CHAPTER 3

OBJECT AND METHODS

3.1. Research Object

The object of the research is Fr. Peter Secondary School that is located in Banz, Jiwaka Province, Papua New Guinea. The research mainly focuses on its management system and was carried out at Indonesian Computer University (UNIKOM), Bandung,West Java, Indonesia.

3.1.1. History of The Company

Fr. Peter Secondary School was established in 1968 by the first Christian Brothers (Catholic-European) that came to Papua New Guinea. During the establishment, it was known as Fatima Secondary School but the name was later (1996) changed to Fr. Peter Secondary School in honor to Late Fr. Peter van Adrichen (Parish Priest and one of the founders). The school's motto is "Angam-Ambam Moraman" (Melpa language) meaning "We Live as Brothers and Sisters" in English. The school has 4 grades (9-12) and each grade has 4 classrooms (Red, Blue, Green and Gold). Grades 9 and 10 are called Lower Secondary whereas grades 11 and 12 are referred to as Higher Secondary. Students normally sit for national exams at grade 10 in order to continue to grade 11 as well at grade 12 in order to further

their studies to college or university. It is a boarding school whereby students choose to register/enroll whether as a boarding or a day student at the beginning of the academic year. There are four schooling terms annually with holiday at the end of each term. From 2008 statistics: total number of staffs=35, total number of students=660. The school is administered by the Principle with his/her two Deputies: Deputy Principle Administration (DPA) and Deputy Principle Curriculum (DPC).

Since the establishment of Fr. Peter Secondary School until now, the school's system is mainly managed manually. That includes enrollment process, registration, school fee payment, creation of class schedules, and others. Consequently, a lot of problems do occur at the beginning of every new academic year like: late commencement of classes; number of new intakes normally exceed the maximum number of students required so this results in over-populated in the classrooms as well as dormitories; clashes in class schedules as well as no proper screening of teachers in order to allocate the right subjects according to their qualifications; and so many other problems.

In this 21st century, technological breakthrough gave way to cellular phones, the internet, robots, automation systems, and have brought various changes in human activities, including the educational system. Changing times call for a different approach on the things man do. With the transformation of the society from a simple to a high complicated and technological one, it is just proper to equip one's self with the appropriate tools to succeed. In this competitive age especially in the education

system, Fr. Peter Secondary School is in great need to improvise its management system in order to adapt to this information or digital age. To produce bright students and achieve its long term goals, the system of the school needs to be changed from manual-based to an automated-based system. Automation is the utilization of technology to replace human with a machine (especially computer) that can perform more quickly and more continuously That is, the automated-based school management system consists of tasks such as registration and enrollment processes, staff profiling and creating class schedules, manage financial recordings, producing student transcripts, and so on. This would greatly have impact on the school's progress and academic performance. As a result, Fr. Peter Secondary School can be able to produce bright students and could be ranked among the top secondary schools in Papua New Guinea.

3.1.2. Organizational Structure of Fr. Peter Secondary School

Here is the organizational structure of Fr. Peter Secondary School.

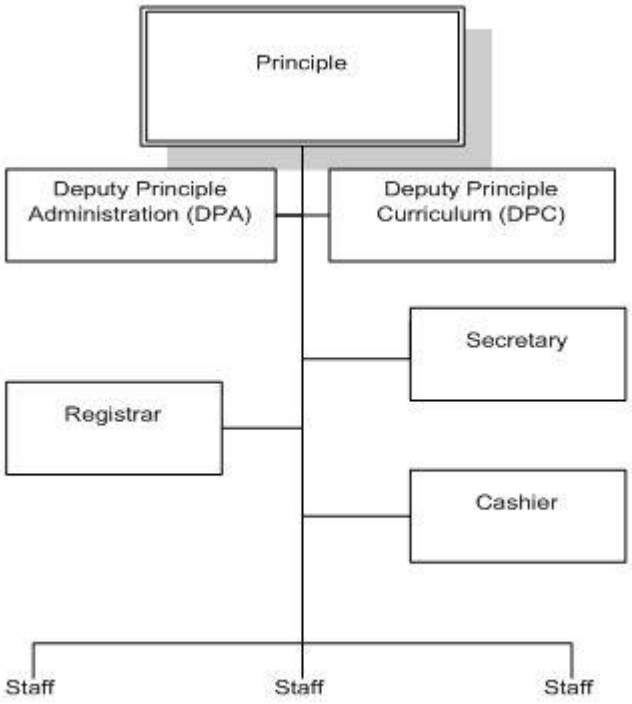


Figure 3.1 Organizational Structure of Fr. Peter Secondary School

3.2. Research Methods

According to Frey, Botan, Friedman, & Kreps (1991), "Research methods are the particular strategies researchers use to collect the evidence necessary for building and testing theories". In preparation of this research, the Descriptive Qualitative Approach was used to collect data, analyze and explain the observations in the field.

3.2.1. Research Design

According to Green and Tull, “It is the specification of techniques and processes for obtaining the information required. It is the over-all operational pattern or framework of the project which states what data is to be gathered from which source by what process”

The research design is defined as the plan for collecting and utilizing data so that desired information can be obtained. It is a thorough outline of how a study is going to take place. That is, how data can be collected, what tools will be used, how the tools will be used and the intended means for analyzing collected data.

3.2.2. Types and Data Collection Methods

The type and data collection methods are as follows:

3.2.2.1. Collecting Primary Data

Primary data are data that were previously unknown and which have been obtained directly by the researcher for a particular research project. In this research, these two methods of collecting primary data were taken into consideration:

1. **The Observational Method**

The researcher observers and records behaviour that is revelant to the research. This is done by a close examination of the current problems faced in Fr. Peter Secondary School..

2. The Interview Method

This technique of data collection is simply a face-to-face conversation with the involvement of questioners. According to Arnold (*et al* 1991), "The interview is, in effect, often used as a 'talking questionnaire'". So the researcher through direct phone call conversation with the respective representatives (staffs) at Fr. Peter Secondary made it possible to get the vital data or information needed.

3.2.2.2. Collecting Secondary Data

Secondary data is collected from data sources that are already existed. In this research, the researcher collected data from previous research, web information, and historical data and information about Fr. Peter Secondary School.

3.2.3. Method and System Development Approach

In this section, it explains about the systems approach, the development of systems, methods of analysis and design analysis tools. Following is the description of the approach and system development.

