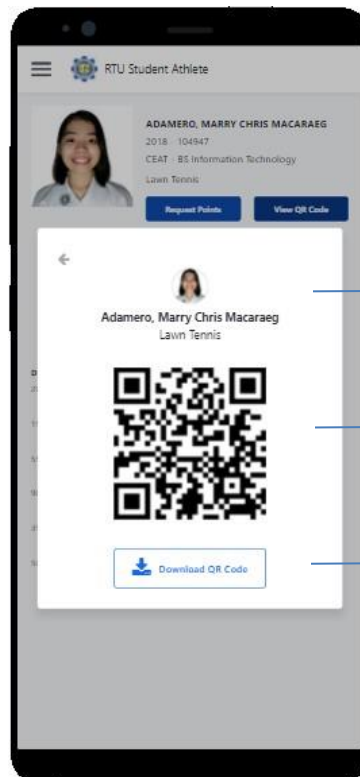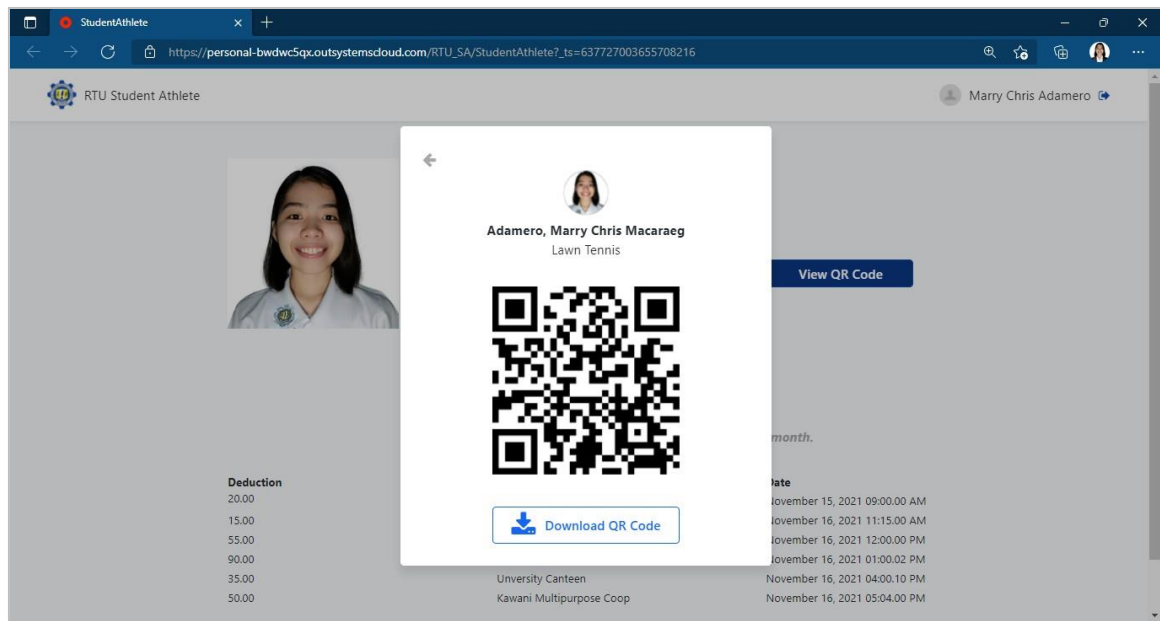
Figure 3.11.5 *Student-Athlete View QR Code*

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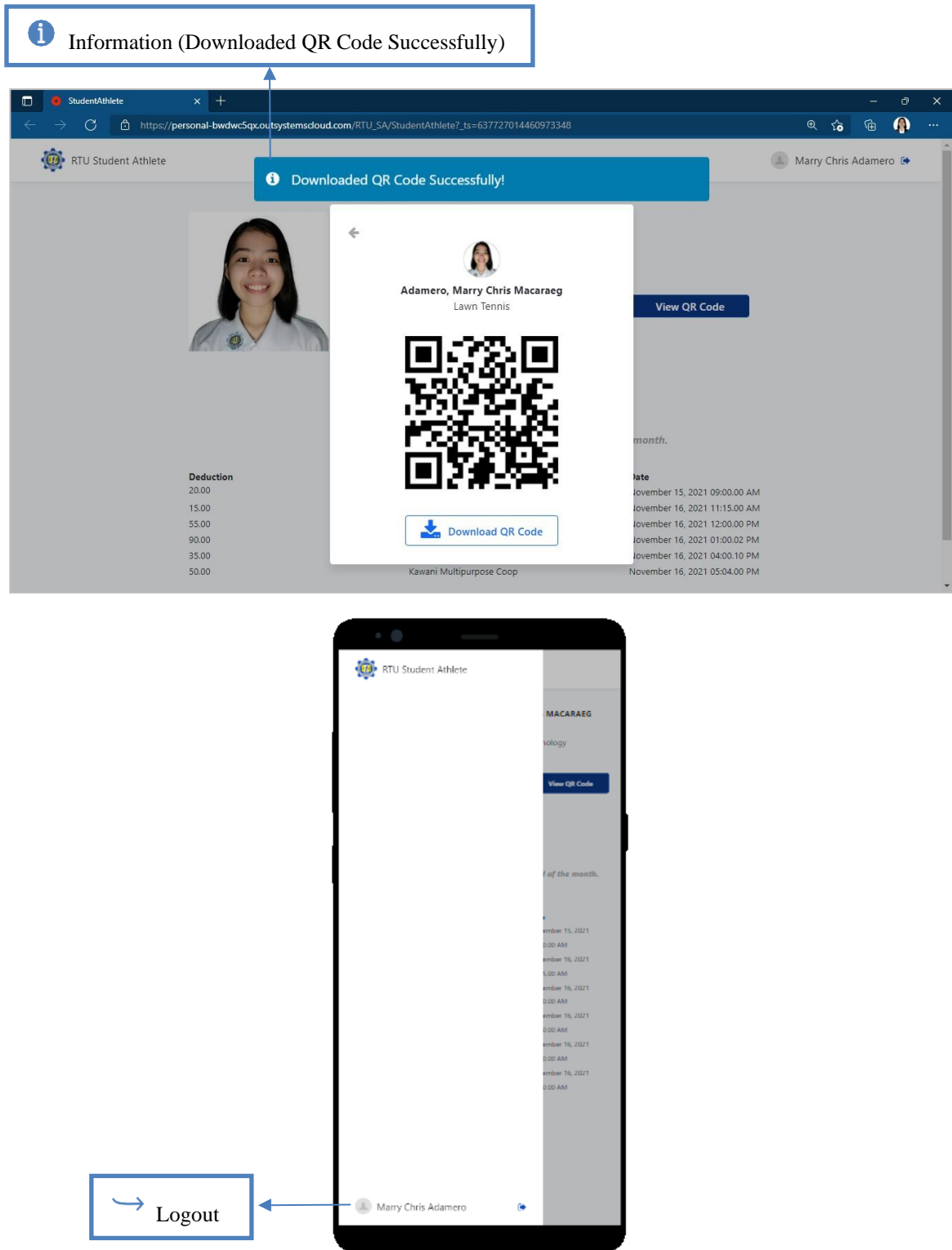
Figure 3.11.6 *Confirmation Message and Logout Side Navigation*

