CHAPTER III

OBJECT AND RESEARCH METHODS

3.1 Research Object

The object or focus of this research is Taurama Fitness Centre and it is situated at Taurama Road in the National Capital District (NCD). Taurama Fitness Centre postal address is P.O. Box 480, PORT MORESBY, National Capital District, Papua New Guinea.

3.1.1 Brief History of Taurama Fitness Centre

Taurama Fitness Centre was founded in 2009 by Johnson Waldford in two rooms inside the Sir Donald Cleveland Pool club at Taurama Road, National Capital District. Supported by Johnson's family, friends and enthusiasts with just a few weights benches and dumbbells, the gym was initially only open on Mondays, Wednesdays and Fridays from 3pm to 8pm for men only. It soon became apparent more space was required for the ever increasing equipment accumulated. Gradually the Fitness Centre allocated more and more space and it quickly expanded.

After 10 months of operation the gym had obtained its first sunbed and realized that women also wanted to train in a gym environment. Hence the introduction of ladies. Every week population of men and women gradually increasing, the gym came up with the initiative of registering members who are interested to train or work out at a daily basis. The fitness center has all the necessary sporting equipment from weights, recumbent bikes, treadmills, stepper, etc. anyone can use. It also has two (2) fitness trainers that assist the beginners use the different equipment and start-up physical work outs. The fitness center can accommodate about 20 people at one given time and is open daily from 8am - 9pm Mondays to Saturdays, except public holidays it is closed. The center is situated near the road side and shares the same boundary with Sir Donald Cleveland Pool which is a public pool for the locals to use. Most people find it more convenient to use the gym; hence the

estimated total number of people using the gym has increased to 40 both men and women of all ages from all walks of life use Taurama Fitness Centre.

It is being monitored that the number of public having to use the gym weekly is increasing. The fitness centre activities carried out daily at Taurama Fitness Centre includes data processing services including transaction of non-member, new member registration and renewing existing member which is done manually (handwritten) up until present. When a non-member comes to the gym he/she must pay a session fee of K5 and gets to sign-in on the log book before he/she uses the gym, after using the gym he/she gets to sign-off again. This is always the case for a non-member who uses the gym daily. For a registered member he or she will only sign-in/sign-out before and after using the gym. And for any interested customer who wants to be a member has to fill in a registration form with all necessary personal details and pays a registration fee of K60 to be a member. All existing members pay K50 monthly to renew their membership. If any member who doesn't renew its membership for at least three months after their last renewal date, they will be no longer considered as a member and will need to register again if they want to be a member and use the gym. So from the daily activities carried out the current system has resulted in errors in terms of calculation of transaction in order to obtain information on income and expenditure in each respective transaction for monthly reports, time consuming for recording each and every member, does not have an accurate database and also it is very costly because it involves a lot of paper work. Monitoring the daily attendance of the members is inaccurate.

3.1.2 Vision and Mission of Taurama Fitness Centre

The vision and mission of Taurama Fitness Centre as follows:

3.1.2.1 Vision

The vision of Taurama Fitness Centre is to become one of the best fitness center in the National Capital that provides maximum benefits and services to the public on the importance of health and sport.

3.1.2.2 Mission

1. Being featured to providing a safe community oriented environment for people of all skill and fitness levels with well-maintained best facilities and services.
2. To create maximum synergy between the business sectors and enterprise business mainly fitness center
3. Educate the public that sports fitness is fun, healthy and important for every age group both men and women, young and old.
4. We strive to enhance and improve the overall health and fitness of others through motivation, education and guidance. We dedicate ourselves to long term relationships as we commit to improve the quality of your life.

3.1.3 Organizational Structure of Taurama Fitness Centre

Illustrated on figure 3.1 is the organizational structure of Taurama Fitness Centre.

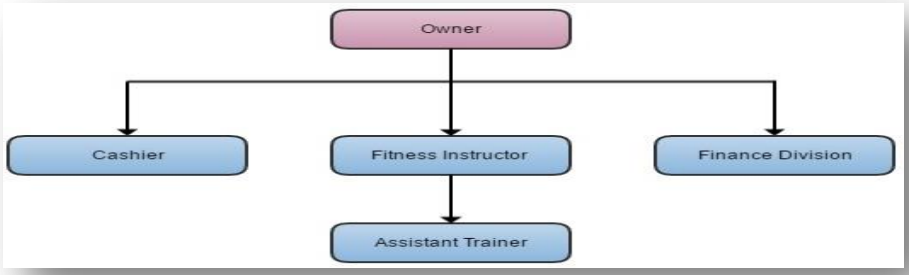


Figure 3.1 Organizational Structure of Taurama Fitness Centre

3.1.4 Duty Description

Details of the duties and functions of the organization per unit

1. **Owner**

   The owner is the founder of Taurama Fitness Centre, he observes the development of the company, sets up a marketing strategy and as well as receiving reports of income and expenses from the Financial Dept.

2. **Cashier**

To serve and record all transactions in the company such as member registration, membership renewal, non-member transaction and record of daily attendance at Taurama Fitness Centre.

3. **Fitness Instructure**

   The fitness Instructure duty is to provide guidance in the use of fitness equipment on techniques in sports fitness to its members. Assists the members and non-members on how to use the fitness equipment and help give start-up training plans.

4. **Assistant Trainer**

   Assistant Trainer is there to assist the fitness instructor in case in the absence of the fitness instructor or at times if there is a lot of people. The assistant trainer helps teach and assist in training if need arise.

5. **Accounts Officer**

   The Accounts officer duty is to make book keeping of all financial procedures and make sure the transaction journal is balanced before it is given to the owner of Taurama Fitness Centre in the form of a monthly financial report.