3.2.3.1. Systems Approach Method

The method the researcher used in systems approach is the Object-Oriented Systems Approach and is visualized with UML (Unified Modeling Language) diagrams as follows: Use Case Diagrams, Activity Diagrams, Sequence Diagrams,

Class Diagrams, Collaboration Diagrams, Component Diagrams, and Deployment Diagrams.

According to Jian Wang (Information System Analysis Section G01-Fall 2001), "The object-oriented approach combines data and processes (called methods) into single entities called objects. Objects usually correspond to the real things an information system deals with, such as customers, suppliers, contracts, and rental agreements. Object-oriented model is able to thoroughly represent complex relationships and to represent data and data processing with a consistent notation, which allows an easier blending of analysis and design in an evolutionary process**.**" And according to Hoffer (et al. 2002), "The goal of object-oriented approach is to make system elements more reusable, thus improving system quality and the productivity of systems analysis and design".

3.2.3.2. Systems Development Method

The system development method used in the research is the Prototype Model. The Software Prototying refers to building software application protype whcih displays the functionality of the product underdevelopment but may not actually hold the exact logic of the original software. Software prototyping is becoming very popluar as a software development model, as it enables to understand the customer requirements at an early stage of develpoment. It helps get valuable feedbacks from the customer and helps software designers and developers understand about what exactly is expected from the product developmet.

According to Sona Malhotra (International Journal of Advance in Information Technology), " Instead of freezing the requirements before a design or coding can proceed, a throwaway prototype is built to understand the requirements. This prototype is developed based on the currently known requirements. Prototyping is an attractive idea for complicated and large systems for which there is no manual process or existing system to help determining the requirements. A prototype is a toy implementation of a system; usually exhibiting limited functional capabilities, low reliability, and inefficient performance."

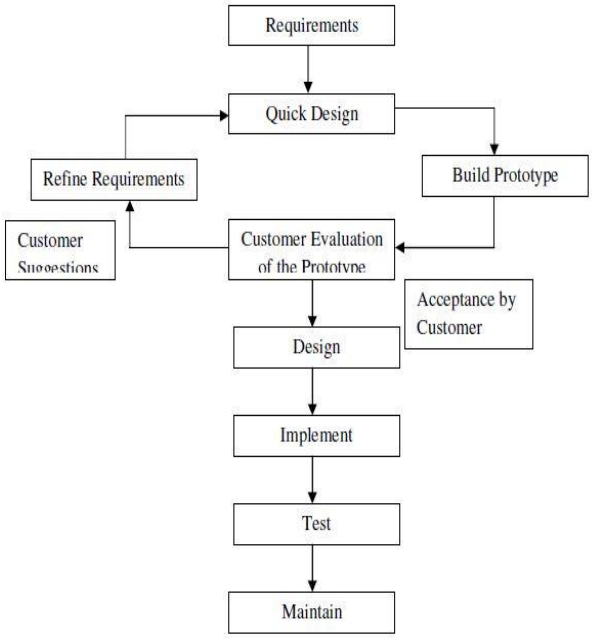


Figure 3.2 Prototype Model (Source:Seema, Sona Malhotra- "International Journal in Computer and Information Technology")

Following is the stepwise approach taken to design Fr. Peter Secondary School Management System's software prototype:

1. **Basic Requirement Identification :** This step involves understanding the very basics system requirements of Fr. Peter Secondary School system especially in terms of user interface. The more intericate details of the internal design and external aspects like performance and security were ignored at this stage.
2. **Developing the initial Prototype:** The initial Prototype of Fr. Peter Secondary School Management System was developed in this stage, where the very basic requirements were showcased and user interface were provided. These features may not exactly work in the same manner internally in the actual software developed and the workarounds were used to give the same look and feel to the customer in the prototype developed.
3. **Review of the Prototype:** The prototype of the school system developed was then presented to the customer and the other important stakeholders in the research. The feedback were collected in an organized manner and used for further enchancements in the system development.
4. **Rewise and Enchance the Prototype:** The feedback and the review comments were discussed during this stage. The changes accepted were again incorporated in the new Prototype developed and the cycle repeats until customer expectations were met.

3.2.3.3. Analysis and Design Tools

With a systems approach that is object-oriented, the researcher used a modeling language called the Unified Modeling Language (UML). According to IBM (ibm.com website), UML is a visual language for specifying, constructing, and documenting the artifacts of systems. Therefore, the developing system is visualized by the following UML diagrams:

1. **Class Diagram**

Class diagrams are the most common diagrams used in UML. Class diagram consists of classes, interfaces, associations and collaboration. Class diagrams basically represent the object oriented view of a system which is static in nature. Active class is used in a class diagram to represent the concurrency of the system. Class diagram represents the object orientation of a system. So it is generally used for development purpose. This is the most widely used diagram at the time of system construction.

2. Deployment Diagram

Deployment diagrams are a set of nodes and their relationships. These nodes are physical entities where the components are deployed. Deployment diagrams are used for visualizing deployment view of a system. This is generally used by the deployment team.

3. Use case Diagram

Use case diagrams are a set of use cases, actors and their relationships. They represent the use case view of a system. A use case represents a particular functionality of a system. So use case diagram is used to describe the relationships among the functionalities and their internal/external controllers. These controllers are known as actors.

4. Activity Diagram

Activity diagram describes the flow of control in a system. So it consists of activities and links. The flow can be sequential, concurrent or branched. Activities are nothing but the functions of a system. Numbers of activity diagrams are prepared to capture the entire flow in a system. Activity diagrams are used to visualize the flow of controls in a system. This is prepared to have an idea of how the system will work when executed.

3.2.4. Testing Software

There is a lot of testing techniques that can be used to test a software, including: Black Box Testing and White Box Testing. As for software testing that is done in this project is the Black Box Testing. According to Vangie Beal (webopedia.com), "Also known as *functional testing*. A software testing technique whereby the internal workings of the item being tested are not known by the tester.

For example, in a black box test on a software design the tester only knows the inputs and what the expected outcomes should be and not how the program arrives at those outputs. The tester does not ever examine the programming codeand does not need any further knowledge of the program other than its specifications."

Black Box Testing - Steps

Here are the generic steps followed to carry out any type of Black Box Testing.