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Administrator Interface

The figure 3.12 shows the interface for admin login form. The admin can login their perspective account. After validating the details entered, they will be redirected to the Dashboard Panel (see figure 3.12.1), where they can see a general information about the athletes. The admin can manage the accounts of the student athletes such as adding or creating new account for new members (see figure 3.12.2), updating old member's information (see figure 3.12.5), access the student-athletes masters list (see figure 3.12.3), overall information of a specific student athlete with their transaction history (see figure 3.12.4), and the archive master list of the former student athletes (see figure 3.12.6).

The admin is the only one can load points to the specific student athletes (see figure 3.12.4 a), and approve the request points of the student athletes (see figure 3.12.7).

Login Form
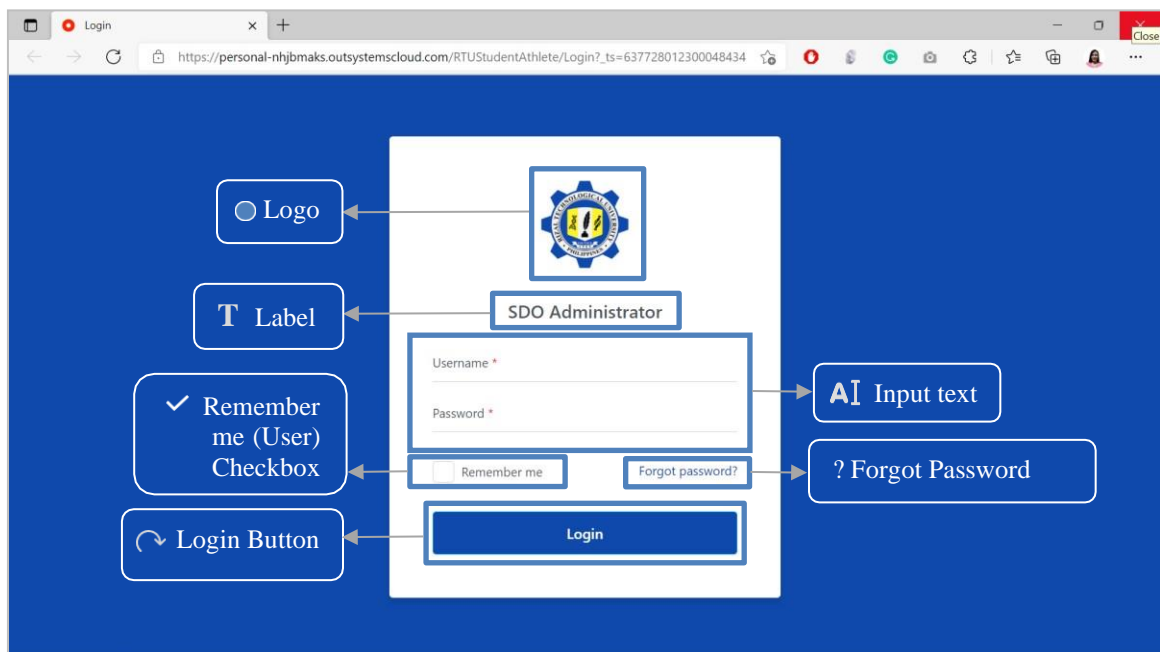
Figure 3.12 *Admin Login Form*

