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"SPACESYNC: A COLEGIO DE MONTALBAN'S CLASS SCHEDULING SYSTEM"

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CHAPTER I

THE PROJECT AND ITS BACKGROUND

Introduction

In today's digital age, technology influences every aspect of our lives, providing advanced features similar to personal computers. Its seamless integration into our daily routines provides unparalleled convenience, mobility, and entertainment. Modern technology shapes students' experiences at educational institutions such as Colegio de Montalban. Technology has become indispensable for everything from facilitating learning processes to increasing teacher-student engagement.

According to Abdullah, P., (2019) the Class Schedule System serves as a comprehensive class management tool for universities. It facilitates the organization of courses by semester, user profile management, and grants users the authority to access and export course details. This solution is distinguished by its flexible and convenient features, empowering deans, program heads, and instructors to optimize efficiency and minimize time wastage. As a result, SpaceSync, Colegio de Montalban's Class Scheduling System, utilizes modern technology to streamline and improve the scheduling experience, catering to the changing needs of both students and faculty.

> **Republic Act of No.10173, also known as Data Privacy Act of 2012, an act protecting individual personal information in information and communications systems in the government and the private sector, creating for this purpose a national privacy commission, and for other purposes.**
> **"Section 2. Declaration of Policy. – It is the policy of the State to protect the fundamental human right of privacy, of communication while ensuring free flow of information to promote innovation and growth. The State recognizes the vital role of information and communications technology in nation-building and its inherent obligation to ensure that personal information in information and communications systems in the government and in the private sector are secured and protected."**

The project developers' work begins with the recognition of the growing need for efficient, reliable, and user-friendly class scheduling systems. Project developers develop "SpaceSync: A Colegio de Montalban's Class Scheduling System" to address this needs. The system includes features such as real-time scheduling updates and conflict resolution algorithms. SpaceSync allows the dean and the program heads to efficiently assign classrooms, faculty to classes, and adjust schedules as needed, reducing administrative burdens and scheduling conflicts. Instructors will provide information that meets the dean and program head's requirements and conveniently input the data to deliver accurate plotting, while students can easily access up-to-date schedules and room assignments via a centralized platform.

Project Context

The system, " SpaceSync: A Colegio de Montalban's Class Scheduling System," is a modern and innovative solution to the challenges faced by dean, program head, instructors and students. Traditional class scheduling are often time- consuming, inefficient, complex, has communication issues, lack of real-time updates, wasted resources, scheduling conflicts and prone to errors. Manual scheduling has been fraught with problems, including double bookings of rooms, long intervals between subjects, and abrupt time changes that lead to conflicts. The project system aims to address these issues by streamlining the class scheduling process and enhancing the end-users' experience.

The system incorporates various devices, and application, including Visual Studio 2022, Visual Studio Code, and XAMPP. These components enables to seamless access control, schedule tracking, and real-time updates on monitoring. To develop the system, project developers requires knowledge of proper class scheduling, as well as expertise in programming software, programming and markup languages such as Visual Basic, HTML, CSS, PHP, JavaScript, SQL, Guna2, API such as JSON, and hardware Project Developers also needed to ensure compliance with relevant laws and regulations, such as the Republic Act 10173. Data Privacy Act of 2012.

The Visual Studio 2022 and Visual Studio Code are used to develop the system's desktop and web applications concurrently, while XAMPP is integrated for server and database use. These components allow for an efficient, user-friendly interface and real-time updates of schedule monitoring information. Therefore, the system provides greater convenience than the school's current scheduling methods. However, with the new class scheduling system in place, issues like conflicting schedules and inaccurate room allocations, which are common in traditional scheduling, are effectively reduced enhancing end-users experience.

Purpose and Description

The system's purpose is to create a convenient, efficient, and effective class scheduling solution that enhances the end-users' experiences, ensuring smoother coordination of academic activities and fostering a more organized learning environment. By streamlining hassle-free scheduling, the system caters to the needs of the dean, program heads, instructors, and students, ultimately enhancing the educational experience. The project developers' aims to provide efficiency and convenience to the target users in a way accessibility is a must, interface and information viewing is easy to comprehend. The end users of the system will be the dean, program heads, instructors, and students. By providing a user-friendly platform, the system aims to benefit the end-users by offering a convenient, and efficient class scheduling.

To develop the system, project developers requires knowledge of proper class scheduling, as well as expertise in programming software, programming and markup languages such as Visual Basic, HTML, CSS, PHP, Javascript, SQL, Guna 2, API such as JSON, and hardware Project Developers also needed to ensure compliance with relevant laws and regulations, such as the Republic Act 10173, Data Privacy Act of 2012. The necessary knowledge includes understanding how the creation of class scheduling works. In terms of programming software, project developers will utilize a combination of front-end and back-end technologies to create an intuitive user interface and ensure smooth functionality.

In terms of hardware, the system will utilize devices like desktop computers, laptops, monitors, printers and mobile devices. These input and output devices enable features such as displaying real-time updates of end-users' class schedules. Thus, SpaceSync is playing a crucial role in enhancing and providing necessary information, ensuring accurate schedules, and facilitating an efficient working class scheduling system.

This system aims to benefit administrators, students, instructors, the school overall, and future project developers. Administrators, including deans and program heads, benefit from automated routine tasks, reducing manual effort and scheduling errors, allowing them to focus on higher-level responsibilities with accurate data management. Students enjoy a simple, intuitive interface to view schedules, accessing essential information like room numbers, times, days, and assigned instructors, which helps them manage their schedules effectively and enjoy a smoother academic experience. Instructors benefit from streamlined management of class times, classroom assignments, and resources, freeing up more time for teaching and student engagement, ultimately enhancing education quality.

The school benefits from optimized resource allocation of the system, leading it to more effective use of classrooms, labs, equipment, and staff. With the use of SpaceSync, it will result in a cost savings and a more harmonious environment, positively impacting both learning and administration. Additionally, future project developers gain insights into successful implementation of strategies, user needs, and potential areas for improvement, enabling them to build upon existing frameworks and create more innovative solutions to meet the evolving needs of educational institutions.

In summary, the project aims to revolutionize the traditional scheduling system by introducing a more comprehensive, user-friendly, convenient, and efficient new class scheduling system. This system simplifies the creation of conflict-free schedules and ensures smoother coordination, providing a seamless experience for its end- users. SpaceSync is a more comprehensive, user-friendly, convenient, and efficient new class scheduling system that streamline the process of organizing and managing class schedules, making it more efficient and less time-consuming. The purpose of SpaceSync is to simplify the complex process of the traditional class scheduling method which involves a lot of challenges. SpaceSync provides an exceptional user experience by offering an intuitive and efficient class scheduling management solution.

Objectives

The project developers intend to develop SpaceSync: A Colegio de Montalban's Class Scheduling System that will take a major role for an organized and efficient class scheduling. Specifically, the project developers aim to:

1. develop a system that prioritizes simplicity, efficiency and flexibility, enhancing experience of a comprehensive class scheduling without requiring more time than the traditional method,
2. develop a desktop application for the system that displays class schedule monitoring to streamline the allocation of classrooms, computer laboratories, instructors' availability, and resources efficiently,
3. develop a web application for the system that prioritizes simplicity, efficiency and flexibility, enhancing experience of its end users with its user-friendly interface,
4. develop a system that provides a user-friendly interface for the head and the program heads to input the instructors' availability and preferences, ensuring their schedules align with their teaching responsibilities,
5. develop a system that enables both instructors and students to access their class schedules easily through a digital platform, facilitating better time management and planning,
6. develop a system that generates comprehensive reports and analytics to assist the dean and program heads in optimizing scheduling processes and resource allocation, and
7. develop a system that enhances communication between dean, program heads, instructors, and students regarding scheduling matters.

Scope and Delimitation

Class Scheduling System, named "SpaceSync," is envisioned as a comprehensive class scheduling system dedicated to enhancing the class scheduling and coordination of class schedules within Colegio de Montalban. Crafted to offer end- to-end scheduling solutions, the system features a user-friendly interface designed to empower the dean and the program heads in efficiently managing class schedules. SpaceSync provides capabilities for creating and managing various types of classes, allocating classrooms, assigning instructors, and tracking pertinent scheduling information. The system's versatility extends to accommodating different programs, courses, sections, rooms, and instructors' availability. Furthermore, it

generates comprehensive reports and analytics to help the dean and the program heads optimize scheduling processes and resource allocation at Colegio de Montalban. SpaceSync also allows students to easily access their class schedules via a digital platform, resulting in better time management and planning. Furthermore, SpaceSync acts as a centralized platform for storing and accessing scheduling data, with powerful reporting and analytics tools to help with decision-making and resource optimization.

Despite its comprehensive functionality, SpaceSync operates within certain constraints. The system's performance may be influenced by hardware limitations, such as memory and processing requirements, which could impact its responsiveness and scalability. Additionally, SpaceSync must adhere to corporate policies and regulatory compliance standards, which may impose restrictions on certain features or data handling practices. Language preferences of users may also pose a limitation, as the system's interface may not fully accommodate alternative linguistic interfaces. Furthermore, while stringent security measures are implemented to safeguard user data, SpaceSync remains susceptible to the evolving landscape of cyber security threats. The dynamic nature of these challenges implies that the system's security may have inherent limitations dictated by the chosen security measures. It is important to note, however, that SpaceSync's functionality is limited to class scheduling within the institution. It does not include broader administrative tasks like enrollment management or financial operations, which are outside its scope.