1. Initially requirements and specifications of the system are examined.
2. Tester chooses valid inputs (positive test scenario) to check whether SUT processes them correctly . Also some invalid inputs (negative test scenario) are chosen to verify that the SUT is able to detect them.
3. Tester determines expected outputs for all those inputs.
4. Software tester constructs test cases with the selected inputs.
5. The test cases are executed.
6. Software tester compares the actual outputs with the expected outputs.
7. Defects if any are fixed and re-tested.

3.2.5. Analysis of Current System

Analysis of the system running is the decomposition activity of a complete information system into components that aim to identify and evaluate the problems that arise, obstacles that may occur and the expected needs, so as to propose improvements that will be performed in the system.

3.2.5.1. Analysis of Document

Analysis of the document is to analyze the activities of all documents that are used on the basis of an information system that is running. As for the types of documents used in Fr. Peter Secondary School system is: Class Schedule, Room Allocation (Boarding), School Fee Payment, Enrollment, Student Academic Performance, and Registration. Here are the details of each of these documents:

Table 3.1 Document Analysis Table

NO	DOCUMENT NAME	COMMENTARY
1	Class Schedule	**Description:** Documents containing information about the teaching schedules. **Function:** Manage class schedules **Source:** Deputy Principle Cirriculum (DPC)**.** **Attribute:** Teacher name, gender, school year, subject name, class name.
2	Boarding Room Allocation	**Description:** Documents containing information about the allocation of rooms for boarding students. **Function:** Manage boarding students' accommodation. **Source:** Registrar **Attribute:** Student name, student id, grade level, dormitory name, room number.
3	School Fee Payment	**Description:** Documents containing the information about students' school fee payment process. **Function:** Manage students' school fee payment process. **Source:** Cashier **Attribute:** Student name, student id, amount

		paid, balance, amount yet to pay, year, grade level.
4	Enrollment	**Description:** Documents containing information about the students' enrollment process. **Function:** Manage the students' enrollment process. **Source:** Enrollment Encoder (staff) **Attribute:** Student name, student id, school year, gender, grade level, class name.
5	Student Academic Performance	**Description:** Documents containing information about students' academic performance or grades. **Function:** Produce students' academic transcripts **Source:** Teacher **Attribute:** Student name, student id, grade level, class name, subject grade, gender, class patron name, subject,
6	Registration	**Description:** Documents containing information about the students' registration process. **Function:** Manage the students' registration process. **Source:** Registrar **Attribute:** Student name, student id, place of birth, date of birth, citizen, fathers name, mothers name, address, school year, gender, grade level, class name, etc.

3.3. Analysis of Current Procedures

Analysis of the current procedures aim to find out more clearly how the system works and know the problems faced by the system that can be used as a foundation for the design of the proposed new system. The analysis of school management system procedure that is running in Fr. Peter Secondary School is as follows:

3.3.1. Use Case Diagram of School System The Ongoing

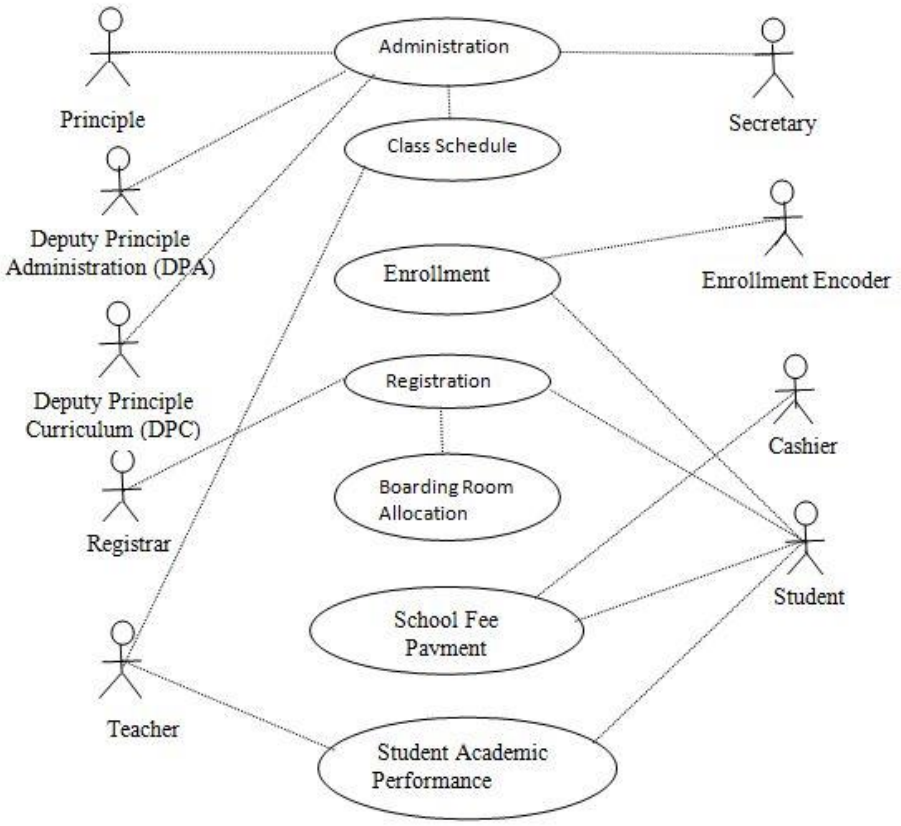


Figure 3.3 Use Case Diagram of School System the Ongoing

3.3.1.1. Scenario Use Case Diagram of School System The Ongoing

The Scenario Use Case Diagram that is running is as follows:

1. **Scenario Use Case Diagram Administration**

The scenario of the use case diagram administration in the current system is as follows:

1 Use Case Name: Administration.

2 Main Actor: Principal, DPA/DPC, Secretary

3 Purpose: Manage staffs (that includes teachers, registrar, cashier, auxiliary, etc), create class schedules, and manage other sections.