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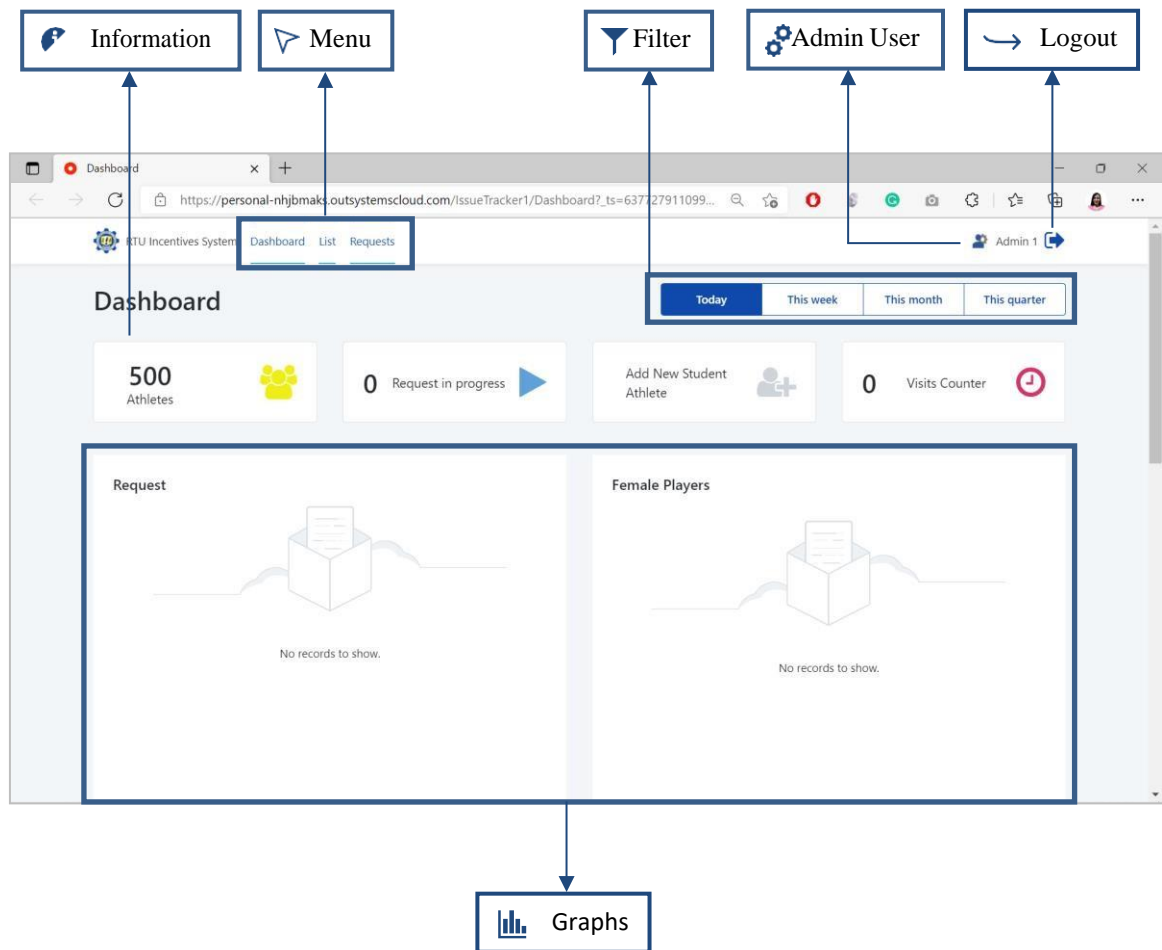
Dashboard

Figure 3.12.1 *(a) Dashboard*
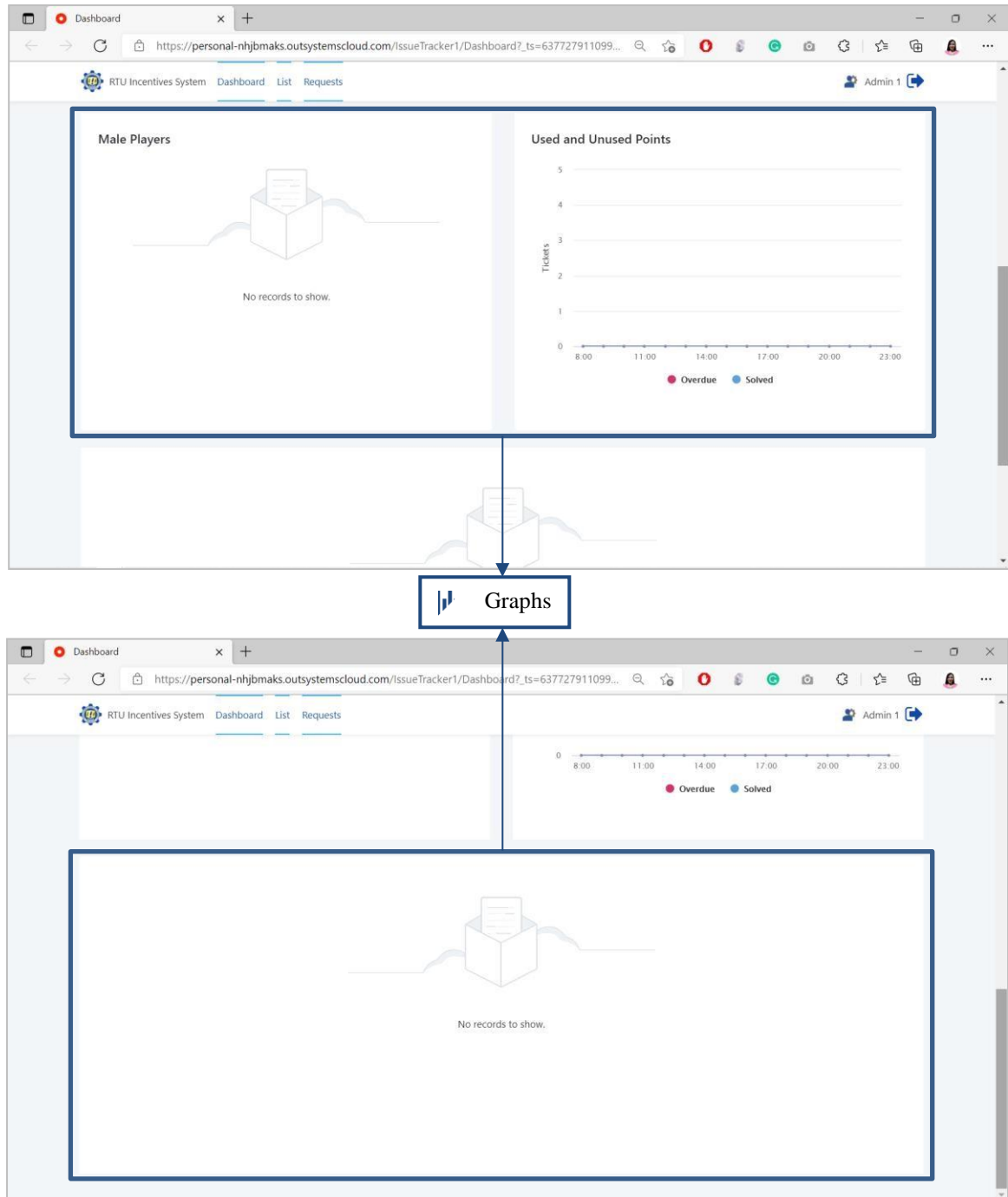
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Figure 3.12.1 *(b) Dashboard*