In defining the scope of SpaceSync, the aim is to provide an efficient and user- friendly class scheduling system while acknowledging and communicating the realistic constraints inherent in its design. These boundaries encompass hardware limitations, regulatory compliance, language preferences, and cyber security considerations. Through the development of SpaceSync, the project endeavors to contribute to the improvement of class scheduling processes within Colegio de Montalban, recognizing the balance between ambition and practicality in the technological landscape of educational institutions. Project developers recognize these limitations and understand that the system may not be able to cater to all possible scheduling scenarios or meet the diverse needs of each user perfectly.

Technical Background

The project developers aimed to develop a modern Class Scheduling System equipped with advanced technologies, the Class Scheduling System, named “SpaceSync.” The project developers aims to develop a system that will address the challenges faced by

Colegio de Montalban's dean, program heads, instructors, and students, providing an organized and efficient class scheduling. SpaceSync serves as an innovative solution to these challenges, leveraging a combination of software and hardware components to streamline the class scheduling process and enhance the experience for end-users. The system incorporates various tools and applications, including Visual Studio 2022, Visual Studio Code, and XAMPP, to ensure seamless access control, schedule tracking, and real-time updates on scheduling information.

The utilization of Visual Basic 2022 (VB.NET) programming language for the system's core development underscores the project's dedication to creating robust, user-friendly, and widely supported software solutions. VB.NET's versatility and seamless integration establish a solid foundation for the system's functionality like the access to create, read, update, and delete (CRUD) a schedule which includes the options that involves programs, sections, courses, instructors, and rooms, guaranteeing a seamless user experience for both the dean and the program heads. Moreover, the incorporation of HTML, CSS, and JavaScript (Visual Studio Code) programming and markup languages in developing the web application emphasizes the system's focus on monitoring end-users' schedules. The versatility and user-friendly nature of HTML and CSS ensure smooth experiences for instructors and students, enhancing accessibility and usability. With this, the end-users can access their schedule through also the use of their mobile devices, enabling them to interact with the web application conveniently using their smartphones, offering features such as class schedules details in which it shows the room, program, course, instructor, section, time and date. The integration of the system’s web application enhances the accessibility of SpaceSync, making it an inclusive and user-centric solution for class scheduling,

The Entity Relationship Diagram illustrates the connections between the entities within the developed system, showcasing their inter dependencies and relationships. The SpaceSync: A Colegio de Montalban’s Class Scheduling System entity-relationship diagram comprises nine (9) major entities. The Users entity, the School entity, the Programs entity, the Courses entity, the Instructors entity, the Students entity, the Sections entity, the Schedules entity, and the Room entity. First, under the users entity are four (4) attributes, userID that serves as the primary key, username, password, and role. Second, under the school entity are four (4) attributes, schoolID that serves as the primary key, address, name, and academic_year. Third, under the program entity are five (5) attributes, programID that serves as the primary key, name, department, no_of_year, and program_code. Fourth, under the

courses entity are six (6) attributes, courseID that serves as the primary key, course_code, year_level, name, description, and type_room. Fifth, under the instructors entity are seven (7) attributes, instructorID that serves as the primary key, email, availability, firstname, lastname, gender, and employee_status. Sixth, under the students entity are seven (7) attributes, studentID that serves as the primary key, email, gender, student_status, firstname, lastname, and student_no, Seventh, under the sections entity are three (3) attributes, sectionID that serves as the primary key, year, and name. Eighth, under the schedules entity are four (4) attributes, scheduleID that serves as the primary key, start_time, end_time, and class_day. Lastly, under the room entity are five (5) attributes, roomID that serves as the primary key, floor_level, room_no, type_room, and building_name. The users entity in which the dean and the program heads belong manage the school in which they can access and control the whole class scheduling system experience. Therefore, the dean and program heads can also create, read, update, and delete (CRUD) a class schedule in which it includes the options that involves programs, sections, courses, instructors, and rooms. The school entity offers programs that comprises of different courses that students enrolls in. Students has sections and takes courses that are being taught by instructors. Students can be categorized into two, regular and irregular students which takes different courses. Schedules that are conducted by instructors consisting of different sections takes place in a room, in which in room entity, the system are classifying the type of room depending on the course being taken by the students. There are three types of room in which these are laboratory, regular classrooms, and the court.

In the context diagram, also known as a Level 0 data flow diagram is a visual representation that provides an overview of a system and its interactions with external entities. The SpaceSync: A Colegio de Montalban’s Class Scheduling System context diagram comprises of three (3) entities – users (Dean or Program Heads), instructors, and students. The student and instructor entity will give information to the user so that the users (Dean or Program Heads) can input both student and instructor information to manage and create their schedule. The Data Flow Diagram illustrates the management of data or flow of data on how the data is stored in a database. The SpaceSync: A Colegio de Montalban’s Class Scheduling System data flow diagram comprises of three (3) entities – users (Dean or Program Heads), instructors, and students, four (4) data stores, and a total of six(6) processes, four (4) for users (Dean or Program Heads), and two (2) for both instructors and students entity.

The flowchart of the class scheduling system, illustrations are shown in the process of how the system works. The starting part is opening the desktop application and a loading screen will pop up. After the loading screen, the users must set up the school and users details. If it's already set up, it will be redirected to the login page in which the users need to input the login details that includes username, password and role where it will asked if the users is an admin or not. If yes, it will be directed to the main form of the admin interface after a successful login. If not, it will be directed to the viewer's interface. If the username and password of the admin account is valid, the system will be directed to the main form. If not valid, the system will remind the users and will show a notification saying "invalid input, please try again" and it will go back to input the username, password, and role interface. After logging in as an admin and be directed to the main form, the user can have access to the change section in which it has ten (10) sections, Reports and Analytics Section, Monitoring Section, Program Section, Section Section, Course Section, Instructor Section, Room Section, Schedule Section, Print Section, and Settings Section. The Program, Section, Course, Instructor, Room and Instructor Section have the same functionality and processes in which the users can add, edit, delete, clear, search, and read in those section. The print section have options to search, print and view schedules. The settings section have the option to edit profile, add, edit, delete, and view role, as well as to import student data and the reset function. The reset function will give the user two options, yes or no. If yes, the desktop application will be formatted and the user will be redirected to the set up page. If not, the users will be redirected to the settings section. Lastly, after the change section, the users have the option to log out. If yes, the desktop application will be redirected back to the login page. If no, the users will have the option to either close the desktop application or be directed back to the main form of the class scheduling system.

The flowchart of the website of the developed system will start on the login page of the SpaceSync website. In the login page, it will asked for login details such as student or instructor's no and email in which it will authenticate and check with the database. If successful, the users will be directed to the homepage. If not, it will remind the users and will show a notification saying "invalid input, please try again" and it will go back to login page. In the homepage, it have the functionality and processes of search and print schedule. Lastly, it has the logout option which has two options, yes or no. If yes, the users will be redirected back to the login page. If no, the user will be given the option to close the web application or be directed back to the homepage of the SpaceSync website.

CHAPTER II

REVIEW OF RELATED LITERATURES, STUDIES, AND SYSTEMS

Review of Related Literatures

In this chapter, various local and foreign literature, studies, and systems were reviewed by the project developers to gain understanding of existing researches and other academic works relevant to the area of the project, and thus, present a broader knowledge to the academic community and at the same time, help the project developers intensify their knowledge in the field.

Class scheduling system (also known as Class Management System) serves as a comprehensive class management tool for universities (Abdullah, 2019). It facilitates the organization of courses by semester, user profile management, and grants users the authority to access and export course details. This solution is distinguished by its flexible and convenient features, empowering deans, program heads, and instructors to optimize efficiency and minimize time wastage. The system's standout feature lies in its flexibility and scalability, vital for future development endeavors. The Class Schedule System requires further enhancements and interconnections for future iterations. One such area is the design and implementation of a smartphone application, which remains a pending task. With a smartphone web application, users gain access anytime and anywhere, overcoming limitations posed by desktop-only applications.

Boctuan et al. (2019) investigated the impact of an A/B block schedule on the academic performance of Grade 12 ABM students at Bestlink College of the Philippines during the 2018-2019 academic year. Employing a Descriptive Research Design with Qualitative Methodology, the study assessed attendance, academic achievement, work immersion, and extracurricular activities as influenced by the scheduling format. Results indicated that the block schedule promoted regular attendance, facilitated academic preparation, accommodated work immersion commitments, and allowed for engagement in extracurricular pursuits. These findings underscored the importance of effective class scheduling in enhancing student outcomes, emphasizing the need for time management guidance and ongoing evaluation of scheduling methodologies to optimize learning environments and promote academic success among students.

Labuanan et al. (2019) addressed scheduling challenges at Isabela State University - Main Campus by implementing a genetic algorithm. This method aimed to simplify the process of creating class schedules by considering instructor availability, room capacity, and course

requirements. Their approach utilized representation and fitness techniques to generate templates and evaluate schedule suitability. Findings indicated that genetic algorithms expedited scheduling and reduced plotting time significantly. Introducing automation into scheduling processes not only saves time but also enhances precision, as evidenced by Labuanan et al.'s study. Additionally, they evaluated their solution using ISO 9126 Standard measures to ensure usability and functionality.