3.2 Research Methods

The research method is a systematic approach that can be used to obtain facts, collect, record, and analyze data, specifically to be used in a particular study. The research method used in this research is the qualitative research method, which involves the use of qualitative data, such as interviews, documents, and participant observation data, to understand and explain social phenomena.

3.2.1 Research Design

The function of a research design is to ensure that the evidence obtained enables you to effectively address the research problem logically and as unambiguously as possible. The research design acts as a guideline to guide the researcher when doing data collection, to ensure what type of data or evidence is relevant to answer the research problem at hand. The type of research design used in

this study is the action research design, which is a characteristic cycle whereby initially an exploratory stance is adopted, where an understanding of a problem is developed and plans are made for some form of intervention strategy.

3.2.2 Data Types and Collection Methods

During the research process the researcher found some problems that arise in the Taurama Fitness Centre to be solved. Therefore, the researcher collected any necessary data by using primary data collection technique and secondary data.

These data types and collection methods used are briefly described as follows:

3.2.2.1 Primary Data Sources

According to J. Hox, H. Boeije (2011), on their book titled Data Collection, Primary vs. Secondary, "Primary data are data that are collected for the specific research problem at hand, using procedures that fit the research problem best".[10]

Primary data are the data obtained directly from the system users. In this research, primary data were collected from direct interaction with the system users through the following data collection methods:

1. **Observation**

   The researcher visited the site of the object, which is Taurama Fitness Centre and observe the course of events fitness services carried out. From this observation, the researcher was able to identify some problems associated with transactions of non-members and membership registration payments of the fitness centre.

2. **Interview**

   This method is a process of acquiring information which involves face to face interaction with the system users, where the researcher asks system users some questions or give the users questioners about the current system.

3.2.2.2 Secondary Data Source

Secondary data used in this research include records and documentation from the organization being researched, information from the organization's website and other internet sources, and from previous studies concerned with the problem. Analysis from secondary data that was collected from secondary sources in a way it help support the primary data collected by the researcher.

3.2.3 Methods and System Development Approach

In system development method, system development approach and the analysis and design tools, as briefly explained in chapter two previously, in this section it will be described in more detail.

3.2.3.1 System Approach Method

The system approach method used in this research is the object-oriented approach. The object oriented approach focuses on objects rather than actions, and data rather than logic. For this research, the object oriented approach was chosen because objects are easier for people to understand, data and processes are not artificially separated, and code can be reused more easily.

3.2.3.2 System Development Method

The system development method used in this study is the development of a prototype model. A prototype is a model or a program which is not based on strict planning, but is an early approximation of the final product or software system. A prototype acts as a sample to test the process.

3.2.3.2.1 Prototype

A prototype development method is employed when it is very difficult to obtain the exact requirements from the system end user. A prototype model makes it easier for the system user to clarify the user requirements specification to system developers. Developing a prototype models involves gathering user requirements for the desired system, and then developing a prototype system inclined to what the system users really want. A prototype system is usually not the final or real system.

However, it provides a display or preview of what the real system will look like. After the prototype system is evaluated by the end user, the system developers can be able to determine the system specifications in accordance with the wishes of system users, and thus create the real system. Illustrated on figure 3.2 is a prototype model:

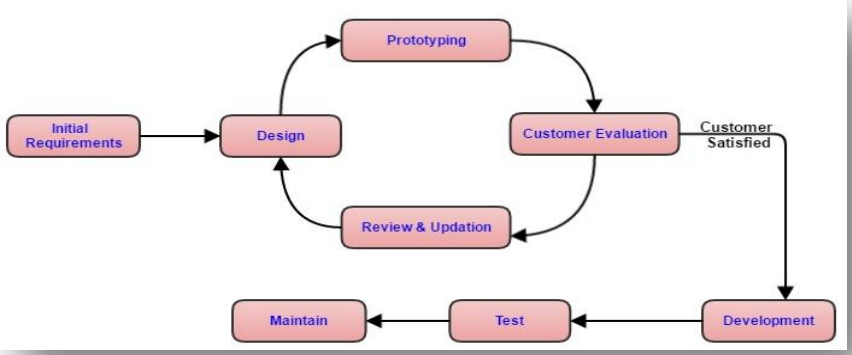


Figure 3.2 Prototype Model

Source: Building Prototypes with Framer by T. Mat, 2011. [11]

The stage in the development of a prototyping involves gathering system requirements, making a quick design, and building a prototype of the required system. After the prototype is built, it is then evaluated and tested by the customer or end user. Iteration occurs in the development of prototypes in accordance with the wishes of the customer. Once the customer is satisfied with the prototype, the actual system is developed, tested and maintained according to the customer's wishes.

Using the prototype model, following are the stages taken in the design and implementation of the Gym Management System of Taurama Fitness Centre:

1. **Requirements Gathering and Analysis**

   The first stage of prototype model begins with requirements analysis, and the requirements of the system are defined in detail. The system users or customers are interviewed in order to know the requirements of the system. In this section the system data requirements and processes of the Gym Management System of Taurama Fitness Centre is determine

2. **Quick Design**

   When requirements are known, a preliminary design or quick design for the system is created. It is not a detailed design. However it includes the important aspects of the system, which gives an idea of the system to the user.

3. **Build a Prototype**

   After gathering the specific system requirements and quick design, the next step involves building a prototype. The prototype is built in accordance to the analysis of the specific system requirement needs gathered in the previous stage.

4. **Customer Evaluation**

   Once the prototype is completed, it is then tested by the system user to see if it meets the initial system requirements. After delivering the system developer needs to provide training about how to use the system. This activity is supported by customer evaluation, and if any changes are found then updating is done. The testing stage is carried out to get feedback from the end user or customer.