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Figure 3.12.2 *Create Account*

Figure 3.12.2 *(a) Popup Verify Information (Create Account)*

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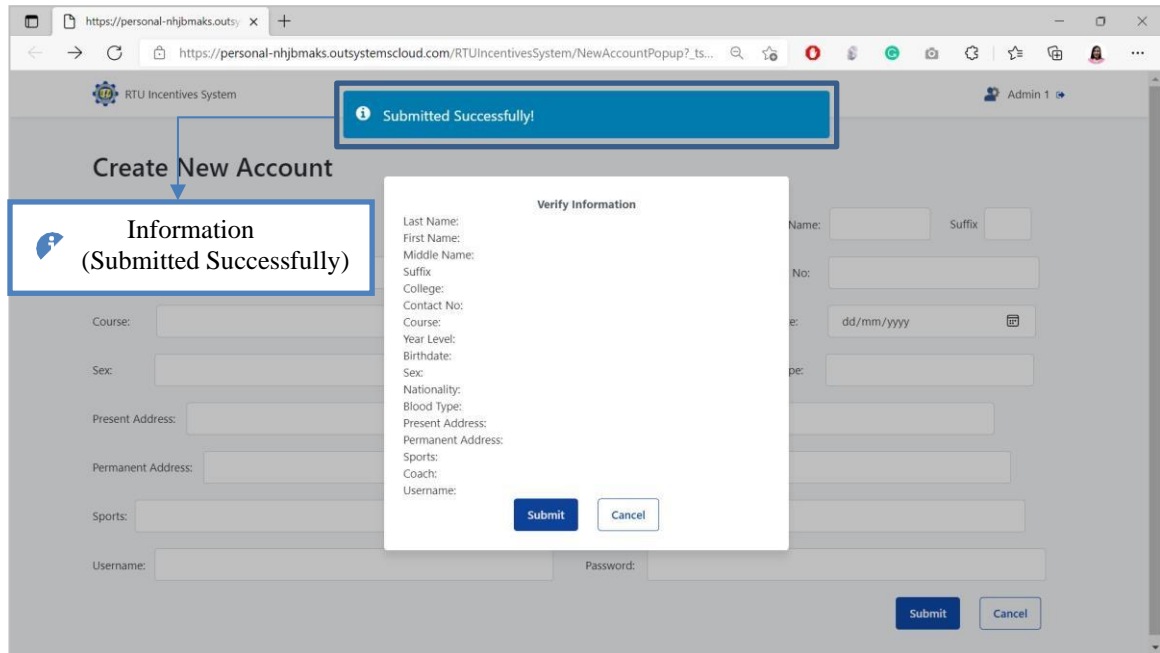
Figure 3.12.2. *(b) Submitted Alert Message (Create Account)*
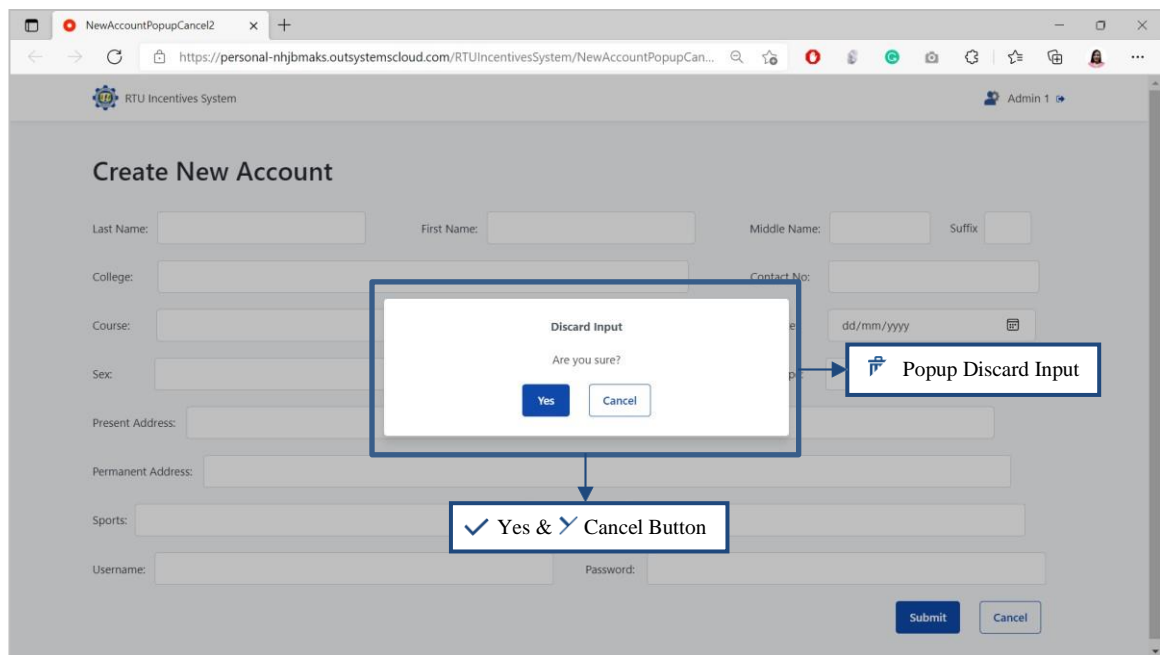
Figure 3.12.2. *(c) Discard Popup (Create Account)*