Class scheduling systems play a crucial role in educational institutions, facilitating the efficient allocation of resources and management of academic activities. A noteworthy contribution to this domain is the class scheduling system developed by jkev (2020) using PHP/MySQLi. This system aims to streamline the scheduling process by enabling schools to assign class schedules without conflicts, detect room availability, and identify time conflicts. Notably, the system empowers administrators to manage various data sets within the system database, including courses, teachers, subjects, rooms, and academic school years. Furthermore, it offers examination scheduling features, allowing administrators to set exam schedules and specify proctor locations. Such functionalities underscore the significance of technological solutions in optimizing administrative processes within educational settings. By leveraging PHP/MySQL, this system demonstrates the potential for web-based applications to enhance scheduling efficiency and organizational effectiveness in academic institutions.

Class scheduling is crucial for optimizing student performance and well-being, as it significantly impacts focus and punctuality. Research by Moral et al. (2023) found no significant difference in these aspects between morning and afternoon classes, suggesting that flexible scheduling can accommodate diverse student needs. Effective class schedules help mitigate issues like fatigue and absenteeism by aligning class times with periods of peak alertness. Additionally, well-planned scheduling ensures efficient use of resources and supports institutional logistics. Thus, class scheduling is a strategic tool that enhances educational outcomes and overall student satisfaction.

Zaeniah et al. (2020) highlighted the challenges of traditional class scheduling, emphasizing the need for meticulous attention to detail. Their study aimed to develop a class scheduling information system to streamline scheduling processes and reduce administrative workload. They introduced a taboo search algorithm to optimize schedule generation, aiming to minimize errors and simplify scheduling overall. Additionally, their research produced a lecture scheduling system tailored for the Faculty of Information and Communication Technology at Mataram University of Technology, enhancing efficiency within academic

departments.

Efficient class scheduling systems are integral to the smooth functioning of educational institutions, aiming to streamline the arduous task of arranging class schedules. This research by Gipit and Acuna focuses on the design and development of a Class Schedule System (CSS) tailored specifically for educational institutions, with InfoTech Development System Colleges Incorporated (IDSC Inc.) serving as a case study. The system is envisioned to revolutionize the process of class scheduling by offering speed, accuracy, and convenience to users. Leveraging an analytical approach and object-oriented programming principles, the system's analysis and design emphasize efficiency and user-friendliness. By employing PHP and MySQLi for system development, the researchers ensure robust database management and the creation of a web interface, enhancing accessibility and usability. The CSS is designed to fulfill four primary functions: user access management, data input for schedule arrangement, data processing, and report generation. Notably, the system's versatility allows for operation via LAN or cloud hosting, enabling seamless access across multiple platforms. Through rigorous testing, the CSS is expected to significantly expedite access to class schedules, thereby enhancing overall efficiency in scheduling tasks within educational institutions. Ultimately, this research underscores the transformative potential of technological solutions in optimizing administrative processes and improving user experiences in the educational sector.

According to Chen et al. (2021), traditional manpower scheduling methods are unable to adequately meet the demands of educational administration in colleges and universities. In today's highly advanced era of computer technology, it has become economically viable to employ software technology for the design of course scheduling systems, thereby relieving educational administrators of the demanding and rigorous task. Commonly utilized course scheduling systems rely on algorithms such as hill climbing, tabu search, ant colony optimization, and simulated annealing. However, these algorithms are not without their limitations. In their research, Chen et al. (2021) investigated the mutation genetic algorithm and its application to student scheduling systems. Through rigorous testing of the system's running speed and accuracy, they discovered that the algorithm performed effectively within the course scheduling system. This finding provides robust evidence of the algorithm's ability to support educational administration staff in tackling the arduous task of scheduling.

Mammi and Ying (2021) mentioned that current timetable scheduling system in Universiti Teknologi Malaysia (UTM) is done manually which consumes time and human

effort. In their project, a Genetic Algorithm approach is proposed to aid the timetable scheduling process. Scheduling information such as rooms available and timeslots needed, it is shown that scheduling can be done more efficiently, with less time, effort and errors. Mammi and Ying said that implementing this system reduces human error and human efforts in the timetable scheduling process.

Efficient management of class schedules is vital for educational institutions to optimize resources and ensure smooth academic operations. Anthology's Class Scheduling system (2024) offers comprehensive features tailored for faculty and staff members tasked with developing and managing class schedules. Users can efficiently schedule classes, assign instructors, and configure various class settings to meet specific requirements, such as room usage quotas and scheduling outside main class hours. Additionally, the system facilitates the storage of class-related comments, configuration of attendance rules, and management of waitlists and fee schedules. Robust conflict resolution features alert users to scheduling conflicts, room or instructor double-bookings, and duplicate class codes, ensuring accuracy and consistency in scheduling processes. The system's reporting capabilities, including the Term Class Schedule report and custom view creation, enable users to access detailed information for informed decision-making. Prerequisites for system access and usage are clearly outlined, emphasizing the importance of proper authorization for performing specific actions within the system. Overall, Anthology's Class Scheduling system represents a valuable tool for educational institutions seeking to streamline class scheduling processes and enhance operational efficiency.

According to Labuanan, Camungao, Tapaoan (2019), Scheduling of classes has been one of the most important factors that school needs to prepare before enrolment plays a vital role in providing an idea of the students in managing their time. As times passes, several issues arise dealing with the scheduling process of schools and universities like time spent in providing solutions for the time conflicts; assigning of faculty, students, rooms and laboratory schedules takes a number of days and even weeks to prepare; and as a result, the scheduled start of classes was not followed. These problems greatly affect the student's eagerness to attend their classes, the time frame of the faculty in delivering the topics and entails negative feedbacks on the top- level management.

Synthesis of the Review

The development of the Class Scheduling System, named "SpaceSync," aims to address challenges encountered in traditional manual scheduling processes. Various literature, studies, and systems pertinent to class scheduling, particularly in the Philippines, emphasize the role of technology in enhancing scheduling efficiency. While the adoption and implementation of class scheduling systems in the country vary, their impact across different platforms is notable. The integration of technology in class management has influenced resource allocation, user experience, and overall scheduling outcomes, highlighting the importance of an efficient system like SpaceSync. However, these benefits are accompanied by limitations and challenges that necessitate thoughtful approaches for improvement.

The importance of class scheduling systems in educational institutions has been shown in many studies. They help in facilitating the process of arranging class schedules, optimizing the allocation of resources, and enhancing academic operations. Boctuan et al. in (2019) proved that block scheduling affected attendance and academic readiness. The work of Labuanan et al. in (2019) applied genetic algorithms and illustrated the method's effectiveness in speeding up the scheduling process. Additionally, the work of jkev (2020) on the development of a PHP/MySQLi- based system further highlights the transformative power of technological solutions in improving the efficiency of scheduling processes.

Further research by Zaeniah et al. in (2020), Chen et al. in (2021), and Mammi and Ying in (2021) emphasizes the difficulties in traditional scheduling and the potential for algorithmic approaches to address such problems. According to Zaeniah et al., the scheduling process requires meticulous attention to detail. Chen et al. and Mammi and Ying explore the effectiveness of genetic algorithms in automating scheduling tasks. These studies give enough evidence on the benefits accruing from algorithmic scheduling approaches, which include efficiency, error reduction, and human effort reduction. Besides, the Class Scheduling system from Anthology is an example of advancements in the technology of scheduling, which has comprehensive features for efficient scheduling and management of classes.

The deployment of the system utilized framework-dependent deployment with Microsoft Visual Studio, offering significant convenience and efficiency to its end- users. SpaceSync's deployment with Microsoft Visual Studio is practical and effective. The user-friendly web application ensures real-time updates on class schedules, promoting seamless communication among users. Additionally, the system enhances the safety and security of records by eliminating the flaws associated with traditional paper-based and verbal announcement methods. Overall, SpaceSync streamlines class scheduling processes and fosters effective communication within educational institutions.

CHAPTER III

EVALUATION, DESIGN, AND FRAMEWORK

This chapter deals with the presentation of the discussion of expected and justification, operational and conceptual framework used, the software, hardware, client requirements as well as the definition of terms.

Discussion of the Expected Output and Justification

SpaceSync offers a comprehensive and user-friendly class scheduling platform for Colegio de Montalban, addressing inefficiencies and inaccuracies in manual scheduling by streamlining the process for greater efficiency and precision. It enhances manual scheduling with robust conflict resolution and effective resource allocation, significantly reducing administrative workloads and improving the academic experience. SpaceSync modernizes Colegio de Montalban's traditional, labor- intensive, and error-prone scheduling processes. By providing a digital platform for manual schedule entry, it automatically identifies and resolves conflicts, reducing double-booking and over-scheduling, and thus enhancing overall efficiency.

Key features include conflict resolution, resource allocation, and real-time updates. The conflict resolution tool prevents simultaneous bookings and overbooked faculty members. Resource allocation optimizes the use of classrooms and laboratories based on availability, preventing overbooking or underutilization. Real- time updates inform stakeholders of schedule changes, minimizing confusion and miscommunication. Administrators manually input schedules, and the system automatically checks for conflicts and suggests solutions. Continuous monitoring allows real-time adjustments, ensuring accurate and up-to-date schedules. This centralized platform, accessible to administrators, faculty, and students, offers an intuitive interface for easy management. The development of SpaceSync is justified by the need to modernize Colegio de Montalban's scheduling processes. It transforms scheduling by analyzing input data for conflicts and suggesting alternatives. Real-time monitoring ensures schedules remain accurate, keeping all users informed of changes, thus guaranteeing an efficient and responsive system that meets institutional needs. By addressing class scheduling challenges, SpaceSync enhances efficiency, security, and user satisfaction. Thorough research on Class Scheduling Management has resulted in a robust, secure, and user- friendly system. By integrating advanced technologies and design principles, SpaceSync is poised to revolutionize class scheduling management.

