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DEVELOPMENT OF WEB-BASED TIMETABLING SYSTEM FOR THE JUNIOR HIGH SCHOOL OF BATASAN HILLS NATIONAL HIGH SCHOOL USING THE ARTIFICIAL BEE COLONY ALGORITHM

A Research Paper Presented to

College of Science of Technological University of the Philippines - Manila

In Partial Fulfillment

of the Requirements for Subject

CC303, Methods of Research In Computing

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S.Y. 2023 - 2024

CHAPTER 1

THE PROBLEM AND ITS BACKGROUND

This chapter discusses the background of the study, its primary and specific objectives and its significance. Moreover, the scope and delimitations of the study are also discussed to provide an overview of the research and a brief description of its concepts.

Background of the Study

Methods of manual timetabling have been practiced by schools for a long time to efficiently allocate resources. Traditionally, schedules for classes, teachers, and exams have been developed and maintained mainly in paper without assistance from any type and form of automation (Oluwole, 2023). This method is common due to its simplicity in implementation and low costs. However, manual processes are labor-intensive, time-consuming, error-prone, and lack scalability (Tank, 2023). This results in higher labor costs and lower morale among educational staff due to repetitive and tedious tasks (CLAConnect, 2022).

In response to this problem, there has been a growing interest in automated timetabling systems that leverages advanced algorithms and automation in its approach. One such approach has been able to develop efficient timetables based on given constraints and factors such as student and teacher availability and preferences and availability of facilities (Konstantinidou, 2023). Through the use of computational techniques, these algorithms have been able to evaluate scheduling options and identify the most optimal solutions that satisfies the needs of an educational institution.

The successful implementation of novel optimization algorithms in real-world engineering problems have piqued the interest of researchers in solving constrained and unconstrained optimization problems (Katiyar *et. al*, 2021). One such algorithm called artificial bee colony (ABC) algorithm has been effective in finding a solution in complex optimization problems. The ABC algorithm was inspired by the foraging behavior of a swarm of honey bees in its task of finding food due as it is able to learn its environment, pass and retain information, and adapt to changes in its surroundings (Mehta, 2022). The adaptive nature of the ABC algorithm can be attributed to the small number of control parameters, fast convergence, and high flexibility, and simplicity within a specific time period. Sarumaha *et. al* (2023) implemented the ABC algorithm in optimizing vehicle routes problem wherein it was able to produce a better solution than the Branch and Cut algorithm for customers less than 100. Moreover, Zhu *et. al* (2021) utilized the ABC algorithm in the development of a school timetabling problem (STP). In this study, the proposed approach was able to solve the STP and handle a large amount of dataset in an ordinary computer hardware.

This project aims to develop a web-based timetabling system using the artificial bee colony algorithm for the junior high school of Batasan Hills National High School. This endeavor would be of great help in improving the scheduling processes of the institution by transitioning from the traditional methods of timetabling to an automated system, significantly improving effectivity and efficiency.

Objective of the Study

The general objective of the study is to develop a web application that utilizes artificial bee colony algorithm for the junior high school of Batasan Hills National High School

Specifically, this study aims to:

- Optimize the scheduling allocation of classrooms, laboratories, and other facilities to avoid conflicts and maximize usage.
- Accommodate last-minute changes or adjustments, such as changes in faculty availability or room bookings.
- Develop an easy-to-use interface for administrators, instructors, and students.
- Generation of detailed reports and analytics on resource utilization.
- Help administrators make decisions for future scheduling.

Significance of the Study

The findings of this project would be useful to the endeavors of the following people and institutions:

For teachers, as it avoids occurrences of time and room conflicts, preventing possible interruptions of classes. Moreover, by taking into account the preferred day and/or time in conducting classes, the satisfaction and performance of teachers would see great improvement.

For the school administration, as it automates a significant educational process, reducing costs and necessity for extra paperwork with improved efficiency. The project also presents better allocation of school resources, ensuring optimality despite limited availability. Moreover, abrupt changes such as roster turnover, new students, or increase/decrease in available facilities would be handled appropriately.