5. **Review and Update**

   There might be also change in input data or system environment. All this require modification of software. If the customer is not satisfied with the prototype, the system developer then repairs the prototype according to the customer feedback. Process undertaken should be in accordance with the order.

3.2.3.3 Analysis and Design Tool

In the this research or study, since the system approach used is the object oriented approach, the analysis and design tool used to model out the system's processes are described as follows:

3.2.3.3.1 Object-Oriented Analysis and Design

In object-oriented analysis, the problem is formulated, user requirements are identified, and then a model is built based upon real–world objects. The analysis produces models on how the desired system should function and how it must be

developed. The models do not include any implementation details so that it can be understood and examined by any non–technical application expert.

In object-oriented design, there are two main stages, namely, system design and object design.

1. **System Design**

   In this stage, the complete architecture of the desired system is designed. The system is conceived as a set of interacting subsystems that in turn is composed of a hierarchy of interacting objects, grouped into classes. System design is done according to both the system analysis model and the proposed system architecture. Here, the emphasis is on the objects comprising the system rather than the processes in the system.

2. **Object Design**

   In this phase, a design model is developed based on both the models developed in the system analysis phase and the architecture designed in the system design phase. All the classes required are identified. The designer decides whether:

   a. new classes are to be created from scratch,
   b. any existing classes can be used in their original form, or
   c. new classes should be inherited from the existing classes.

   The associations between the identified classes are established and the hierarchies of classes are identified. Besides, the developer designs the internal details of the classes and their associations, i.e., the data structure for each attribute and the algorithms for the operations.

3.2.3.3.2 Unified Modeling Language (UML)

In this section since the approach used in this study is object-oriented approach the tool that is used is the Unified Modeling Language (UML). The UML which was briefly described in the previous chapter is a graphical language for specifying, visualizing, constructing and documenting the artifacts of software

systems. UML is used to model the system that is being built. The basic building blocks of UML are:

a. Model elements (classes, interfaces, components, use cases, etc.)
b. Relationships (associations, generalization, dependencies, etc.)
c. Diagrams (class diagrams, use case diagrams, etc.)

The UML has thirteen types of diagrams, each providing a certain view of a system. In this study only several types of UML diagram are used and these diagrams are explained as follows:

1. 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. Illustrated in figure 3.3 is an example of a use case diagram.

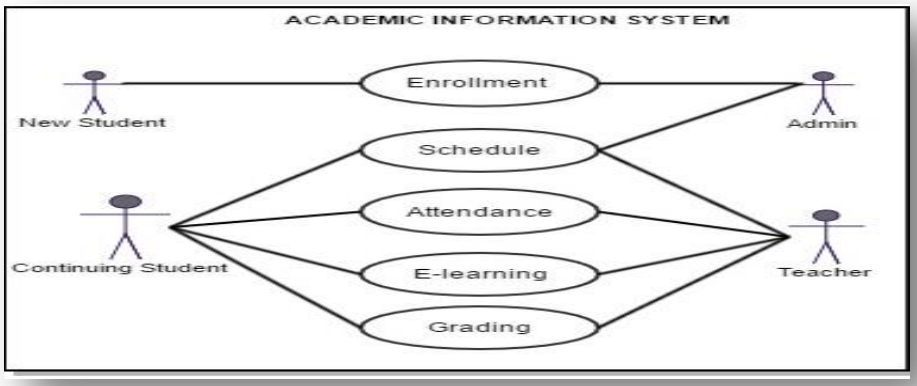


Figure 3.3 Use case diagram of an academic information system

Source: http://creately.com/ [12]

2. 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.

An activity represents an operation on some class in the system that results in a change in the state of the system. This is prepared to have an idea of how the system will work when executed. Illustrated in figure 3.4 is an example.

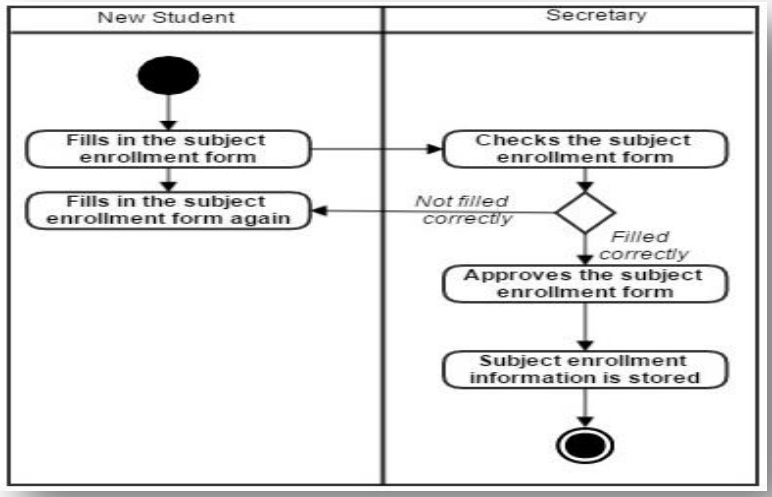


Figure 3.4 An activity diagram for subject enrollment

Source: http://creately.com/ [12]

3. Sequence Diagram

A sequence diagram is an interaction diagram. From the name it is clear that the diagram deals with some sequences, which are the sequence of messages flowing from one object to another.

Interaction among the components of a system is very important from implementation and execution perspective. So Sequence diagram is used to visualize the sequence of calls in a system to perform a specific functionality. Illustrated in figure 3.5 is an example of a sequence diagram.