Operational Framework

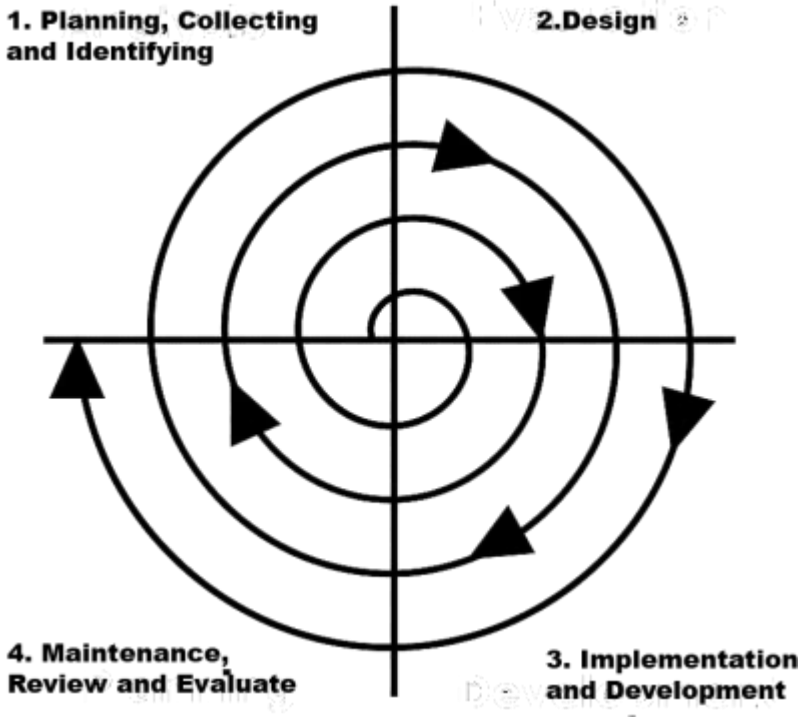

Figure 4.1. An Operational Framework illustrating the development of the Comprehensive Class Scheduling System, SpaceSync, using the Spiral Model

The project developers have employed the spiral model for the testing and maintenance of SpaceSync. This process is iterative and allows us to revisit different stages of the development whenever a bug or an error occurs, ensuring that continually refine and improve the system. This cyclical process will persist until the project developers are confident that SpaceSync is fully operational, robust, and free from bugs.

The development of SpaceSync followed the Spiral Model of the System Development Life Cycle (SDLC). This model is particularly effective for managing large, complex projects that require continuous refinement and risk assessment. The Spiral Model's iterative nature allowed the project developers to incorporate user feedback and make necessary adjustments at each phase, ensuring the system met all requirements and functioned optimally.

In the initial phase, the project developers focused on planning and requirement gathering. This involved detailed consultations with stakeholders to understand their needs and expectations for SpaceSync. Key activities included identifying the system's functional

and non-functional requirements, determining project scope, and outlining initial project risks. The objective was to ensure that all essential features were documented and aligned with the users' goals. Data collection from existing systems, user surveys, and feedback sessions were instrumental in this phase, providing a comprehensive foundation for the subsequent design.

During the design phase, the project team translated the gathered requirements into a coherent system design. This involved creating detailed desktop and website flowcharts, data flow diagrams, and user interface prototypes. The design emphasized user-friendliness and robustness, incorporating features such as real-time scheduling and user management. The project developers also designed the database schema, ensuring efficient data storage and retrieval. This phase was crucial for visualizing the end product and planning the integration of various components, ensuring that the system's structure would support its intended functionalities.

In the implementation phase, the project team began coding and building SpaceSync based on the design specifications. The development process was iterative, with regular testing and refinement to address any issues that arose. Developers used Visual Studio Code, Visual Studio 2022, and other development tools to create the desktop and web application. Integration of third-party APIs and testing for compatibility across different devices and platforms were key activities in this phase. The iterative approach allowed the team to continuously improve the system's functionality and performance, ensuring that it met all specified requirements.

The final phase involved rigorous testing, maintenance, and evaluation. The system underwent extensive testing to identify and fix bugs, optimize performance, and ensure security. Feedback from users was crucial during this phase, as it provided insights into potential improvements and usability issues. Regular updates and patches were released to address any emerging problems, and the system's performance was continually monitored. This phase ensured that SpaceSync remained reliable and effective, meeting the users' evolving needs and maintaining high standards of quality.

Conceptual Framework

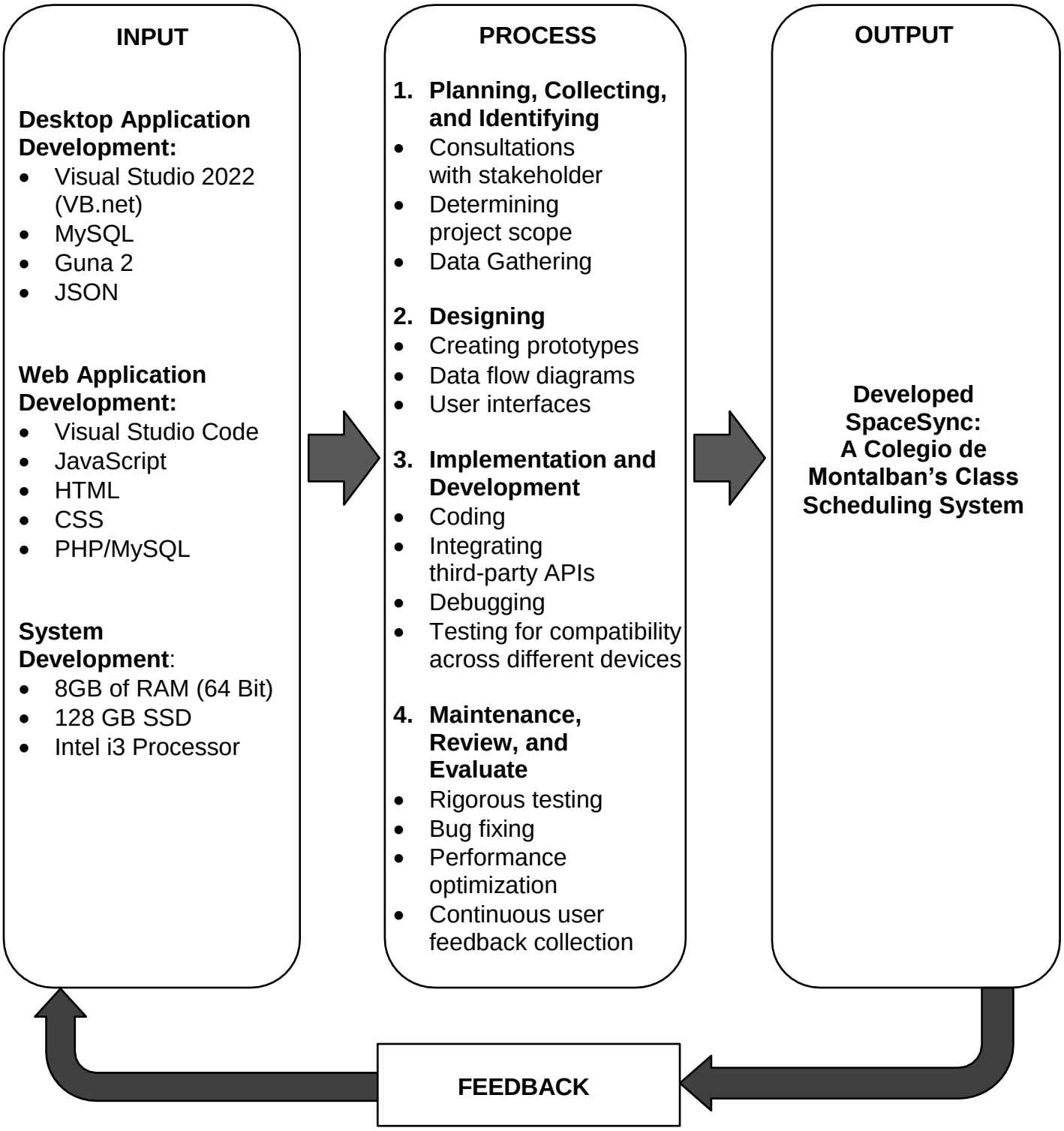

Figure 4.2. A Conceptual Framework Showing the Development of SpaceSync: A Colegio de Montalban's Class Scheduling System

The conceptual framework for SpaceSync, Colegio de Montalban's Class Scheduling System, is structured around four key components: Input, Process, Output, and Feedback. This framework provides a clear and systematic approach to developing and refining the class scheduling system. The Input phase focuses on collecting all necessary data required for the system. It includes user requirements and resource availability. The input phase ensures that the project developers have a comprehensive understanding of the system requirements before moving forward.

The Process phase involves several critical stages. Initial planning and requirement identification involve consultations with stakeholders to understand their needs and determine the scope of the project. This stage also includes brainstorming and data gathering to outline the project's foundation. During the design phase, the team creates prototypes and blueprints for both desktop and web applications. This involves creating data flow diagrams and user interface designs, ensuring that the system will be user-friendly and meet functional requirements. The implementation and development stage involves the actual coding and building of the system, using various development tools such as Visual Studio 2022 and Visual Studio Code. The process includes coding, integrating third-party APIs, debugging, and testing for compatibility across different devices. After development, the system undergoes rigorous testing to identify and fix bugs, optimize performance, and ensure security. Continuous evaluation and user feedback collection are integral to maintaining and improving the system.