For future researchers, the project can serve as a basis for future endeavors that focus on the transition of traditional scheduling methods to a modern, automated, data-driven system.

Scope and Delimitations

The timetabling system is focused on improving the traditional timetabling by integrating it with technology, making it web-based for easy access. Recent studies and research will be used as reference in checking the features of a timetabling system. This study will also involve interviewing with the client to meet their expectations and answer their needs on the problem that they are facing in timetabling. System involves time, money, and materials, and the number of personnel/programmers needed for the research.

CHAPTER 2

CONCEPTUAL FRAMEWORK

This chapter covers the review of related literature, conceptual model of the study, system architecture, and definition of terms. These sections collectively provide a comprehensive overview and theoretical framework for researchers to better understand the context of the study.

Review of Related Literature

Timetabling System

As defined by Suresh *et.al* (2015), timetabling refers to the assignment of a particular resource to an object given the space time and constraint in a manner that is as optimal as possible. This method is practiced by all educational institutions to schedule teachers and students to resources such as classrooms while minimizing overlaps and conflicts. School timetabling problems vary from institution to institution depending on the needs of the school (Zekang *et. al*, 2019). However, most schools still practice manually creating timetables for teachers, classes, students, and examinations using mainly paper without assistance from any form or type of technology or automation (Oluwole, 2023). This method is still in practice nowadays due to its simplicity and low costs in implementation (Tank, 2023). However, manual production of timetables is an extremely repetitive and tedious task as institutions are required to create new schedules for every new semester, quarter, or term (Techie-Menson & Nyagorme, 2021). Moreover, failure to resolve timetabling problems might cause disruptions due to overlaps and conflicts particularly in room and timeslot schedules. Hence, the demand for automated timetabling systems for schools in particular has seen significant increase.

In response to this problem, the implementation of computational techniques in processes such as scheduling have been in-demand. One such approach is called smart scheduling which creates optimal schedules for institutions through the utilization of algorithms and automation (Konstantinidou, 2023). This approach has been used mainly in tandem with optimization algorithms that are able to maximize utilization of resources and minimize conflicts with constraints with regards to time and other factors. Moreover, development of timetabling systems are expected to follow constraints. As defined by Bashab *et. al* (2022), constraints are classified into two (2), hard constraints that must be strictly followed or else the solution fails and soft constraints, which are not required but improves the overall quality of the solution if followed. Factors such as the availability and preferences of both students and teachers, and capacity of rooms must be taken into consideration when developing timetables to obtain the most optimal solution. This use of technology and automation for developing timetables for schools has improved the efficiency of creating schedules for students and teachers alike, reduced possibility of human errors that may cause disruptions, and enabled the flexibility and adaptability of such systems to constant changes in a school environment (Melnikova *et. al*, 2023).

An example of the implementation of smart scheduling has been accomplished by Hoshino and Fabris (2020). In this study, individual preferences of students were taken into consideration during the creation of timetables for a Canadian all-girls high school using graph coloring combined with integer linear programming. This study was particularly challenging as small interdisciplinary institutions usually only have one or two sections for each course. However, it was concluded that considering the preferences of students when it comes to courses has its benefits.

On the other hand, university timetables are said to be much more complex and encounter a lot of problems. Therefore, optimization algorithms are necessary to generate optimal schedules (Bashab et al., 2022). This paper reviews recent studies on university timetabling, covering key key concepts, methods, optimization, and more. It also highlighted the importance of considering first the various constraints to achieve optimal schedules and then explaining how performance is evaluated using benchmark datasets. The paper also offers valuable insights for students, researchers, and professionals in discussing current challenges and future research opportunities in university timetabling.

Chen *et. al* (2021) emphasized on the difficulty of solving the university course timetabling problem (UCTTP) due to the large size population and the diversity in the hard and soft constraints. However, perspectives, trends, and challenges in solving the UCTTP revealed that researchers over the years have implemented meta-heuristic, hybrid, hyper-heuristic, or state-of-the-art methodologies in finding solutions for the issue.