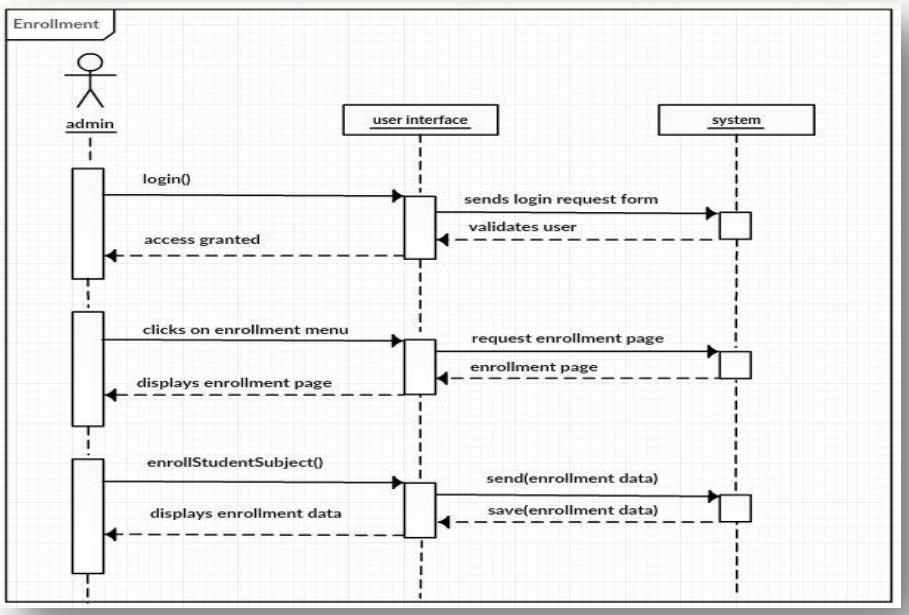


Figure 3.5 is a sequence diagram for Enrollment

Source: http://creately.com/ [12]

4. Class Diagram

Class Diagram provides an overview of the target system by describing the objects and classes inside the system and the relationships between them. It provides a wide variety of usages; from modeling the domain-specific data structure to detailed design of the target system. With the share model facilities, you can reuse your class model in the interaction diagram for modeling the detailed design of the dynamic behavior. The Form Diagram allows you to generate diagram automatically with user-defined scope. Illustrated in figure 3.6 is an example of a class diagram.

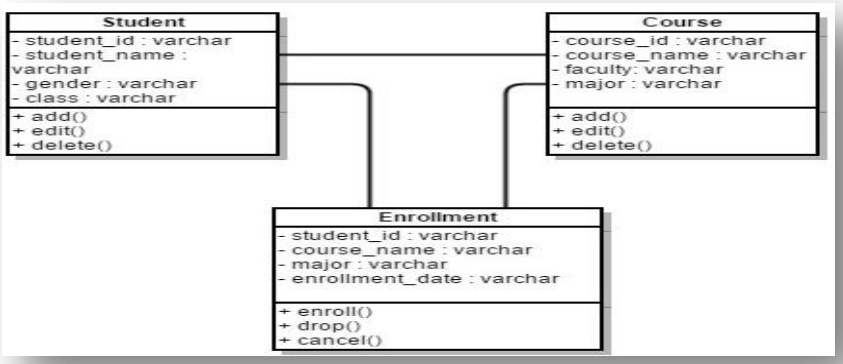


Figure 3.6 is a class diagram of course enrollment

Source: http://creately.com/ [12]

5. Object Diagram

Object Diagrams, sometimes referred to as Instance diagrams are very similar to class diagrams. As class diagrams they also show the relationship between objects but they use real world examples. They are used to show how a system will look like at a given time. Because there is data available in the objects they are often used to explain complex relationships between objects. Illustrated in figure 3.7 is an example of an object diagram:

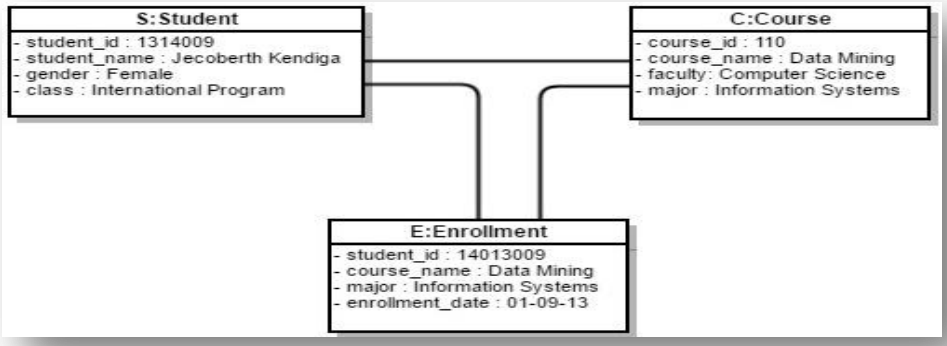


Figure 3.7 An object diagram of course enrollment

Source: http://creately.com/ [12]

6. Component Diagram

A component diagram displays the structural relationship of components of a software system. These are mostly used when working with complex systems that have many components. Components communicate with each other using interfaces. The interfaces are linked using connectors. Figure 3.8 illustrates an example of a component diagram.