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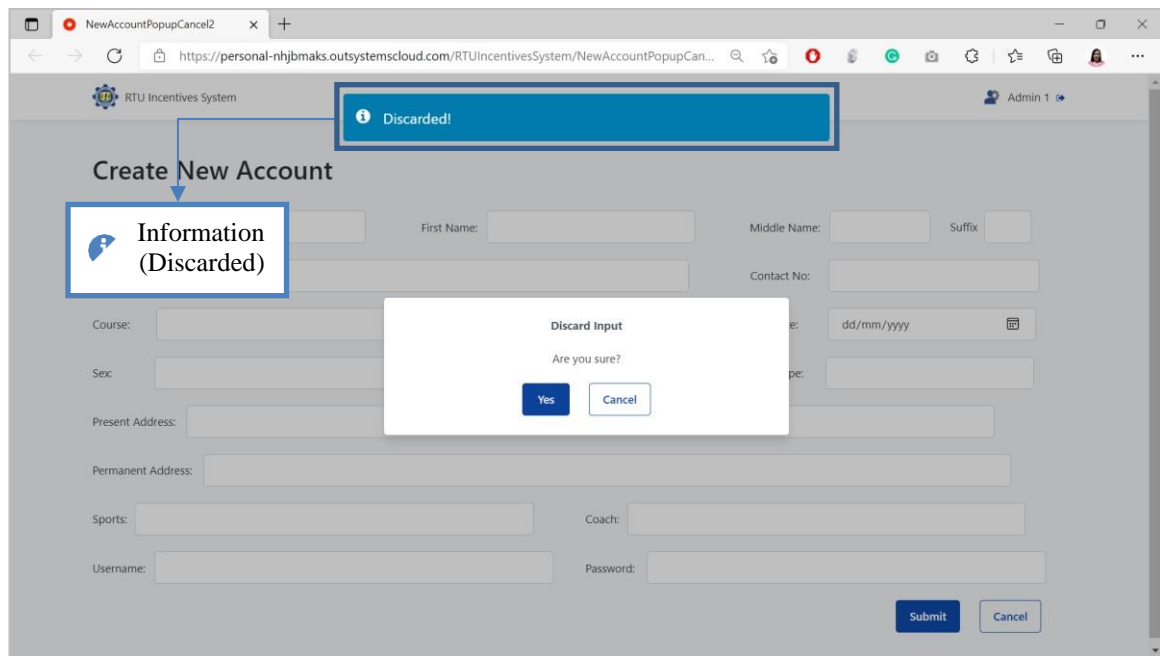
Figure 3.12.2 *(d) Discarded Alert Message (Create Account)*
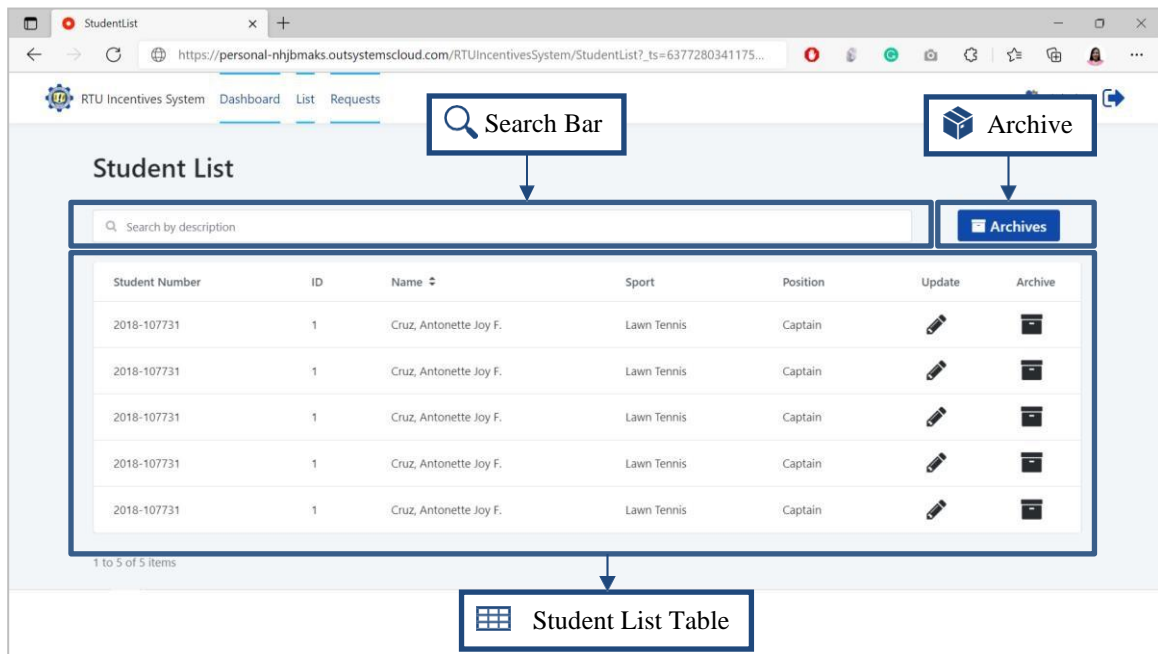
Figure 3.12.3 *Student Athletes Master List*