Artificial Bee Colony (ABC) Algorithm

Artificial Bee Colony Bee (ABC) algorithm is a heuristic algorithm inspired by the way bees collect honey or forage for food (Gupta et al., 2020). When bees look for and/or gather food for the colony, different types of bees, foraging behavior, and dances are involved in the process (Mehta, 2022). Employed bees take use of the available information about food sources, onlooker bees are responsible for the gathering of such information to build a food source for the colony while scout bees locate for new sources around the hive. Whenever a bee finds a food supply, it extracts and stores the nectar to one of the empty cells in the hive and it performs a specific type of dance that depends on the profitability of the food supply to convey the information to other bees.

The intelligent foraging behavior of bees led to Devis Karaboga proposing the ABC algorithm in 2005 which was specifically based on the model proposed by Tereshko and Loengarov ("Transpire Online", 2019). Katiyar *et. al* (2021) stated that the ABC algorithm is advantageous due to its adaptive nature. Specifically, the ABC algorithm involves a small number of parameters such as colony size and maximum cycle number, efficient convergence, high flexibility, and the simplicity in implementation given a specific time period.

The steps of the ABC algorithm are summarized below ("Baeldung", 2023):

1. **Production of initial food source:** Random generation of solutions as food sources.
2. **Sending employed bees to food source:** Each employed bee is assigned to a food source.
3. **Calculation of probability values during selection:** Employed bees evaluate the probability of the assigned food source based on amount of nectar (quality of solution).
4. **Food selection process by onlooker bees**: Onlooker bees evaluate the probabilities given by employed bees.
5. **Abandonment**: Scout bees are sent out to search for potential food sources if the quality of food source is significantly low.

Several improvements to the Artificial Bee Colony algorithm have been proposed and implemented over the years. Pan *et. al* (2017) proposed the Hybrid Artificial Bee Colony (HABC) algorithm to address the issues of low accuracy of solutions and slow convergence rate. Improvements were made by designing a search model based on the best-of-random mutation scheme and generating solutions by updating multiple dimensions. Results have shown significant improvement in the optimization performance.

Wang *et. al* (2020) also proposed the integration of a new neighborhood selection mechanism to the ABC algorithm. The new ABC (NSABC) chooses the best solution within a neighborhood radius to generate offspring or new solutions. This is opposed to the probabilistic selection not working with increasing iterations due to the inability to distinguish two different solutions. Results have shown that the NSABC achieved better results compared to 5 other variants of the ABC algorithm.

Applications of the Artificial Bee Colony (ABC) Algorithm

The ABC algorithm has been applied in various fields. According to Kaya *et. al* (2022), the ABC algorithm has been widely utilized in solving 12 areas of combinatorial optimization problems. These areas include assembly/disassembly, bioinformatic, graph coloring, routing, rule mining, web service composition, social network analysis, team orienting, timetabling, traveling salesman, vehicle routing, and other problems. Moreover, the ABC algorithm has seen significant importance in the following areas:

- **Green Production Inventory:** Supakar *et al.* (2022) applied the ABC algorithm on a green production inventory problem with preservation for deteriorating items in neutrosophic fuzzy environment, which allow to determine optimal parameters, since the ABC algorithm helps to find the optimal values of the decision variables involved in the production inventory system. Given the imprecise nature of parameters such as deterioration rate, demand rate, and various cost, the ABC algorithm effectively navigates through the neutrosophic uncertain environment to identify solutions that can perform well under different levels of uncertainty. Also, by solving the model in crisp, neutrosophic, and crispified forms, the ABC algorithm allows for the comparison of solutions across different representations of uncertainty as well as used to solve numerical examples constructed to illustrate the proposed model.