Table 3.2 Scenario Use Case Diagram Administration The Ongoing

Principal/DPA/DPC/Secretary	Staff
	1.. Provide their personal information
2. Check carefully and create staffs' profile in order allocate positions in various sections	
Alternative scenario	
3. Rejects the unqualified staffs based on the provided personal background information	
	4. May withdraw from the school

2. Scenario Use Case Diagram Registration

The scenario of the use case diagram registration in the current system is as follows:

1 Use Case Name: Registration

2 Main Actor: Registrar, Student

3 Purpose: Manage the registration process and student records.

Table 3.3 Scenario Use Case Registration the Ongoing

Registrar	Student
1. Registrar provides registration form to the enrolled students	2. Students fill the registration form and send the filled registration forms to the registrar.
3. Registrar check for confirmation purposes 4. Registrar approves the registration. 5. Provide the list of approved registered students.	
	6. Students check on the notice boards to confirm the approved registration lists.
Alternative Scenario	
7.Do not approve the registration	8. Students re-registrar and fill the form correctly

3. Scenario Use Case Diagram Student Academic Performance

The scenario of the use case diagram student academic performance in the current system is as follows:

1 Use Case Name: Student Academic Performance

2 Main Actor: Teacher, Student

3 Purpose: Manage academic performance of students and produce transcripts.

Table 3.4 Scenario Use Case Student Academic Performance the Ongoing

Teacher	Student
1. Teacher gives tests, assignments, quiz, and exams.	
	2. Students do quiz, tests, exams, test, etc. 3. Students submit the answer/answer sheets to the teacher.
4. Teacher corrects and marks the quiz, tests, exams, assignments.	
5.Teacher grade students according to their marks 6. Teacher produces the transcripts and gives to the respective class patrons/matrons.	
	7. Students get the transcripts from their respective class patron/matron.
Alternative Scenario	
	8. Students do not agree with their grading or the mark given on the transcript 9. Check with the respective teacher (s) to negotiate.
9. Teacher reconsider the marks or grades on the transcripts and edit them if necessary and re-print the transcripts	

4. Scenario Use Case Diagram Enrollment

The scenario of the use case diagram enrollment in the current system is as follows:

1 Use Case Name: Enrollment

2 Main Actor: Enrollment Encoder (teacher/staff), Student

3 Purpose: Manage the enrollment process.

Table 3.5 Scenario Use Case Diagram Enrollment the ongoing

Enrollment Encoder (Teacher)	Student
1. Provides enrollment form	2. Fill the enrollment form
3.Check for confirmation purpose	
4. Lists of enrolled students is produced	5. Students check on the notice boards to confirm
Alternative Scenario	
	6. If a student name is not listed, re-check with the enrollment staff
7. Re-check with the enrollment forms and reconsider to see if there were mistakes involved	

5. Scenario Use Case Diagram School Fee Payment

The scenario of the use case diagram school fee payment in the current system is as follows:

1 Use Case Name: School Fee Payment

2 Main Actor: Cashier, Student

3 Purpose: Manage accounting work and financial records

Table 3.6 Scenario Use Case School Fee Payment the Ongoing

Cashier	Student
	1, Pay the school fee upfront at school (cashier's office) or pay at the bank to the school's account and get the receipt 2.Give the paid school fee receipt to the Cashier (if paid at the bank)
3.Check to confirm and do the financial records	
Alternative Scenario	
5. If check and realized that the amount paid is less than the required amount, a list of notice is produced to the respective students	.
	6.Top up again on the amount already paid to meet the required amount of school fee payment

6. Scenario Use Case Diagram Class Schedule

The scenario of the use case diagram class schedule in the current system is as follows:

1 Use Case Name: Class Schedule

2 Main Actor: Deputy Principle Curriculum (DPC), Secretary

3 Purpose: Make class schedules for the teachers

Table 3.7 Scenario Use Case Diagram Class Schedule The Ongoing

Deputy Principle Curriculum (DPC)/Secretary	**Teacher**
1. Create class schedules and allocate subjects to the available teachers	
	2.Sign and confirm the allocated subject (s)
3. Approve and sign for confirmation purpose	
Alternative scenario	
	4. Do not agree with the allocated subjects
5. Reconsider the subjects again	

7. Scenario Use Case Diagram Boarding Room Allocation

The scenario of the use case diagram boarding room allocation in the current system is as follows:

1 Use Case Name: Boarding Room Allocation

2 Main Actor: Registrar

3 Purpose: Manage the boarding students' accommodation

Table 3.8 Scenario Use Case Diagram Boarding Room Allocation The Ongoing

Registrar	Student
1. Registrar provides registration form to the enrolled students	2. Students fill the registration form and register whether as a day/boarding student 3. Students send the filled registration forms to the registrar.
4. Registrar check for confirmation purposes 5. For boarding students, dormitory name and room numbers are allocated accordingly to their level of grades (grade 9-12). 6. Registrar approves the registration and provides the list of registered boarding students.	
	7. Students check on the notice boards to confirm their names on the boarding lists.
Alternative Scenario	
8. Do not approve the registration	9. Students re-registrar and fill the form correctly

3.3.2. Activity Diagram System The Ongoing

In this section, it contains the documentation workflow system that is running at Fr. Peter Secondary School System which aims to see the flow of the running system processes.

The activity of school system that is running at the moment is as follows:

1. **Activity Diagram Administration The Ongoing**

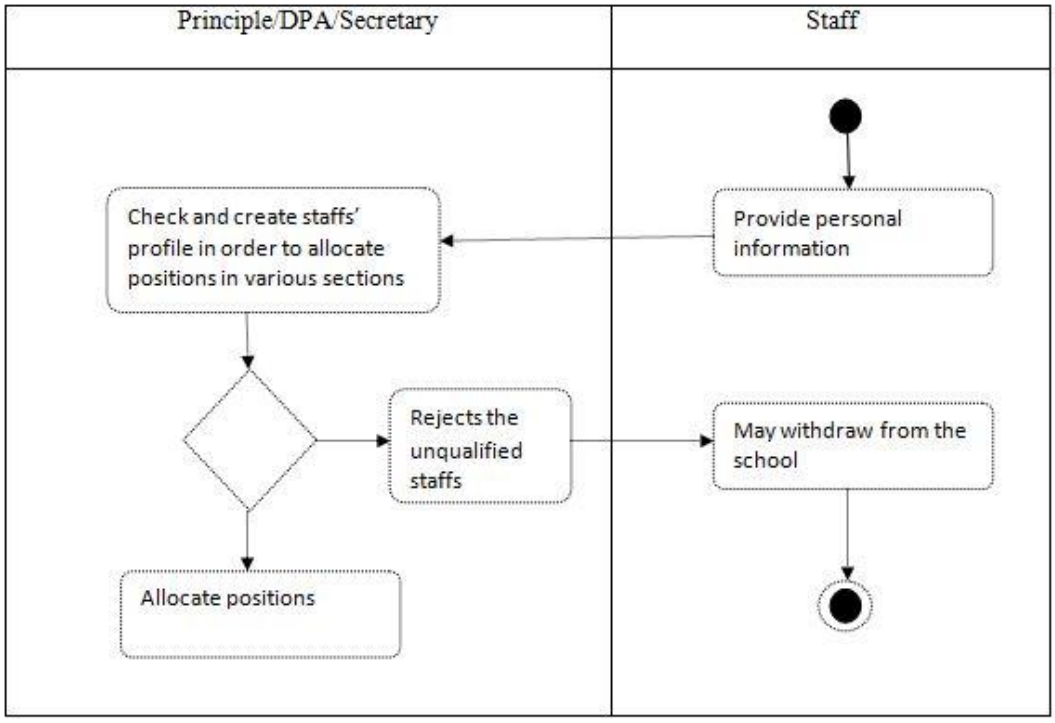


Figure 3.4 Activity Diagram Administration The ongoing

The figure above describes the flow of the administration at Fr. Peter Secondary School. Every staffs provides his/her personal information like education background, address, etc, to the administration. The admin then checks thoroughly and only allocates positions to those qualified ones. However, the unqualified staffs may simply withdraw from the school if possible.

2. Activity Diagram Registration The Ongoing

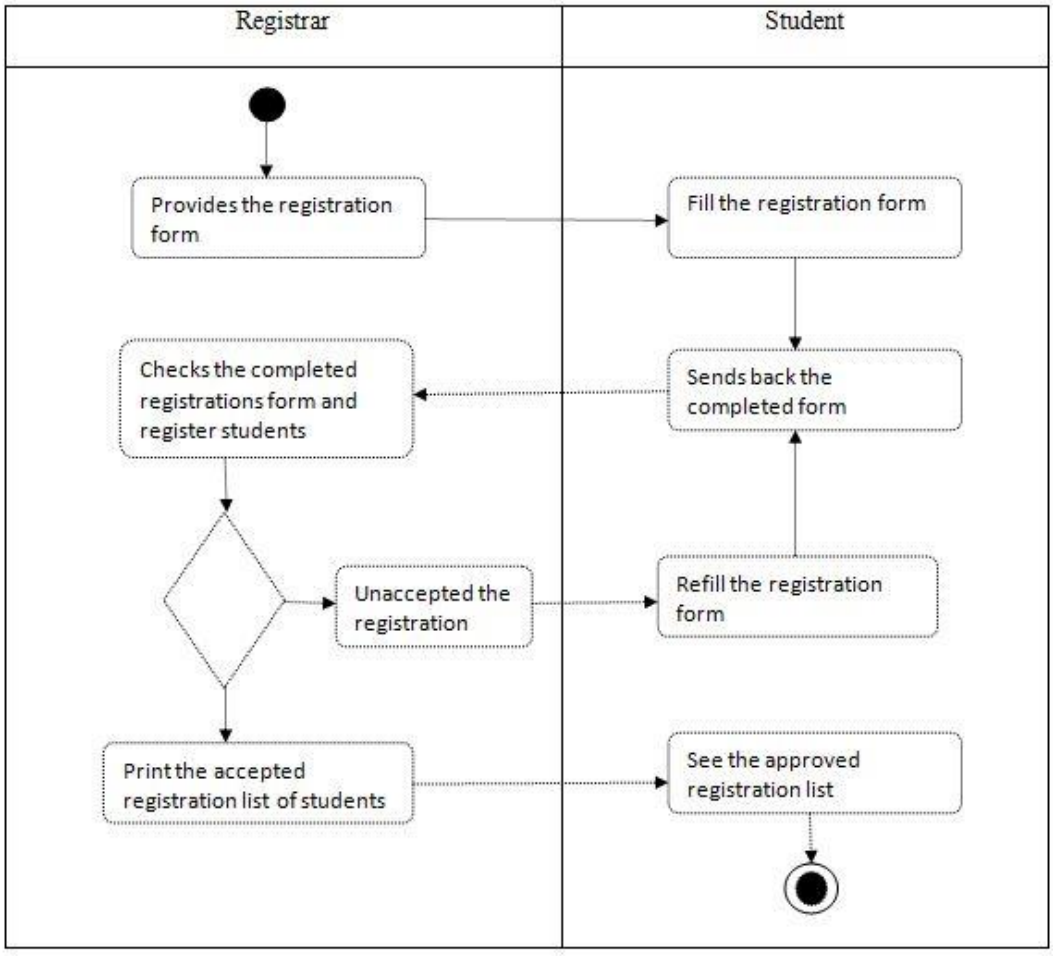


Figure 3.5 Activity Diagram Registration The Ongoing

The figure above describes the flow of registration at Fr. Peter Secondary School. The registrar provides the registration form to the enrolled students. The students then fill the registration forms and send them back to the registrar. The registrar checks the filled forms thoroughly and registers them. However, those students that their registration is not accepted, they re-register again.