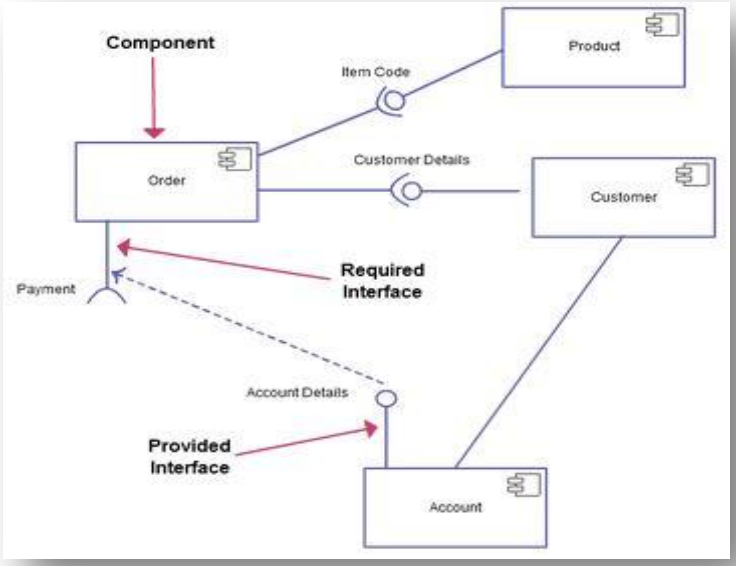


Figure 3.8 An example of a component diagram

Source: http://creately.com/ [12]

7. Deployment Diagram

A deployment diagram can be used to model the physical architecture and (in the case of networks or distributed systems) the topology of the software system being developed. The deployment diagram helps to model the physical aspect of an Object-Oriented software system. It models the run-time configuration in a static view and visualizes the distribution of components in an application. In most cases, it involves modeling the hardware configurations together with the software components that lived on. Illustrated in figure 3.8 is an example of a deployment diagram.

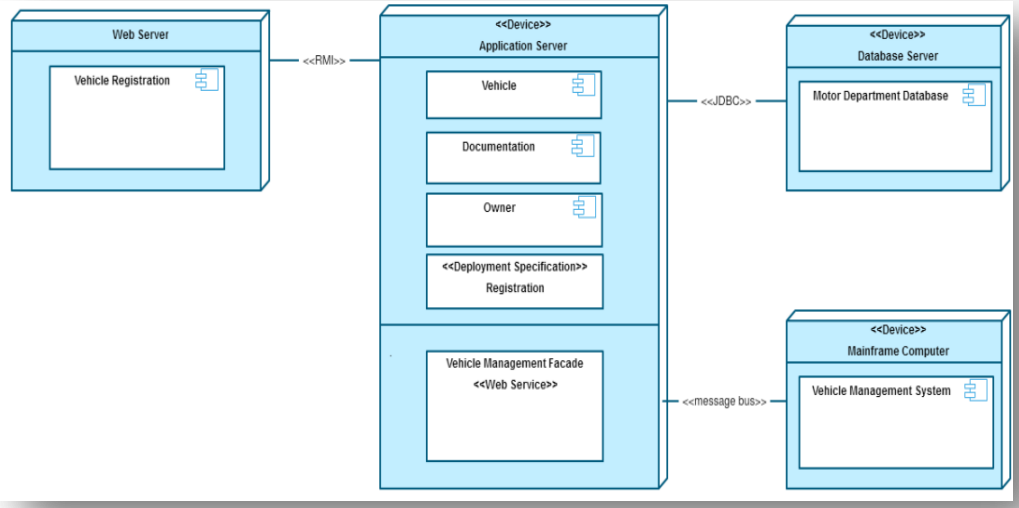


Figure 3.9 is a deployment diagram for a vehicle registration system

Source: http://creately.com/ [12]

3.2.4 Software Testing

Software testing is a process, or a series of processes, designed to make sure computer code does what it was designed to do and, conversely, that it does not do anything unintended. Software should be predictable and consistent, presenting no surprises to users. The two main types of software testing techniques are black box testing and white box testing. However, in this research Black box testing is used.

3.2.4.1 Black Box Testing

Black box focuses on the functional requirements of software. Black box testing enables to derive sets of input conditions that will fully exercise all functional requirements for a program. Black box is not an alternative to white box, but it is a complementary approach to uncover different class errors. Black box testing focuses on these following:

a. Incorrect or missing functions;
b. Interface errors;
c. Errors in data structures or external database access;

d. Behavior or performance errors;
e. Initialization and termination errors.

Through these testing techniques we can determine if the functions appear to work according to their specifications.

3.3 Analysis of Current System

System analysis is the process of breaking down a complete information system into components, in order to study how each component works, as to simplify the problem faced by an information system into component parts. This makes it easier for the system developer to define the problems faced by the system and find a way to solve these problems. In order to develop a new system, the system developer must analyze the current system, identify the problems faced with the current system, and analyze the system procedures and how the system works.

3.3.1 Analysis of Current Procedures

The analysis of the current procedures aims at finding out how the current system works and what problems are faced with the current system procedures. In order to build a new system, the system developer must first know the current system procedures, as they will act as a foundation on which the new system will be built upon. In this case, there are five main current procedures of Taurama Fitness Centre gym management and they are; registration, membership renewal, non-members transaction, attendance and financial reports. Those procedures are the main procedures that are carried out at Taurama Fitness Centre. The following are the brief details of the five current procedures of Taurama Fitness Centre:

1. **Registration**

   In this research, registration is referring to the new members who desire to register at Taurama Fitness Centre. This procedure is done by the new members before they start attending their daily gym sessions.

2. **Membership Renewal**

   Membership renewal is referring to the existing members who get to pay their membership fees monthly to the duty cashier.

3. **Non-member Transaction**

   Non-members' transaction is referring to those who are not members that pay a daily gym session fee before they attend the gym every time.

4. **Attendance**

   Attendance is the daily log list that keeps a record of the date and time of everyone (member or non-member) that enters and exits the gym at any given time.