- **Intelligent Price Supervision:** the ABC algorithm was also used in the intelligent price supervision system of digital economy written by Li (2023). The study addresses the increasing need for an intelligent price regulation system in the rapidly evolving digital economy by proposing a method based on the Artificial Bee Colony (ABC) algorithm. It is used to monitor and analyze market prices, identify patterns and trends, and dynamically adjust prices to achieve optimal regulatory effects. The experimental results of the study demonstrated that the intelligent price supervision system achieved a security level of up to 98%, confirming its effectiveness and reliability in meeting market demands and ensuring secure price regulation.
- **Project Scheduling:** the implementation of the ABC algorithm in a study conducted by Yarramsetti (2019) for project scheduling showed great effectiveness compared to traditional methods. The study discusses an approach for scheduling and staffing in project management. The primary point is on tackling the challenges of human resource allocation and task scheduling through an Event-Based Scheduler integrated with Fuzzy C-Means clustering and the Artificial Bee Colony algorithm. Based on the results, the proposed method leads to a better schedule with lower costs and more stable work assignments. Overall, the study presents a comprehensive approach to improving software project scheduling through advanced clustering and optimization techniques, aiming for cost-effective and efficient project management.

- **Air Freight Station Scheduling:** Wang *et. al* (2022) tackled the optimization of scheduling tasks for an air freight station using an enhanced Artificial Bee Colony algorithm. This study focuses on optimizing the sequence of outbound and inbound tasks and scheduling the actions of dual elevating transfer vehicles in the said station. Along with the ABC algorithm, An improved multi-dimensional search strategy is also introduced to enhance the balance between exploration and exploitation by covering more dimensions as well as using the best dimension of the current optimal solution. Based on many experiments, it shows that the IMAC algorithm outperforms the original ABC and other improved algorithms.
- **Patient Admission Scheduling:** According to Bamigbola *et. al* (2023), the hybrid Hill-ABC algorithm effectively addresses the Patient Admission Scheduling (PAS) problem by utilizing global search capabilities of the ABC algorithm. The said approach offers a promising solution for some complex combinatorial optimization problems like Patient Admission Scheduling in healthcare settings, Additionally the study emphasizes the integration of ABC and hill climbing for the patient admission by enhancing the solution quality. The Patient Admission Scheduling problem involves assigning patients to limited rooms while also meeting various constraints. Existing algorithms struggle with the highly constrained solution for the PAS. To address these challenges, a hybrid approach combining ABC algorithm and HCH is proposed.
- **Operating Room Scheduling:** the ABC algorithm was also effective in reducing operating costs and enhancing operating room utilization as discussed by Lin and Li (2021). The study tackled the challenge for optimizing operating room schedules in hospitals, its main goal was to reduce cost and to maximize operating room utilization.

By using sample cases of surgery sizes between 40 - 100 cases for small surgery sizes, and 120 - 150 cases for larger surgery sizes. The ABC algorithm demonstrated far better efficiency and solution compared to heuristics approach.

- **Job-Shop Scheduling:** another application of the ABC algorithm was used in the study of Li *et al.* (2023). This study is about the Flexible Job-shop Scheduling Problem with Lot Streaming (FJSP-LS), an extension of FJSP commonly encountered in manufacturing. Since the FJSP-LS is complex and unstable for many algorithms to find an optimal solution, the study proposes a hybrid algorithm called RL-ABC, this algorithm is the combination of Reinforcement Learning and ABC algorithm. RL-ABC divides the problem-solving process into two stages. First stage is determining the best dispatch scheme and the second is optimizing sublots. The algorithm is compared against five other algorithms and real instances, showing effectiveness and robustness in reducing Makespan, despite slightly longer CPU times.

For the purposes of this project, the following are the applications of the ABC algorithm in education particularly in the development of timetabling systems.

- **Online Examination Timetabling:** the ABC algorithm was used in the development of online examination timetabling systems in higher education (Zhu et al., 2022). Educational timetables have become essential for school and universities, since the COVID-19 pandemic. Traditional timetabling methods are challenged transitioning to online exams, which involve new constraints like unlimited room capacity and varied exam durations. This study used a local university scenario to propose a conceptual model for online exam scheduling. First, a conflict table is created to manage constraints, and second, a Modified Artificial Bee Colony (MABC) algorithm is applied to optimize the schedule. The model was tested with a large dataset of 16,246 exam items, involving 9,366 students and 209 courses. The results demonstrated that the ABC algorithm effectively met all hard constraints and minimized violations of soft constraints.