3. Activity Diagram Student Academic Performance The Ongoing

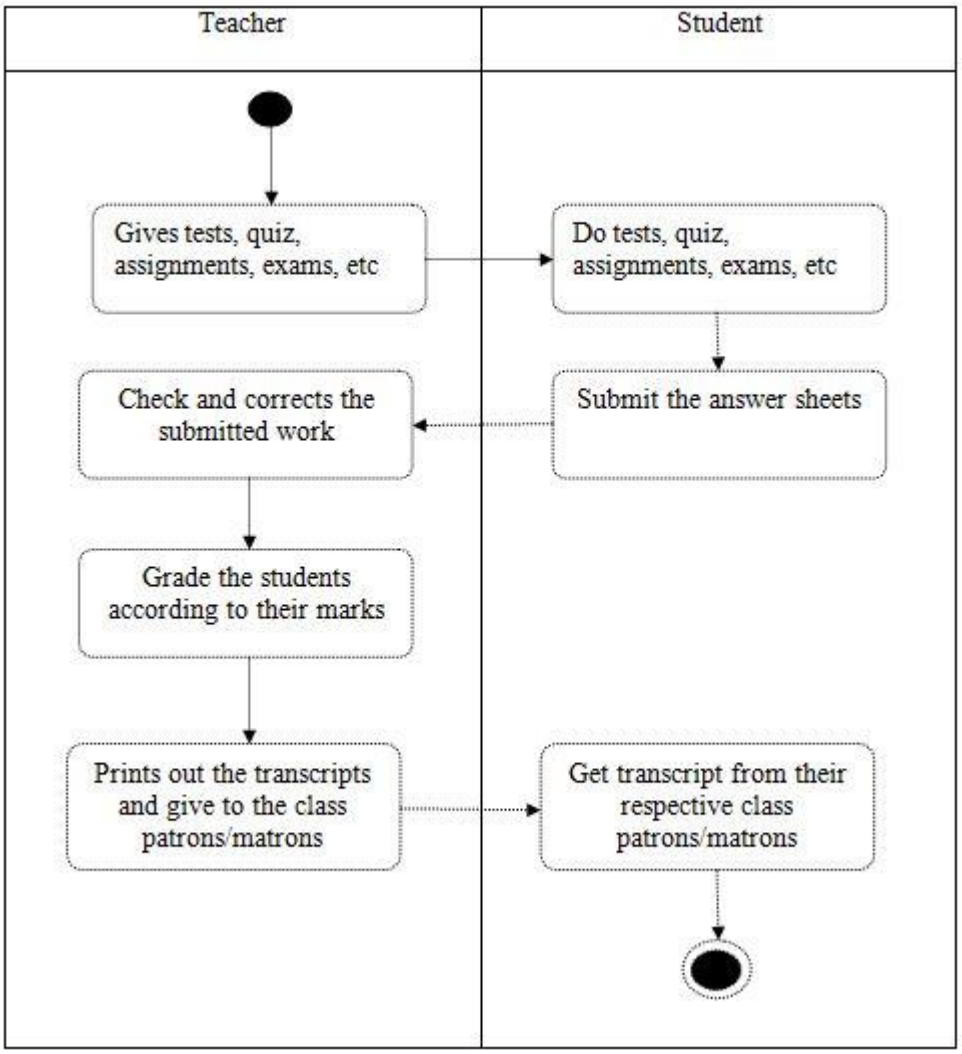


Figure 3.6 Activity Diagram Student Academic Performance The Ongoing

The figure above describes the flow of student academic performance at Fr. Peter Secondary School. The teacher gives tests, quiz, assignments, exams and tasks to the students. The students do them and submit the answer sheets to the teacher. The submitted work is marked and grading is awarded accordingly. Then the teacher

produces transcripts and gives to the respective class patrons/matrons so students get their transcripts from them.

4. **Activity Diagram Enrollment The Ongoing**

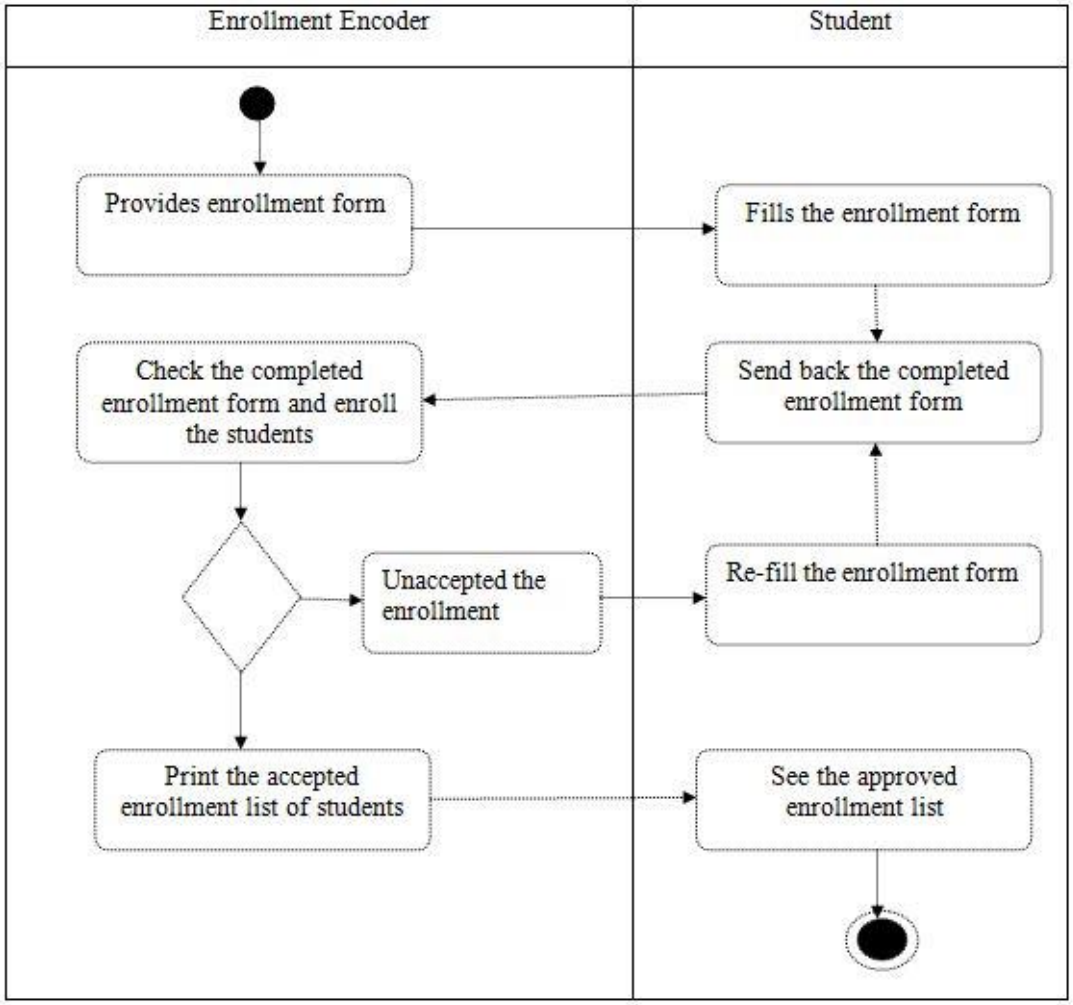


Figure 3.7 Activity Diagram Enrollment The Ongoing

The figure above describes the flow of enrollment at Fr. Peter Secondary School. The enrollment encoder (teacher) provides the enrollment form to students. The students

fill the enrollment forms and send them back. The staff checks the filled forms thoroughly and enrolls the students. However, those that are unaccepted have to re-enroll again by filling the forms again.