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Figure 3.12.4 *Student Athletes Account Overview*

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Figure 3.12.4 *(a) Load Points (Account Overview)*

Figure 3.12.5 *Update Account*

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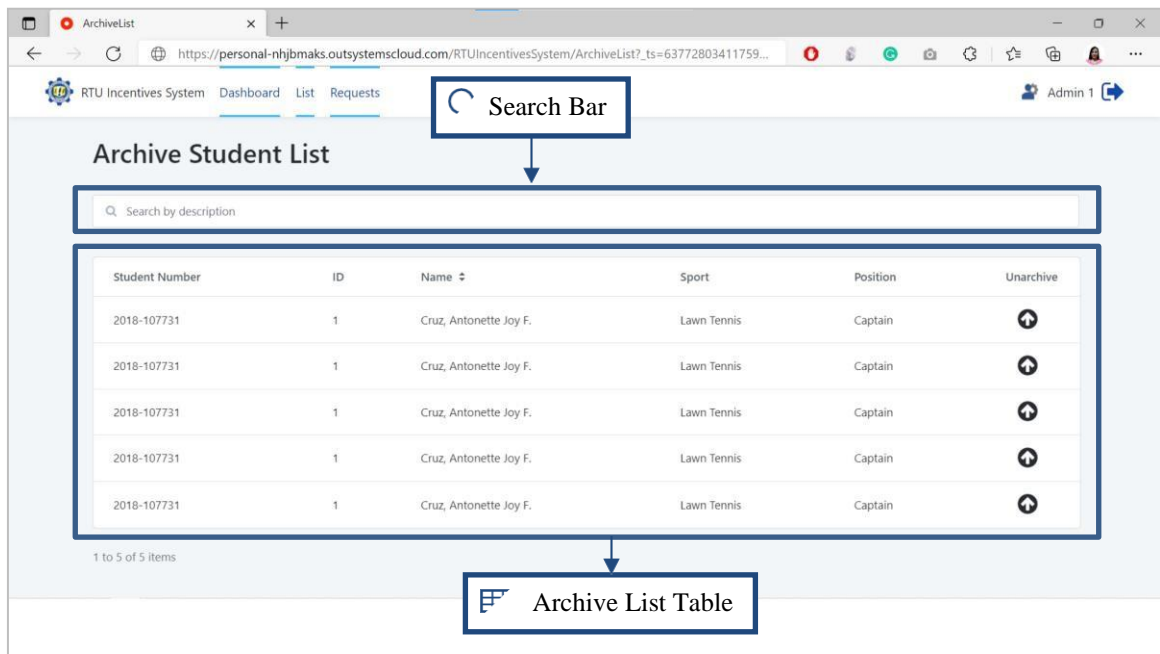
Figure 3.12.6 *Archive Master List*
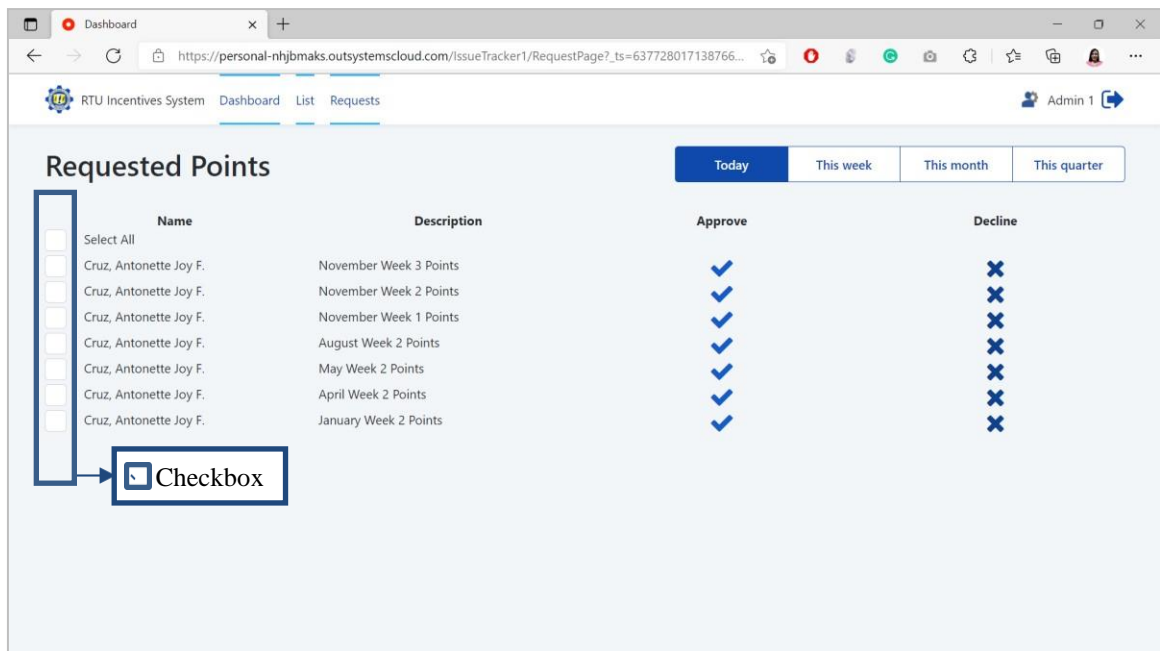
Figure 3.12.7 *Requested Points*