- **School Timetabling:** in another study from Zhu *et al.* (2021), the ABC algorithm was applied to resolve the school timetabling problem (STP) which has not developed as quickly as examination and course timetabling issues due to its greater diversity and complexity. This study introduces the conceptual model for STP that thoroughly integrates educators' availability, preferences, and expertise. By adapting the ABC algorithm, well-known for its effectiveness with large datasets in examination and course timetabling, and incorporating a virtual search space to manage the extensive search domain, the study achieved successful results. Using a substantial randomly generated dataset, the study's findings demonstrate that it effectively handles the STP and processes substantial data sets on standard computer hardware, thus reducing computing costs. The study approach is far more efficient and capable of producing more satisfying results than the conventional method.
- **Uncapacitated Examination Timetabling:** Bolaji *et. al* (2015) presented the Hybrid Artificial Bee Colony (HABC) to solve the examination timetabling which is a combinatorial optimization problem of assigning examinations to time slots based on given constraints. Results showed that the HABC is a powerful technique capable of generating new results for problem instances while being competitive and working well across all tested instances in comparison with other approaches.

These literatures have defined timetabling systems and the current demands and issues revolving around these concepts. Moreover, the ABC algorithm was discussed through the introduction of its origins and steps of implementation as well as recent developments and improvements. Lastly, the applications of the ABC algorithm highlighted its versatility and effectiveness in finding solutions for various optimization problems. This project focuses on leveraging the ABC algorithm to develop a web-based timetabling system for the junior high school of Batasan Hills National High School.

Conceptual Model of the Study

Input	**Process**	**Output**
1. User information a. University admin login credentials b. Course details c. Instructor details d. Classroom details 2. Timetabling constraints a. Course schedules b. Instructor availability c. Classroom availability d. Maximum class sizes	1. Data collection - Gather all input data (course details, instructor availability, classroom details, etc.) 2. Algorithm Application - Apply the Artificial Bee Colony (ABC) algorithm to optimize the timetabling process: i. Initialization: Generate initial population (timetable solutions) ii. Employed Bee Phase: Evaluate solutions based on constraints. iii. Onlooker Bee Phase: Select and improve solutions. iv. Scout Bee Phase: Introduce new solutions to replace poor solutions. 3. Timetable Generation - Create an optimized timetable based on the algorithm's output. 4. Validation - Ensure the generated timetable meets all constraints if necessary	1. Generated Timetable a. Optimized schedule for courses, instructors, and classrooms 2. Reports a. Timetable summary for university admin. b. Individual schedules for instructors c. Room allocation details

Input

Timetabling system input refers to the data and information that is required as system inputs that includes important details for scheduling such as classroom, instructor, and course details. The constraints are also included to determine how the functionalities will work.

Process

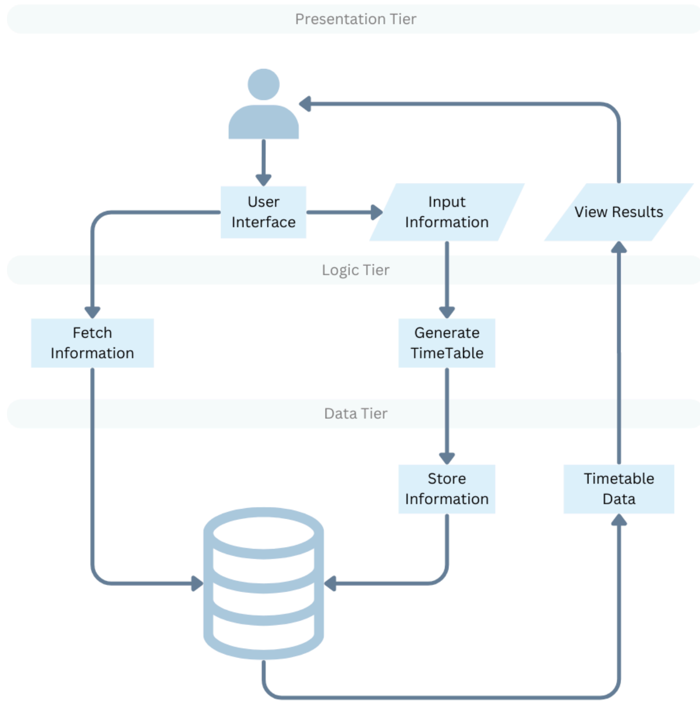
The process of the timetabling system refers to the step-by-step procedure in developing the said system. This includes the planning execution up to the deployment of the system. Conducting meetings with the team on how to develop the system, gathering of related information, creating a wireframe and blueprint of the system, testing, and deployment are the key factors to consider in doing the process of the system development.