The Output phase results in the fully functional SpaceSync system. This system includes a user-friendly interface for scheduling classes, managing resources, and accessing real-time updates. Additionally, the system provides detailed reports and analytics to help administrators optimize scheduling processes. Feedback is continuously collected and analyzed to identify areas for enhancement and address any issues, ensuring that the system remains effective and aligned with users' needs over time.

Requirement Specifications

The requirement specifications for SpaceSync detail the necessary components and conditions for both the development and operational phases of the system. The system must be accessible to both users and developers, catering to the scheduling needs of Colegio de Montalban by providing easy access and user-friendly interfaces. Administrators and instructors should be able to view and update their schedules, manage resources, and handle bookings efficiently. The development of SpaceSync utilizes integrated development environments (IDEs) such as Visual Studio 2022 and Visual Studio Code, which are essential for building a robust and user-friendly application.

For the desktop application, the minimum requirements include a Windows 10 operating system or higher, an Intel i3 processor or equivalent, 8 GB of RAM (64-bit), and at least 128 GB of available storage disk space. These specifications ensure that the application runs smoothly and can handle complex scheduling data. The technological stack for development involves a combination of front-end and back-end technologies. For desktop applications, Visual Studio 2022 (VB.net), MySQL, Guna 2, and JSON are used. For web applications, Visual Studio Code, JavaScript, HTML, CSS, and PHP/MySQL are employed. The system should operate on devices such as desktop computers, laptops, monitors, printers, and mobile devices, enabling features like real-time updates of class schedules and enhancing the system's functionality and user experience

Definition of Terms

Analytics. Refers to the systematic computational analysis of data of statistic.

Attributes. Refers to the characteristic of an entity.

Context Diagram. Refers to a visual representation that provides an overview of a system and its interactions with external entities.

Courses. Refers to structured program of study, often part of a curriculum that focuses on a particular subject or topic.

CRUD. Refers to the four basic operations stands for Create, Read, Update, and Delete. Commonly used to interact with a database or a data management system.

CSS. Refer to Cascading Style Sheets, is a style sheet language used to describe the presentation and formatting of documents written in markup languages like HTML.

Data Flow Diagram. Refers to a graphical representation that depicts how data moves through a system, showing the flow of information between different processes, entities, data stores, and external systems.

Database. Refers to a structured collection of data that is organized, stored, and managed in a way that allows for efficient retrieval, updating, and manipulation of information.

Desktop Application. Refers to a software program designed to run on a desktop or laptop computer.

Entity. Refers to a fundamental concept used to represent a distinct object or thing about which information is stored. In relational databases, an entity typically maps to a table, with its attributes corresponding to columns in the table.

Entity-Relationship Diagram. Refers to a visual representation used in database design to illustrate the relationships between different entities within a system or database.

Flowchart. Refers to visual representation of a process or a sequence of steps, often used to illustrate the flow of information, tasks, or decisions in a logical and organized manner. It uses standardized symbols and shapes to depict various elements, such as processes, decisions, inputs, outputs, and the direction of flow.

Form. Refers to the primary window or user interface of a Windows Forms application. This 'Main Form' serves as the central point for interaction in a desktop application, providing a space to add UI components like buttons, text boxes, labels, and more. Developers use forms to create a structured layout for user interaction and to handle events triggered by user actions.

Guna 2. Refers to a popular framework and set of components for building modern, visually appealing desktop applications using Windows Forms (WinForms) in the .NET environment. Developed by Guna UI, this framework provides a wide range of UI controls and design elements that can be used to create sleek, user-friendly applications with enhanced visual styles and functionalities.

HTML. Refers to Hyper Text Markup Language, is a standard markup language used to create and structure content on the World Wide Web. It is the foundational language for building web pages and web applications.

JavaScript. Refers to a high-level, interpreted programming language primarily used for creating interactive and dynamic content on websites and web applications. It is one of the core technologies of the World Wide Web, alongside HTML and CSS.

Management System. Refers to a structured framework or set of processes, practices, and policies designed to organize, control, and coordinate various activities. within an organization or domain. Management systems help organizations achieve their goals, improve efficiency, ensure compliance, and maintain quality.

Markup Languages. Refers to a type of language used to annotate, structure, and format text or data in a way that defines its meaning or presentation. Unlike traditional programming languages, which focus on operations and logic, markup languages primarily concern themselves with structure and presentation.

Monitoring. Refers to the process of systematically observing, tracking, and collecting data over time to assess the performance, status, or condition of a system, process, environment, or application.

Primary key. Refers to a field or a combination of fields in a database table that uniquely identifies each record in that table. It serves as a unique identifier for each row, ensuring that no two rows have the same value in the primary key column(s). Primary keys play a crucial role in database design and data integrity.

Programming Languages. Refers to a formal languages used to communicate instructions to a computers, allowing developers to create software, applications, websites, and other types of programs.

Programs. Refers to a structured set of courses, activities, and learning objectives designed to achieve specific educational goals. Programs can vary widely in scope, duration, and focus, and they can be offered by schools, colleges, universities, or training institutes.

Relationship. Refers to how entities are related to each other.

Role. Refers to what type of user will use the Desktop Application. It will be either Admin or Viewer.

Scheduling System. Refers to a software or organizational framework designed to manage and organize time-based tasks, resources, or events. The purpose of a scheduling system is to ensure that tasks are planned efficiently, resources are utilized optimally, and conflicts are minimized.

SpaceSync. Refers to the name of a class scheduling system designed to manage and organize class timetables, room allocations, and other related scheduling tasks.

Users. Refers to an individual or entities that interact with a system, product, or service. In technology and software contexts, users are the people who utilize applications, websites, devices, or platforms to perform tasks, access information, or achieve specific goals.

Visual Basic. Refers to a high-level programming language developed by Microsoft, primarily designed for building Windows-based applications.

Visual Studio Code. Refers to a free and open-source code editor developed by Microsoft. It is widely used by developers for writing, debugging, and running code across various programming languages and platforms.

Visual Studio 2022. Refers to a popular integrated development environment (IDE) developed by Microsoft, designed for software development across a wide range of programming languages and platforms. It is used by developers to build applications, software, websites, and other projects for various operating systems, including Windows, macOS, and Linux.

Web Application. Refers to a software program or application that is accessed and used through a web browser over a network, typically the Internet.

User-Interface. Refers to the part of a system, application, or device with which users interact to accomplish tasks or communicate with the system. It encompasses the visual and interactive elements that allow users to navigate, input data, control processes, and receive feedback.

XAMPP. Refers to a free and open-source software package that provides a complete local development environment for web applications. It includes several essential components needed to run a web server, allowing developers to test and develop web- based applications locally before deploying them to a live server.

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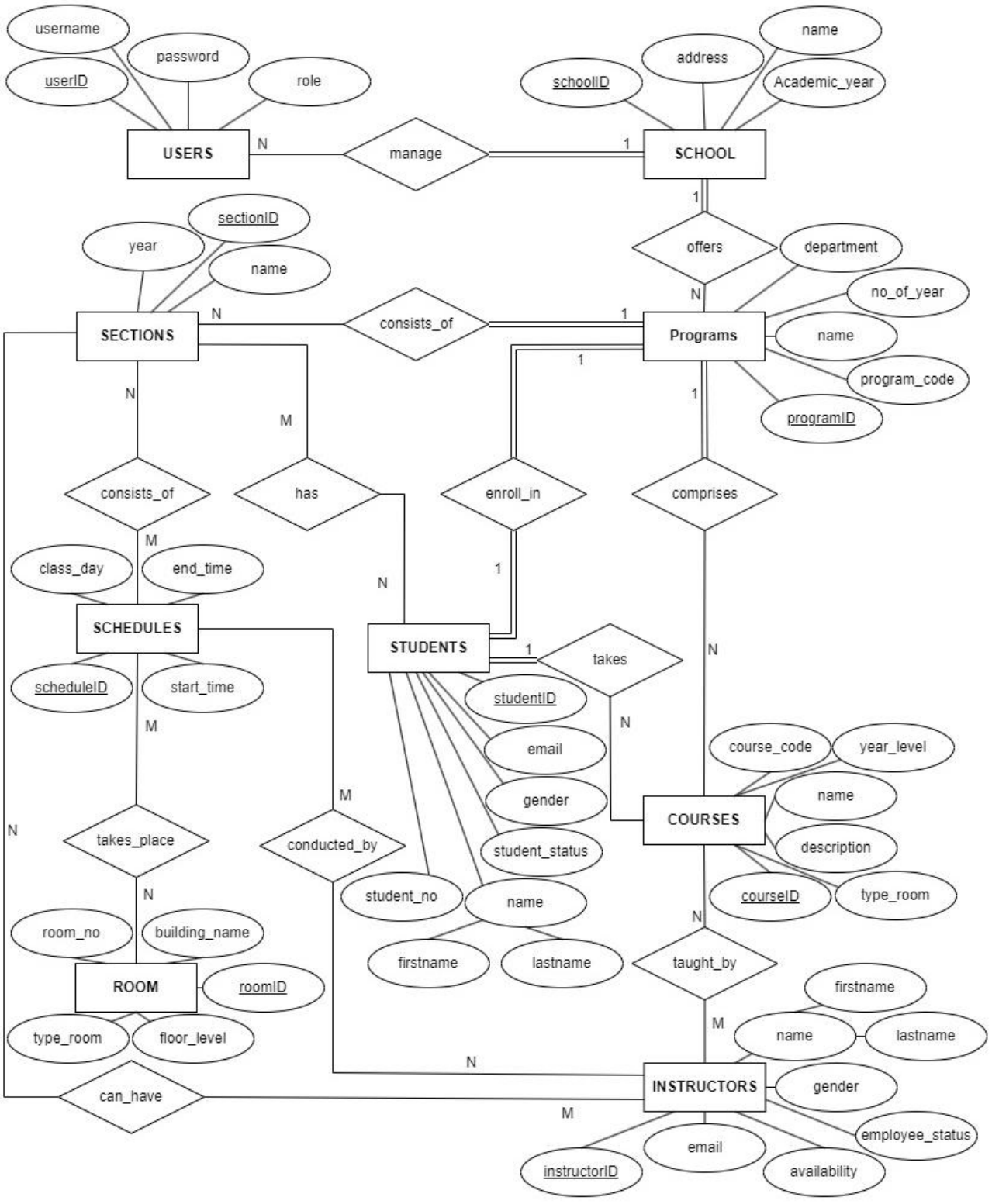