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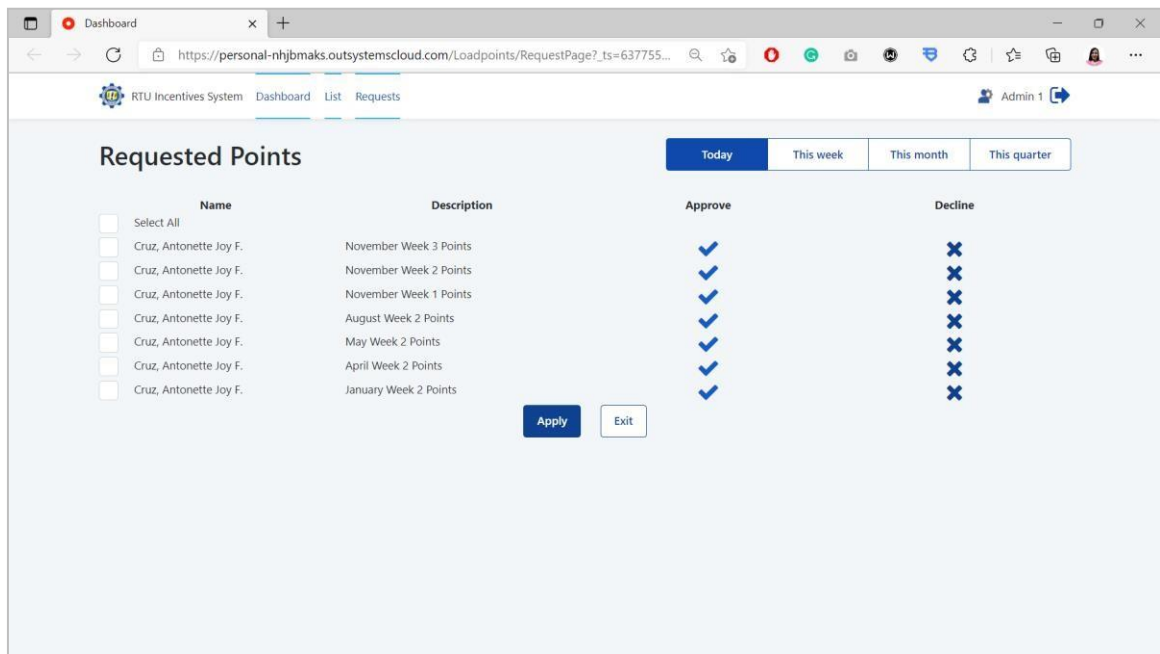
Figure 3.12.7 *(a) Requested Points (Select All)*
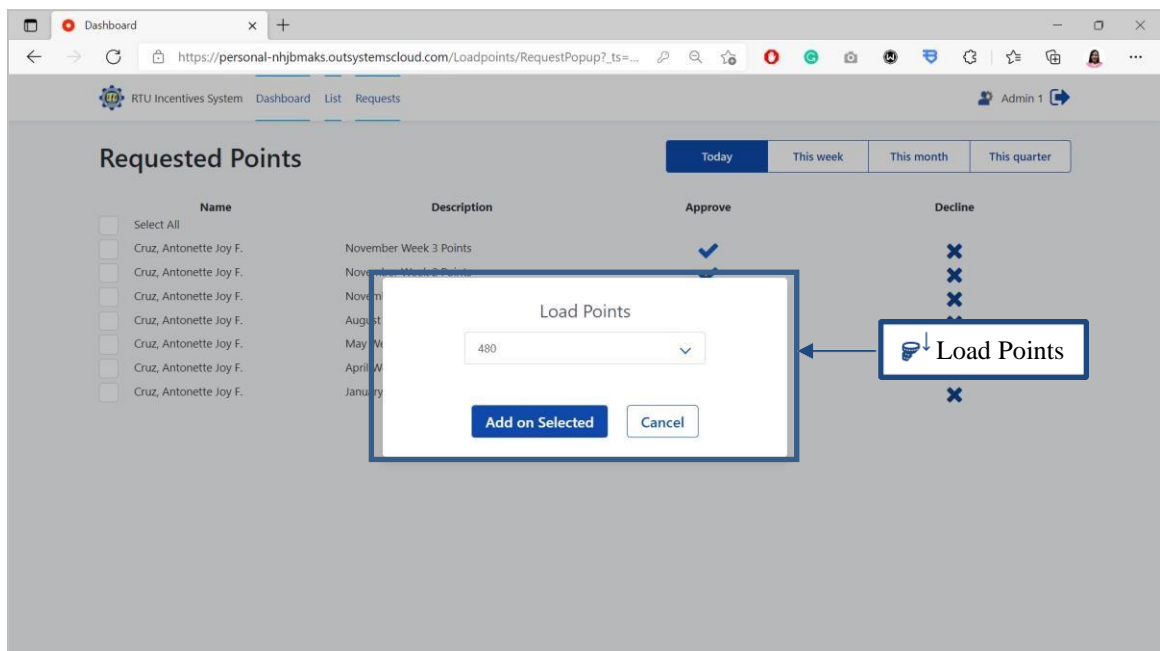
Figure 3.12.7 *(b) Requested Points (Load Selected)*