Output

The output is the overall produced timetabling system after the execution of the process and taking every input into consideration.

System Architecture of the Study

The illustration below provides a comprehensive view of the system architecture, encompassing its foundational structure, logic tier, and data tier. This graphic effectively illustrates the intricate interactions among the system's various components and functionalities, offering a clearer understanding of its overall design and operational aspects.



Presentation Tier

The presentation tier serves as the interface for administrative staff. It includes web pages or forms through which admin interact with the system, displaying data and receiving inputs.

Logic Tier

The logic tier, also known as the logic layer, processes data from the presentation tier, interacts with the database, and sends results back to the presentation tier. It handles user authentication, authorization, and ensures that only authorized users can access the system.

Data Tier

This layer is responsible for storing and managing system data. It handles data storage, retrieval, and manipulation. The logic tier communicates with the data tier to access and manipulate data, and the data tier returns the results to the logic tier.

Definition of Terms

To facilitate the understanding of this study, several key terms are defined as follows:

Artificial Bee Colony (ABC) Algorithm. This algorithm was mentioned a lot in this study, it refers to a heuristic method inspired by how bees gather honey and search for food (Gupta et al., 2020).

Timetabling. In this study, timetabling refers to the allocation of specific resources to an object given the space time and constraints, aiming for the most efficient outcome or solution (Suresh et al., 2015).

Smart Scheduling. In this study, it refers to creating optimal schedules for institutions through the utilization of algorithms and automation (Konstantinidou, 2023).

Optimization Problems. This refers to the problems focused on finding the most efficient solution. These areas include assembly/disassembly, bioinformatic, graph coloring, routing, rule mining, web service composition, social network analysis, team orienting, timetabling, traveling salesman, vehicle routing, and other problems (Kaya et al., 2022).

Hard Constraints. This study classified constraints and hard constraints is one of them. These are rules that must be strictly followed or else the solution fails (Basha et al., 2022).

Soft Constraints. Unlike hard constraints, soft constraints are not required or mandatory. However, following them can enhance the overall quality of the solution (Basha et al., 2022).

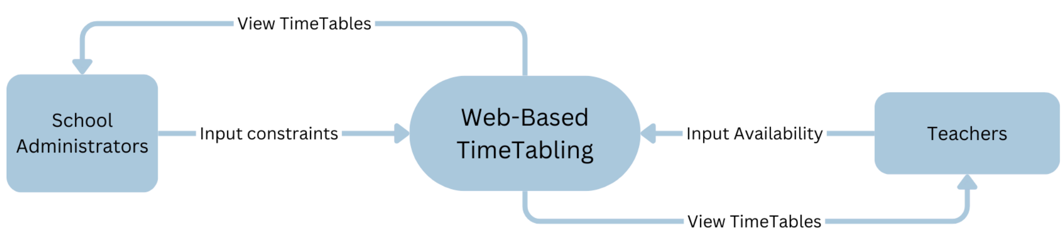
CHAPTER 3

METHODOLOGY

The chapter aims to provide a clear and comprehensive overview of the research methodology, detailing how the system will be designed, built, operated, tested, and evaluated in order to generate the data and insights needed to address the study's objectives.