Figure 1. Entity - Relationship Diagram of

SpaceSync: A Colegio de Montalban's Class Scheduling System

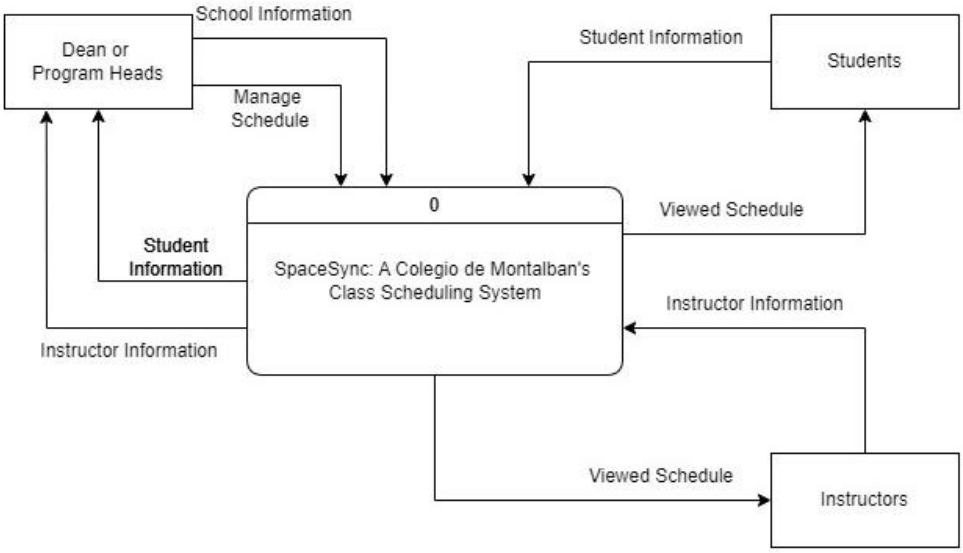


Figure 2.1. Desktop Application's Context Diagram of SpaceSync: A Colegio de Montalban's Class Scheduling System

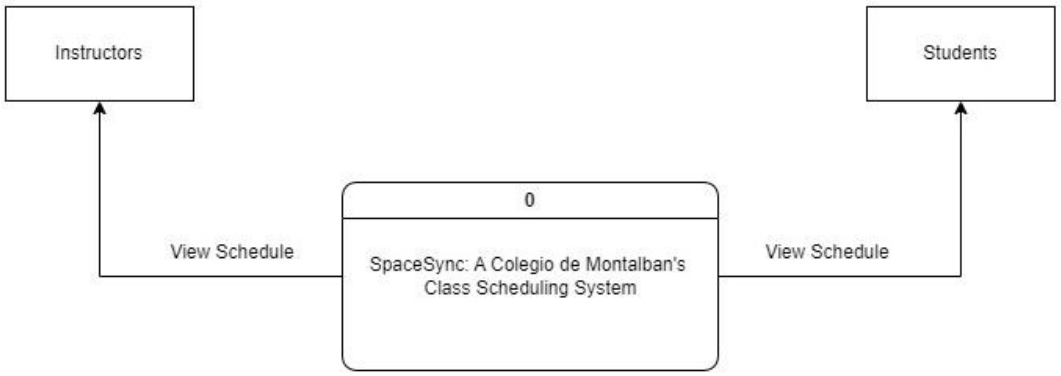


Figure 2.2. Web Application's Context Diagram of SpaceSync: A Colegio de Montalban's Class Scheduling System

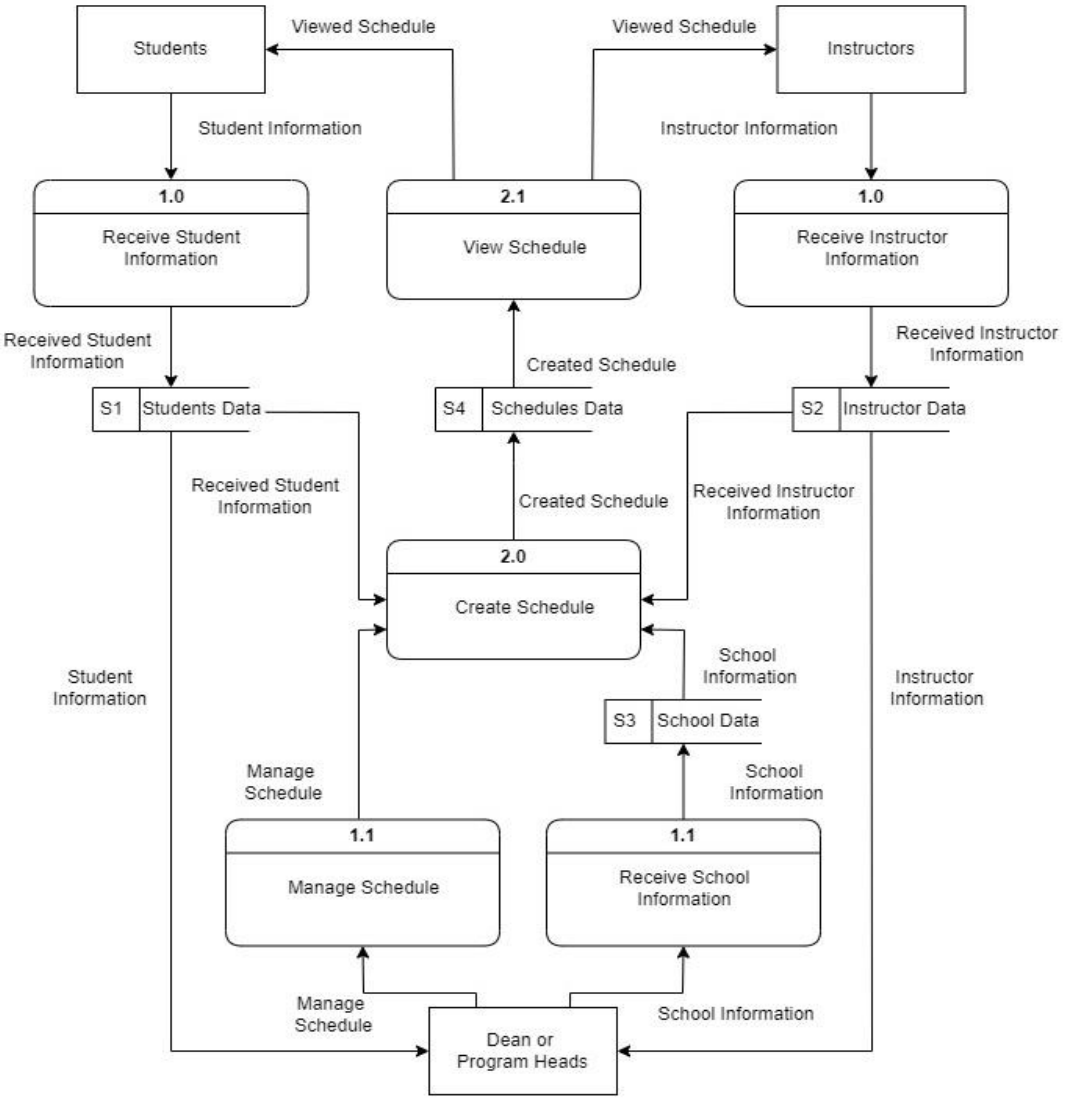


Figure 2.3. Desktop Application's Data Flow Diagram of SpaceSync: A Colegio de Montalban's Class Scheduling System