5. **Financial Reports**

   Financial reports refers to the transactions records that the finance division does every month. These records consists of the monthly registration transactions, membership renewal transactions and the non-members' transaction records.

The analyses of the current academic procedures at Taurama Fitness Centre are as follows:

3.3.1.1 Use case diagram for Taurama Fitness Centre current system.

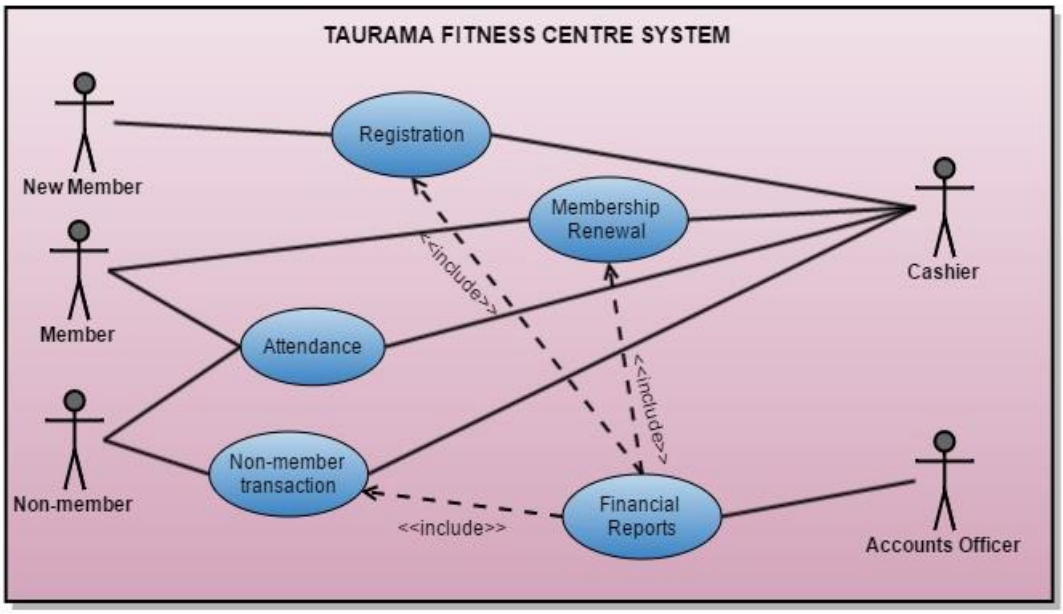


Figure 3.10 Use case diagram for the current Taurama Fitness Centre system

3.3.1.2 Use Case

1. Definition of actors

Following are the definition of the actors in the Taurama Fitness Centre system:

Table 3.1 Definition of Actors

No	Actor	Definition
1	New Member	The new member is the person who wants to become a member. In this case, the new member will go through the registration process in order to become a registered member at Taurama Fitness Centre.
2	Member	The member is the person who has already registered and uses Taurama Fitness Centre at any time he/she wishes and pays membership renewal fee every month.
3	Non-Member	The non-member is the person who is not a registered member, he/she uses Taurama Fitness Centre at any time but pays a daily session fee before they use the gym every time.
4	Cashier	The cashier is the person who his duty is to serve the members and non-members by doing the registration, membership renewals, non-members daily transactions and recording of attendance.
5	Accounts Officer	The accounts officer is the person in carrying out the financial procedures and managing the book keeping of all the financial records that takes place and creates monthly financial reports.

2. Definition of Use Case

The following are the definitions of the use case in the Taurama Fitness Centre system:

Table 3.2 Definitions of Use Case

No	Use Case	Description
1	Registration	In this case, registration is referring to the new members who desire to register at Taurama Fitness Centre.
2	Membership Renewal	Membership renewal is referring to the existing members who get to pay their membership fees monthly in order to renew their membership accounts.
3	Non-members' Transaction	Refers to those who are not members that pay a daily gym session fee before they attend the gym every time.
4	Attendance	Attendance is the daily recording that keeps a record of the date and time of everyone (members or non-members) that enters and exits the gym at any given time.
5	Financial Reports	Refers to the transactions records that the finance division does every month. These records consists of the monthly registration transactions, membership renewal transactions and the non-members' transaction records.

3. Use Case Scenarios

a) Registration

Table 3.3 Use Case Scenario for Registration

Use Case Name	Registration
Primary Actor	New Member
Supporting Actor	Cashier
Summary	In order to be a registered member, a person is required to fill in a member's registration form and pays a registration fee. The form is then checked by the cashier before it is accepted and registered.
Pre-Condition	The person is not a registered member
Normal Flow of Events	1. Person fills the member's registration form. 2. Cashier checks the form, if the form is filled correctly or not. If not the person has to fill the form again. 3. Cashier approves the registration form. 4. Person pays a registration fee to the cashier. 5. Person's registration form is saved and payment is processed. Record is stored in files/database by the cashier
Post Conditions	The person is a registered member

b) Membership Renewal

Table 3.4 Use Case Scenario for Membership Renewal

Use Case Name	Membership Renewal
Primary Actor	Member
Supporting Actor	Cashier
Summary	The membership renewal fee is paid monthly by the existing member to the cashier in order to use the gym
Pre-Condition	Member's membership permit is due
Normal Flow of Events	1. Member pays the membership renewal fee to the cashier. 2. Cashier checks the membership book and confirms the member's due date before payment is processed. 3. If due date is correct the cashier renews the membership to the following month.
Post Conditions	Member's membership is not yet due

c) Non-member Transaction

Table 3.5 Use Case Scenario for Non-member Transaction

Use Case Name	Non-member Transaction
Primary Actor	Non-member
Supporting Actor	Cashier
Summary	Before a non-member uses the gym, he must pay a daily session fee to the cashier.
Pre-Condition	Non-member has not paid the session