5. Activity Diagram School Fee Payment The Ongoing

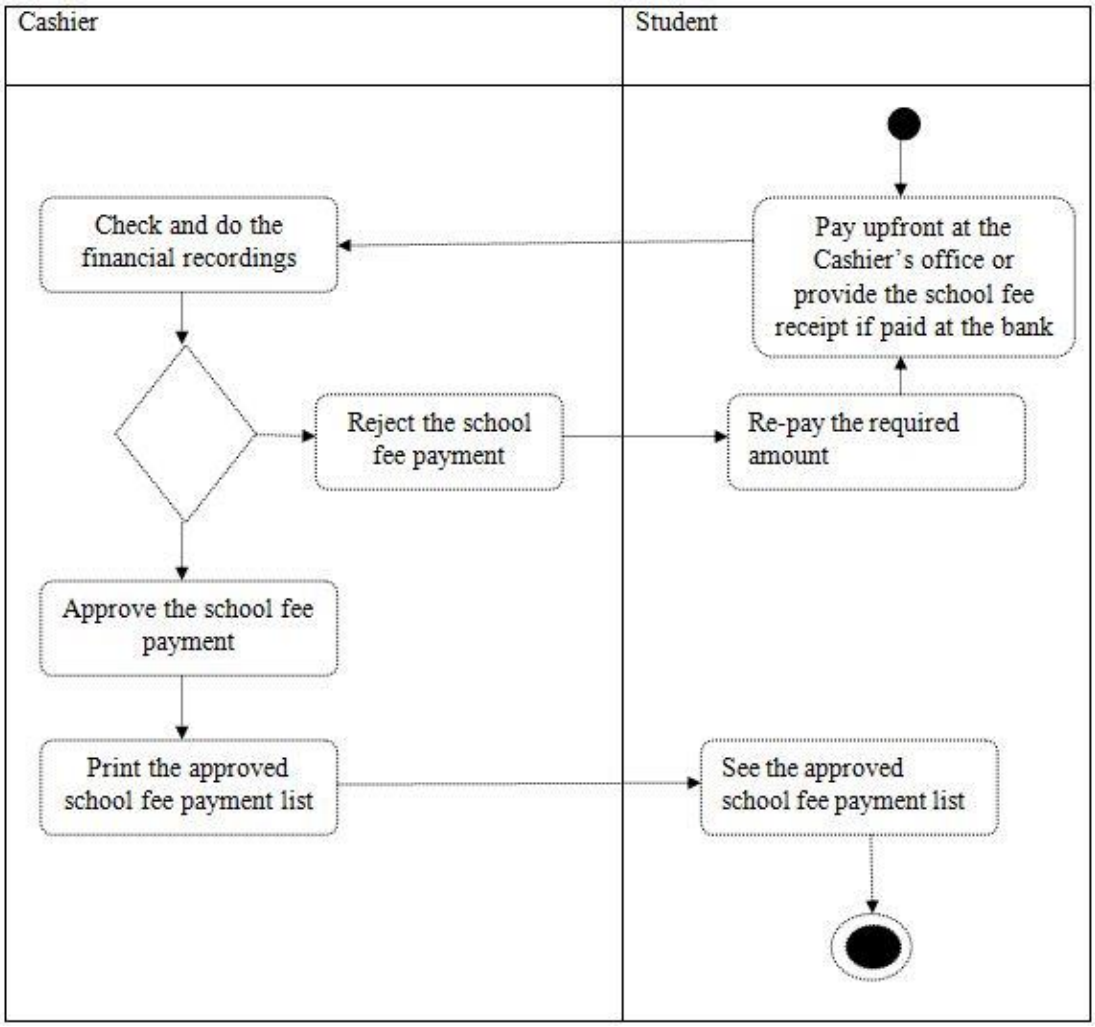


Figure 3.8 Activity Diagram School Fee Payment The Ongoing

The figure above describes the flow of school fee payment at Fr. Peter Secondary School. The students pay upfront at the Cashier's office or provide the school fee payment receipt (if they paid at the bank) to the cashier. The cashier checks and does the financial recordings. However, those students that did not meet the required amount of school fee payment have to re-pay again.