PROJECT DESIGN

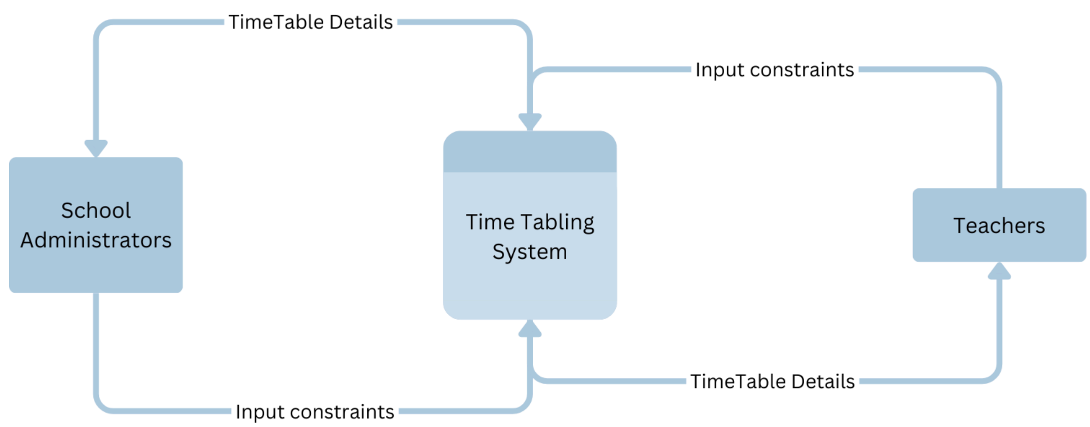
The primary goal of this project is to design and develop a web-based timetabling system for the Junior High School of Batasan Hills National High School. Traditional methods of scheduling classes and allocating teachers are often manual, time-consuming, and prone to errors. This project aims to automate the timetabling process using the Artificial Bee Colony (ABC) algorithm, which can efficiently generate optimal timetables that balance teacher and student needs. The web-based system will provide real-time and accurate information on class schedules, teacher assignments, and student attendance, enhancing the overall efficiency and effectiveness of the school's operations.



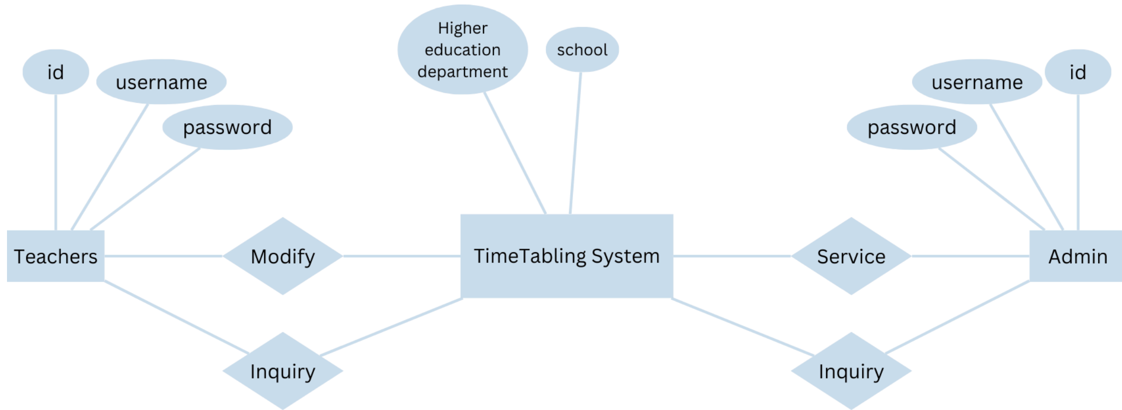
A context diagram provides a high-level view of the web-based timetabling system for the Junior High School of Batasan Hills National High School. It is a simple diagram that defines the system's scope, restrictions, and connections to external entities such as school administrators.

The context diagram for this project would illustrate how the web-based timetabling system interacts with various users, including school administrators, teachers, and students. It shows the system's boundaries and the data flows between the system and external entities.

For example, the context diagram shows that the system receives input from school administrators and teachers regarding class schedules, teacher assignments, and student enrollment. It would also show that the system provides output to teachers in the form of class schedules and student attendance records.



The data flow is depicted within the Data Flow Diagram (DFD) Level 0 (the data flow can also be considered level 1). Both school admins and teachers are required to input constraints. The resultant timetable, after the process of these inputs, will be relayed back to both school admins for evaluation and teachers for their class schedules.