	fee
Normal Flow of Events	1. Non-member pays the daily gym session fee to the cashier 2. The cashier records the payment of the non-member into the daily transaction book. 3. Payment is processed and the non-member is able to use the gym
Post Conditions	Non-member has paid the session fee

d) Attendance

Table 3.6 Use Case Scenario for Attendance

Use Case Name	Attendance
Primary Actor	Members and Non-members
Supporting Actor	Cashier
Summary	As the member and non-member enters and before exiting the gym they must inform the cashier, in order for the cashier to record their name, time and date before and after using the gym.
Pre-Condition	Member and non-member has not inform the cashier its time of entry/exit before/after using the gym
Normal Flow of Events	1. Members/non-members enters the gym and informs the cashier their name. 2. Cashier signs-in the

	members/non-members' name, time and date in the attendance log book before they can use the gym. 3. After they finish using the gym the cashier then signs-off their time on the attendance log book before they exit the Fitness Centre.
Post Conditions	Member and non-member has inform the cashier his time of entry/exit from the gym

e) Financial Reports

Table 3.7 Use Case Scenario for Financial Reports

Use Case Name	Financial Reports
Primary Actor	Accounts Officer
Supporting Actor	Owner
Summary	The Accounts officer manages the book keeping of all financial procedures and make sure the transaction journal is balanced before it is given to the owner of Taurama Fitness Centre in the form of a monthly financial report.
Pre-Condition	Monthly financial report has not been done by the accounts officer
Normal Flow of Events	1. Accounts officer records and balances all daily transactions

	into a monthly report respectively from the registration, non-members' transaction, membership renewal and expenditure records. 2. After all financials records are balanced, they are documented into a monthly financial report. 3. The accounts officer then forwards the monthly financial report to the owner of Taurama Fitness Centre.
Post Conditions	Monthly financial report has been done by the accounts officer

3.3.1.3 Activity Diagram

In this section, the activity diagram will present the flow of processes in the current gym management system of Taurama Fitness Centre. The processes will be shown in their respective activity diagrams.

The activities or processes that are carried in the current gym management system of Taurama Fitness Centre are illustrated as follows:

1. **Activity Diagram for Registration at Taurama Fitness Centre**

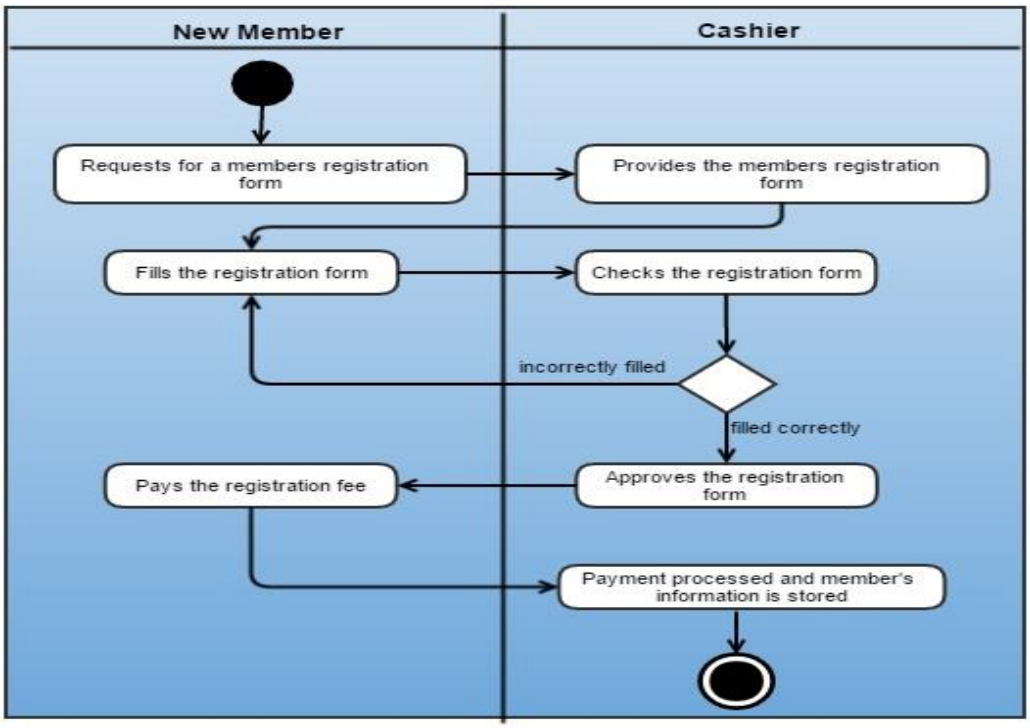


Figure 3.11 Activity diagram for new member registration at Taurama Fitness Centre