6. Activity Diagram Class Schedule The Ongoing

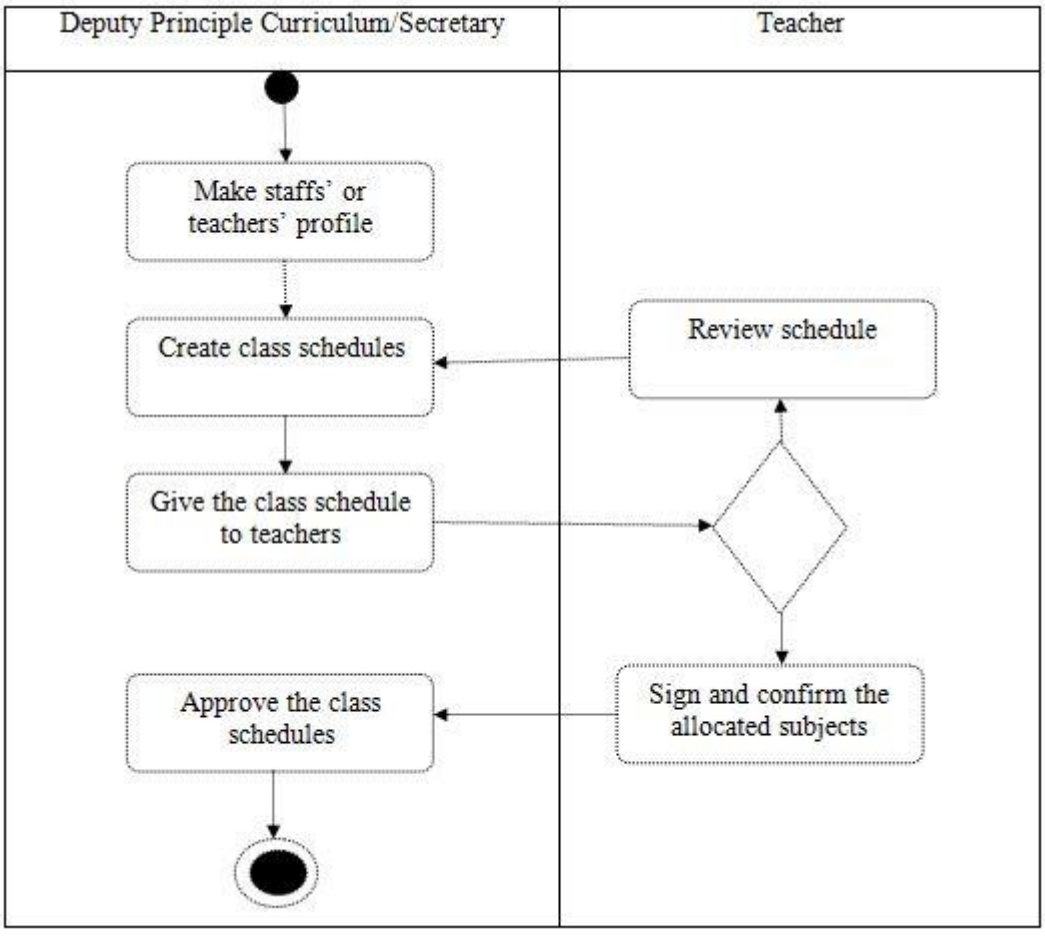


Figure 3.9 Activity Diagram Class Schedule The Ongoing

The figure above describes the flow of the class schedule at Fr. Peter Secondary School. The school's Administration especially the Deputy Principle Curriculum/Secretary makes the profile of every staffs/teachers and according to their personal information and educational background; class schedule is created. The schedule is given to the teachers so they can sign and confirm it. If a teacher is disagreeing with the given class schedule, a review is made by the Administration to re-schedule.

7. Activity Diagram Boarding Room Allocation The Ongoing

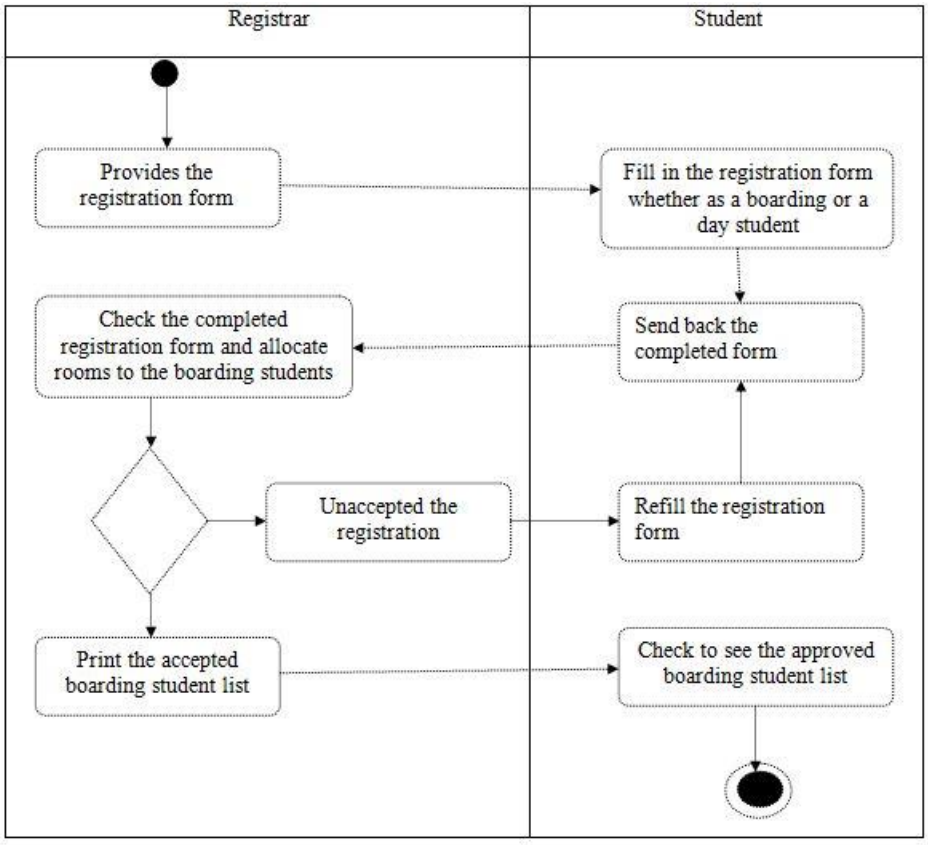


Figure 3.10 Activity Diagram Boarding Room Allocation The Ongoing

The figure above describes the flow of boarding room allocation at Fr. Peter Secondary School. The registrar provides the registration form to the students. The students fill up the form and choose whether to be a boarding or a day student and send back the forms to the registrar. The completed filled forms are checked by the registrar and for the boarding students; rooms are only allocated to those that have met the requirement. However, for those students that have not met the requirement to be a boarding student, they re-register accordingly again.

3.3.3. Ongoing Evaluation System

After passing through several stages of analysis of School System that is running in Fr. Peter Secondary School, it can be seen that there are deficiencies in the system; these shortcomings are described in the following table:

Tabel 3.9 Evaluation System the Ongoing

No	Problem	Part	Settlement plan
1	Making class schedules manually normally results in timetable collisions or clashes	Administration	Creating a system that will manage class schedules more effectively and can also update or improve more easily when there are changes to be made, etc. Also every student can have access to his/her class time anytime to keep up to date with changes made in the timetable

2	Over-crowded in the classrooms as well as dormitory rooms for boarding students	Enrollment and Registration	The creation of a new system that can manage enrollment and registration processes in a well-organized manner and can distribute students equally in every sections, thus, considering the expected maximum number and keeping well-record of students' statistics
3	Financial crises due to school fee problem/payment	School Fee Payment	Creating a system that can manage well the accounting process and financial records effectively and can produce school fee ledger for students to see and keep up to date with their payments.
4	Manual production of students' academic transcripts normally results in inaccuracy of marks given and also so much time is taken to get it prepared	Student Academic Performance	A new system that can manage and display students' grading and marks accurately at the end of every term on the website so students can freely access it.