PROJECT DEVELOPMENT

Phase 1:

To initiate the process, it is necessary to conduct an interview with the client school to assess the current state of them in accommodating timetable scheduling. This can give an idea to the developers on what actions must be taken into consideration in developing the system. This approach considers as well the population of the school, working time, and the mode of learning since approaches are different depending on the day and modality of learning.

Phase 2:

Upon the completion of the interview, developers must initiate a study by assessing the given data by the client on what are the proper measures that must be taken into account to optimize the efficiency and effectiveness of the timetabling system. This phase is critical as this will affect the overall performance of the system that will be created.

In order to ensure that the system will contribute and simplify the scheduling of the school, multiple assessments will be conducted to determine the viability of it as well as to check if it does cater and answer the problem of the client that is currently facing.

Phase 3:

System development initiates at this phase after gathering the important information as well as researching on what are the things to consider in optimizing the system.

React JS and tailwind CSS will be used as a front-end development frameworks as this has been one of the widely used frameworks given the efficiency that it can provide as well as the interactive appearance that it can give, making it very user-friendly especially for beginners who are not familiar with website architecture.

Utilizing MongoDB as its backend offers a flexible schema design, which allows for the easy handling of unstructured data and rapid iteration of application features. Its document-oriented storage system enables developers to store data in a JSON-like format, promoting better performance and scalability compared to traditional relational databases. Additionally, its rich query language and powerful indexing options provide developers with the tools needed to build responsive and complex queries, making it an ideal choice for dynamic web applications that require real-time data processing and high availability.

The objective of the system is to develop a blueprint for the new system that fulfills all the old ways in accommodating timetabling to digitize for better efficiency. Furthermore, the most optimal design solution is devised in this phase. To ensure effective interaction among the system and user, each object must be functional and appropriately categorized into its respective class.

OPERATION AND TESTING PROCEDURE

Testing and operating procedure of utilizing school timetabling systems to generate timetables.

Table 2. Admin Interface

System Function	Procedure	Expected Output
1. Login as admin staff	1. Input username 2. Input password 3. Then click the login button	1. The application should handle both of these scenarios without crashing. 2. Incorrect credentials should generate an error message and prompt the user to input the correct details. 3. Upon successful login the user must be redirected to the home screen.
2. Admin Dashboard	1. Homepage of the Admin	1. They can see the Report Summary of the following: Total Class, Total Students, Total Teachers, and Total Classrooms. 2. They can see the current time table generated.
3. Students Tab	1. Click view the all information of all the students enrolled.	1. They can view all students information

4. Teachers Tab	1. Click view all information of all the teachers.	1. They can view all teachers' information, including their constraints (availability, preferences, etc) that is needed for the generation of timetables.

Table 2. Teachers Interface

System Function	Procedure	Expected Output
2. Login as teacher	4. Input username 5. Input password 6. Then click the login button	4. The application should handle both of these scenarios without crashing. 5. Incorrect credentials should generate an error message and prompt the user to input the correct details. 6. Upon successful login the user must be

		redirected to the home screen.
5. Teachers Dashboard	2. Homepage of the Teachers	3. They can see the Report Summary of the following: Their total assigned class, students, and all Classrooms. 4. They can see the current time table generated.
6. Teachers Tab	2. Click view information of their information.	2. They can view and edit all their information, including their constraints (availability, preferences, etc) that is needed for the generation of timetables.

Experts:

Technical evaluation: a technical evaluation of the school timetabling system capabilities, including data security, accuracy, and conformance to rules and standards.

User interface evaluation: An evaluation of the school timetabling system user interface, considering its usability and accessibility for various user groups.

Effectiveness evaluation: An assessment of the school timetabling system success in achieving the project's goals and anticipated results, especially the generation of the school time table.

To ensure that every aspect of a system operates as planned and to identify and resolve any issues promptly, assessments should be conducted at various stages of the project. Additionally, post-project evaluations should be performed to identify areas for future improvement and to gauge the system's overall impact.

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