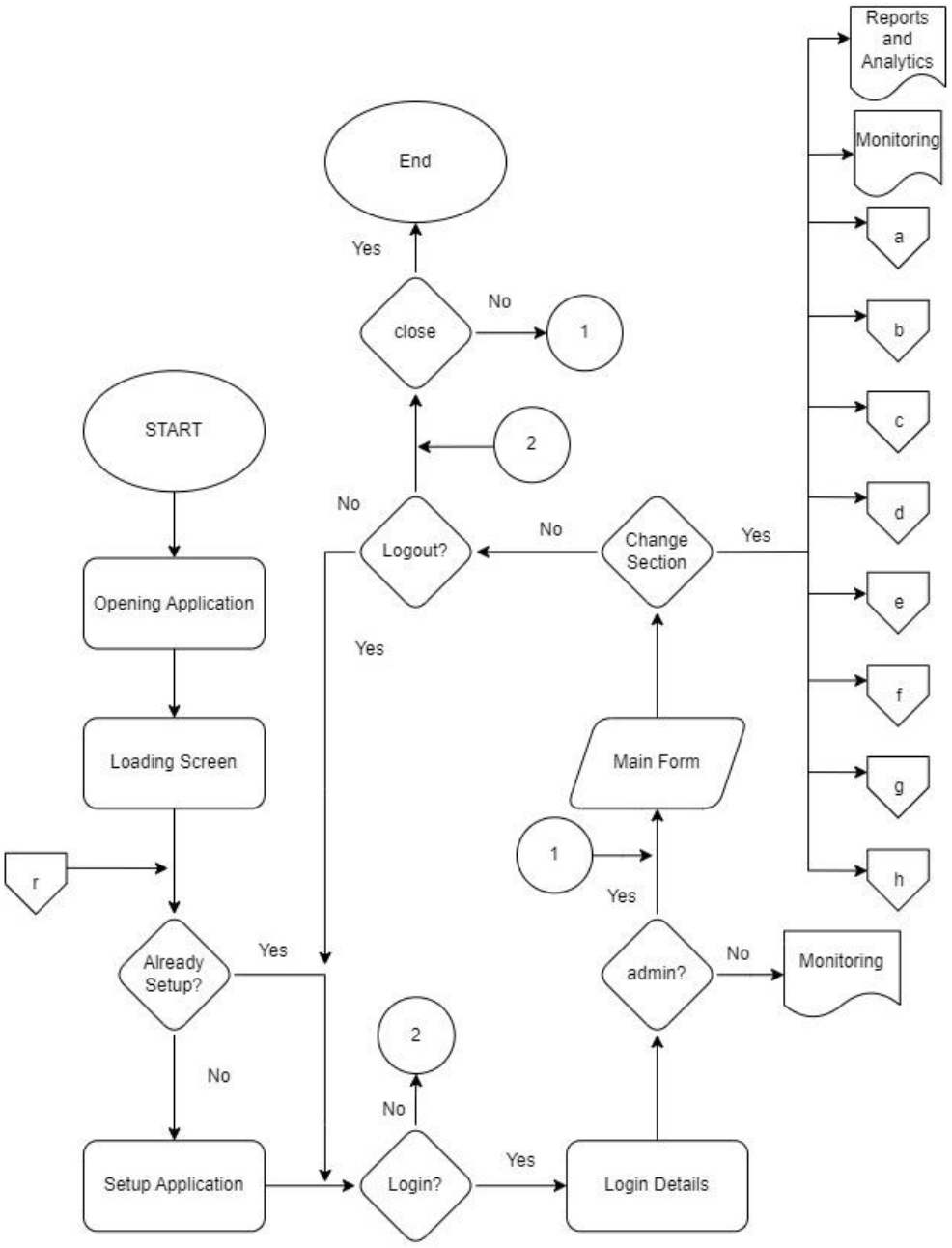


Figure 3.1. Desktop Application's Flowchart Page I of SpaceSync: A Colegio de Montalban's Class Scheduling System

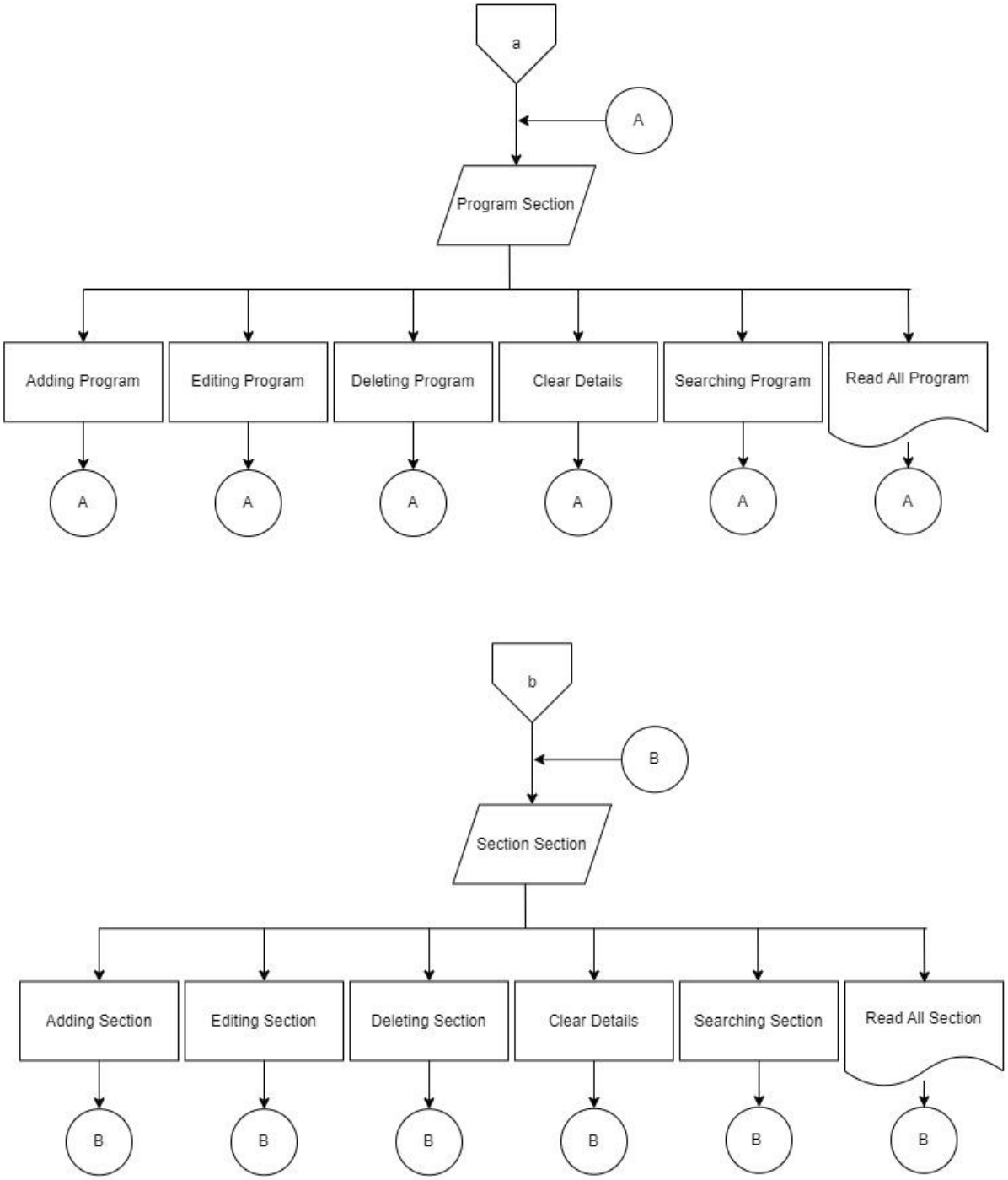


Figure 3.2. Desktop Application's Flowchart Page II of SpaceSync: A Colegio de Montalban's Class Scheduling System