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Figure 3.12.7 *(c) Audit Trail*

In the admin interface, it has the student-athletes counter, list, and add new student athletes' buttons. On the student-athletes counter, can view the current counts of student-athlete members. In the student-athletes list, the admin can access the list of the student-athletes with names, sports events, and student numbers. It also has update and delete record buttons. When the specific member on the list is clicked, the admin will access the complete information of the member and has add points button that can be used to replenish the student athlete's wallet. Provides soft copy and hard copy of audit trail by clicking the download records button.

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Cashier Interface

The figure 3.13 shows the interface for cashier's login form. The cashier can login to their designated account. After validating the entered details, user will be redirected to the cashier screen (see figure 3.13.1), where they can see the initial information of student-athletes. The cashier can check and deduct from the available balance points of the student-athletes such as purchased items/meals and record the transaction done. Transaction history of a certain account scanned via QR code which will be displayed as saved (see figure 3.13.2),

The cashier is the only one who can deduct points to a certain student-athlete (see figure 3.13.1), and save the transaction history of the student athletes (see figure 3.13.2).
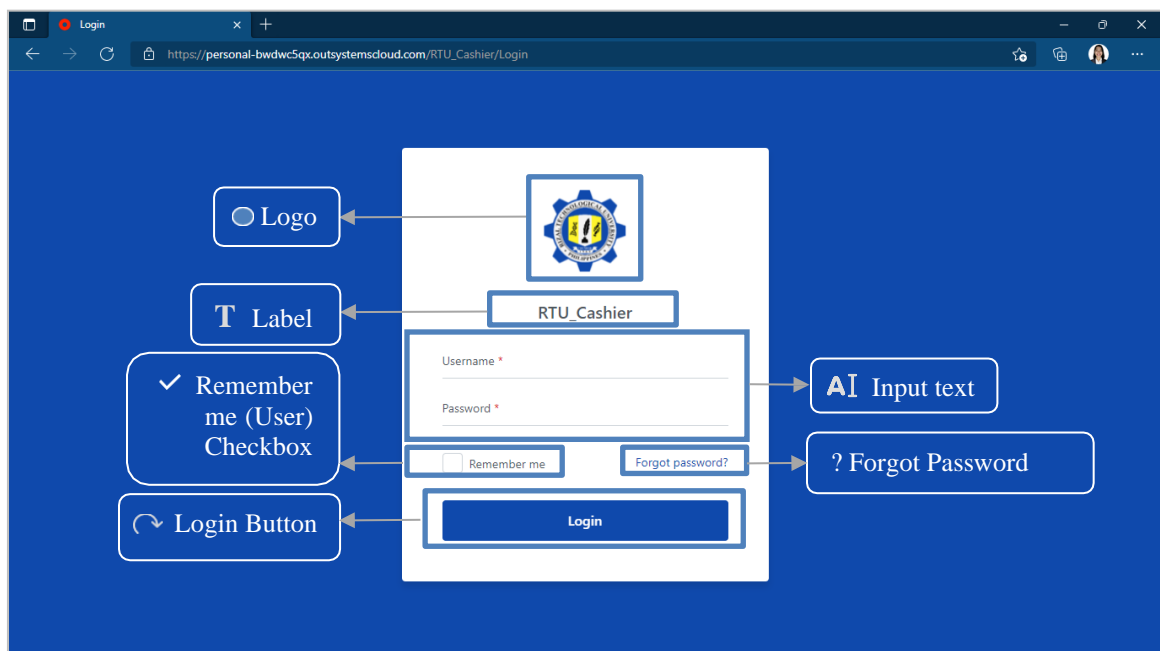

Figure 3.13 *Cashier Login Form*

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Figure 3.13.1 *Cashier Desktop View*

Figure 3.13.2 *Saved Payment Transaction*

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Microsoft Visual Studio facilitates the source code for the prototype and web application development. By using WampServer to store all the information by a database. Lucidchart helps to sketch and outline the flowchart diagrams to provide designs for the User Interface of the web application. Lastly, GitHub, an open-source version control software, allows for real-time collaboration to make separate changes for a web application at the same time.

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