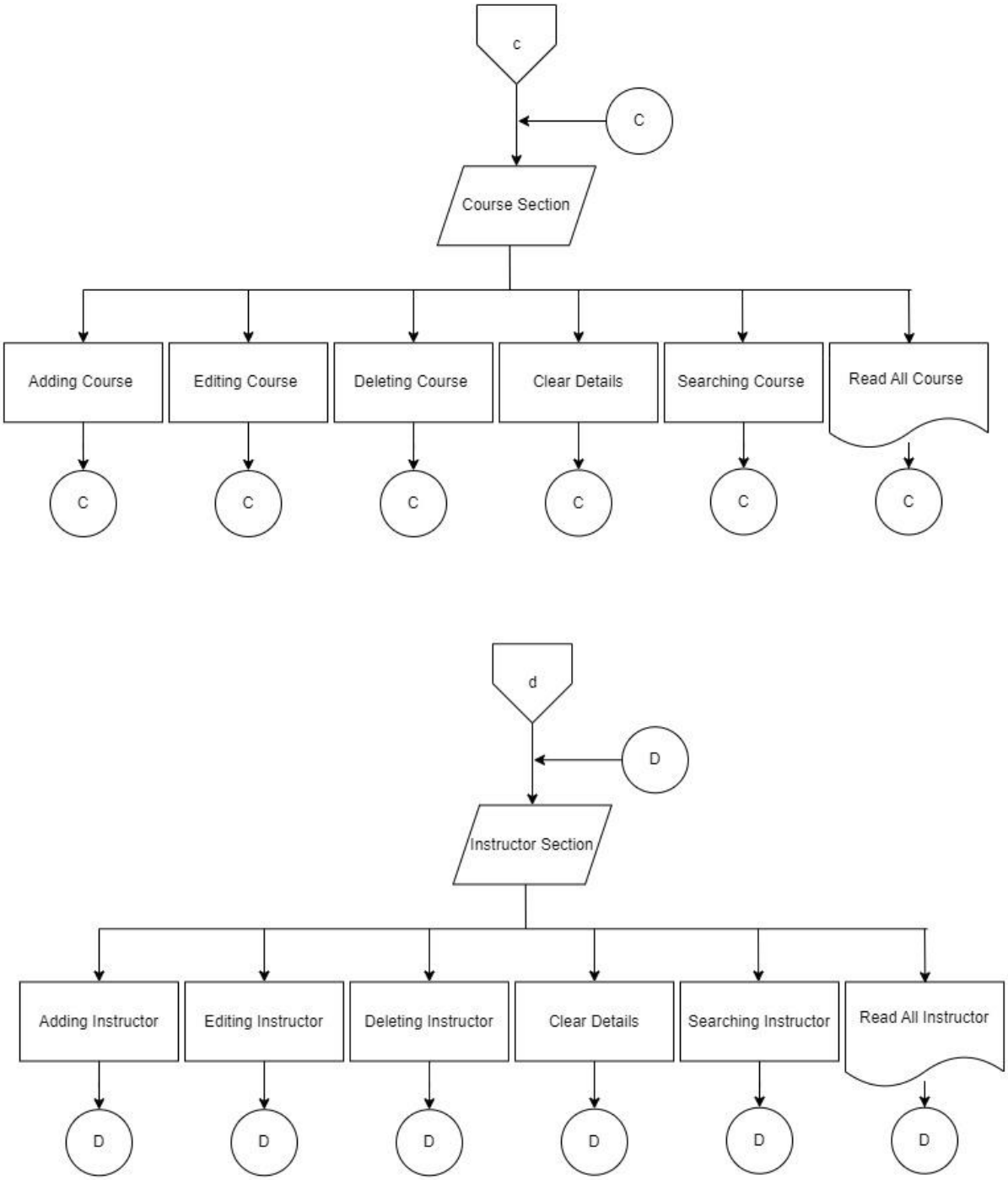


Figure 3.3. Desktop Application's Flowchart Page III of SpaceSync: A Colegio de Montalban's Class Scheduling System

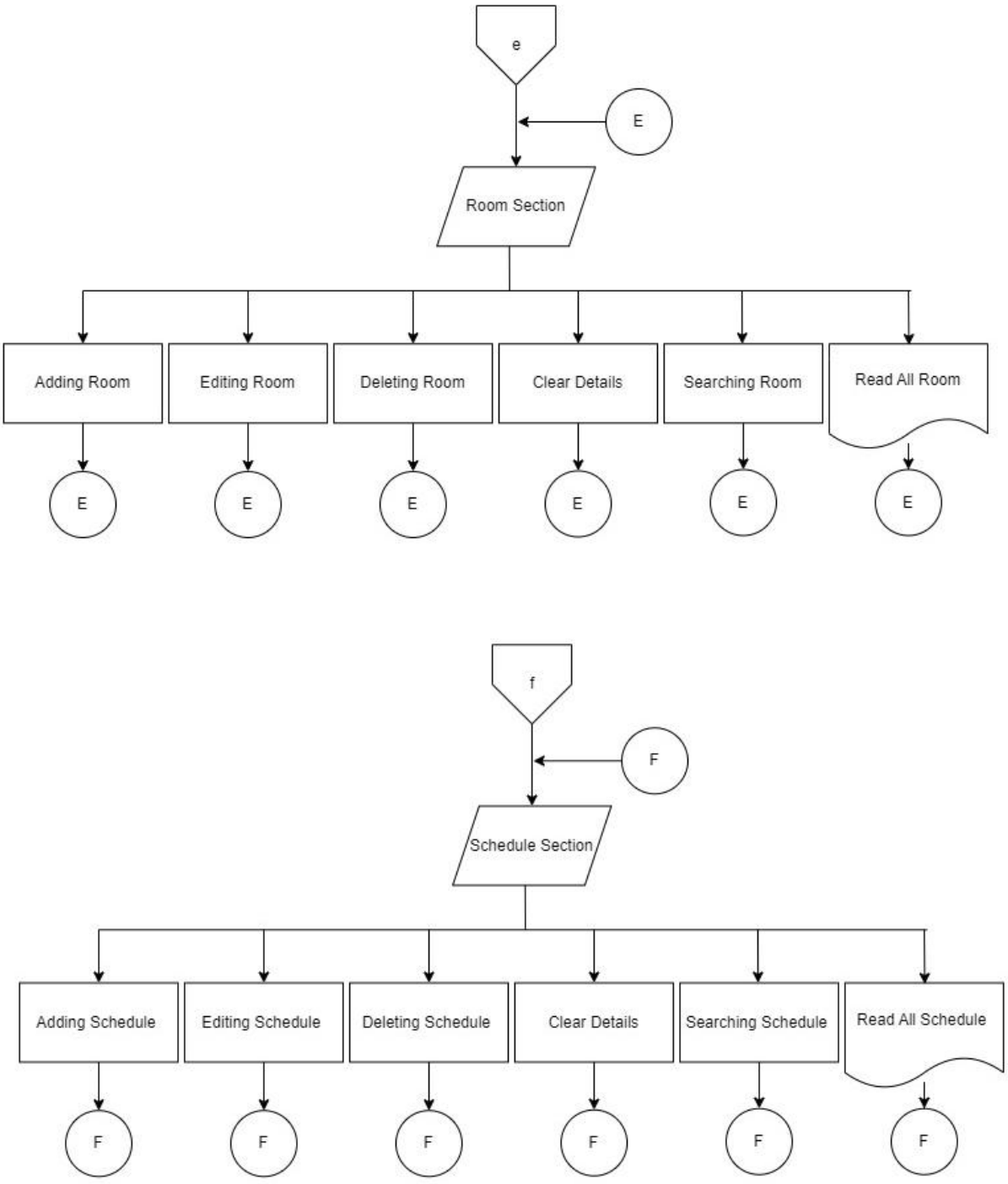
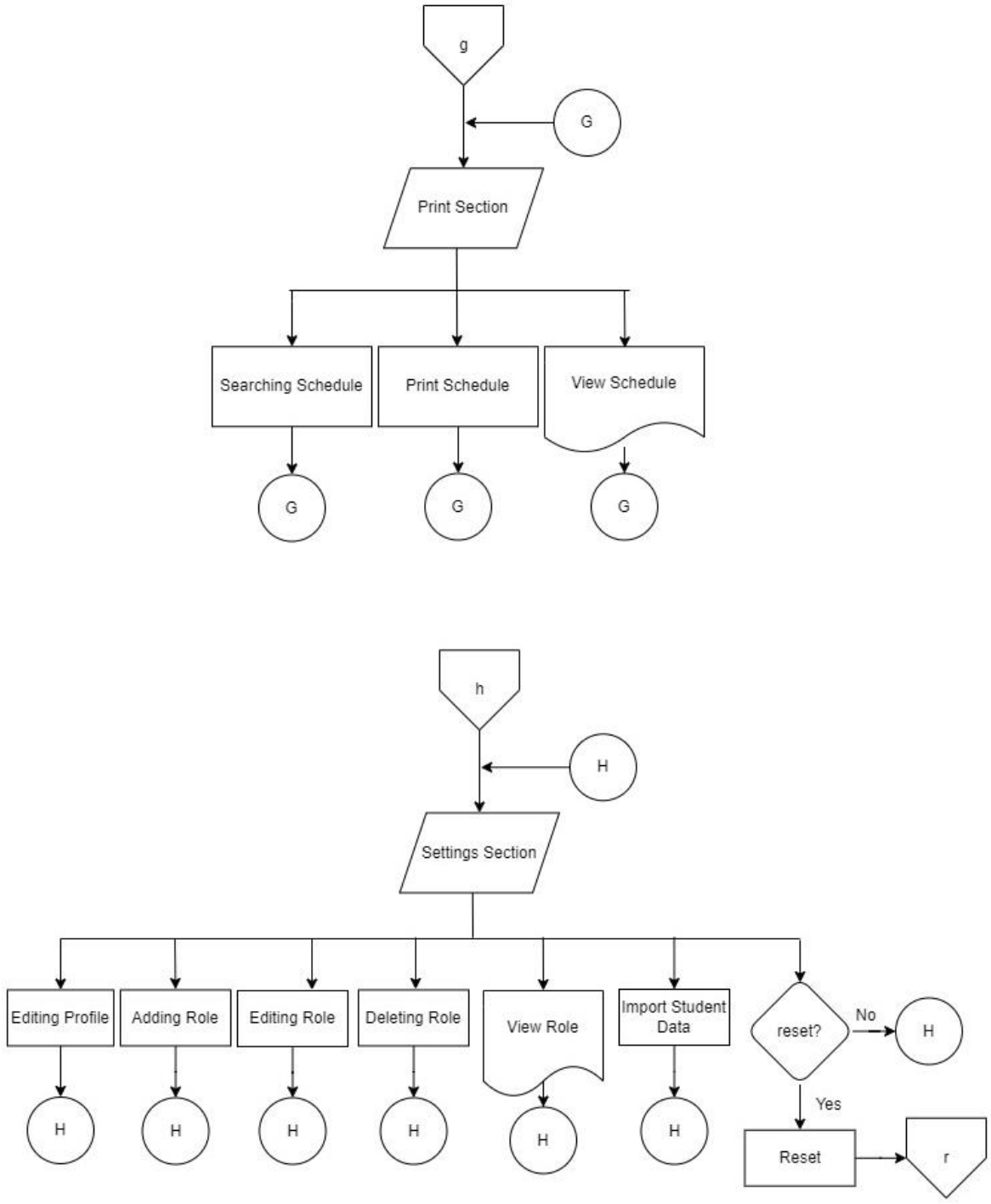


Figure 3.4. Desktop Application's Flowchart Page IV of SpaceSync: A Colegio de Montalban's Class Scheduling System



-Figure 3.5. Desktop Application's Flowchart Page V of SpaceSync: A Colegio de Montalban's Class Scheduling System