2. Activity Diagram for Membership Renewal at Taurama Fitness Centre

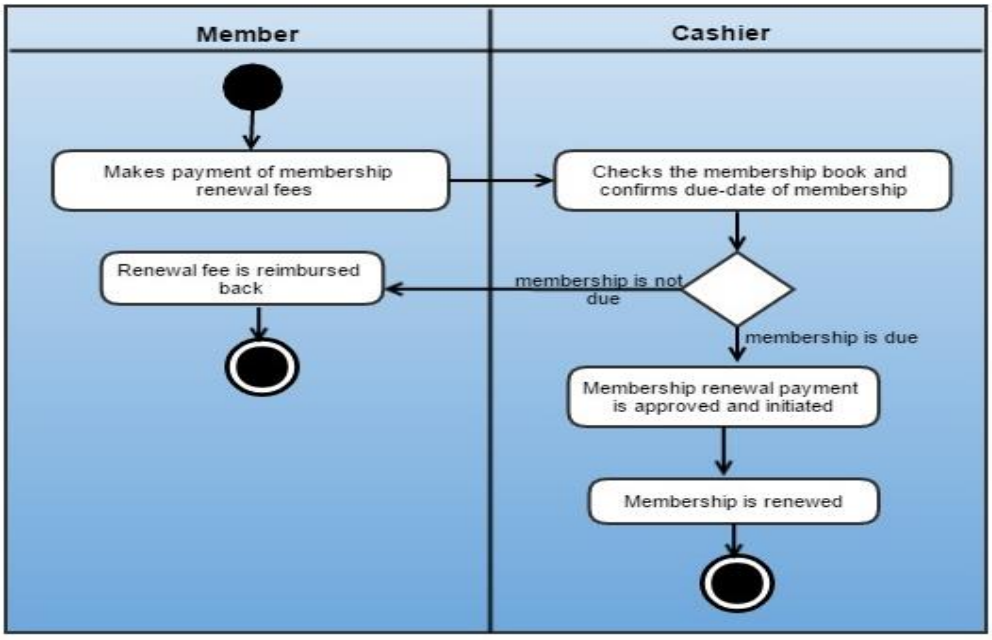


Figure 3.12 Activity diagram for membership renewal at Taurama Fitness Centre

3. Activity Diagram for Non-member Transaction at Taurama Fitness Centre

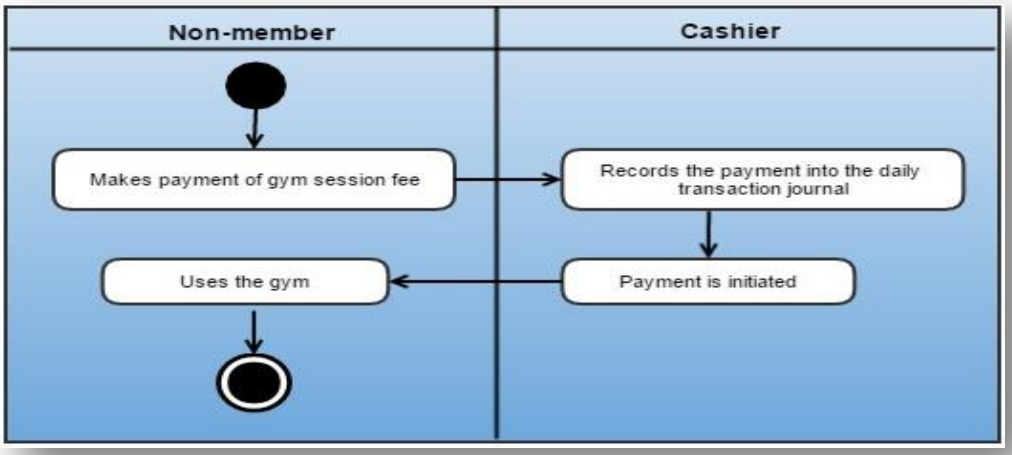


Figure 3.13 Activity diagram for non-member transaction at Taurama Fitness Centre

4. Activity Diagram for Attendance at Taurama Fitness Centre

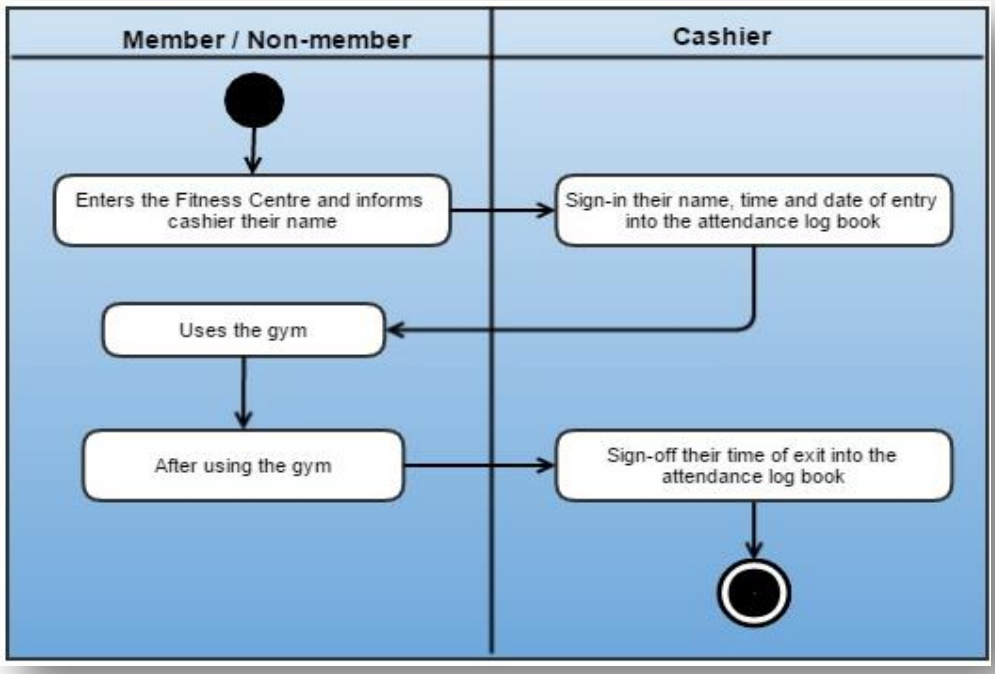


Figure 3.14 Activity diagram for attendance at Taurama Fitness Centre

5. Activity Diagram for Financial Reports at Taurama Fitness Centre

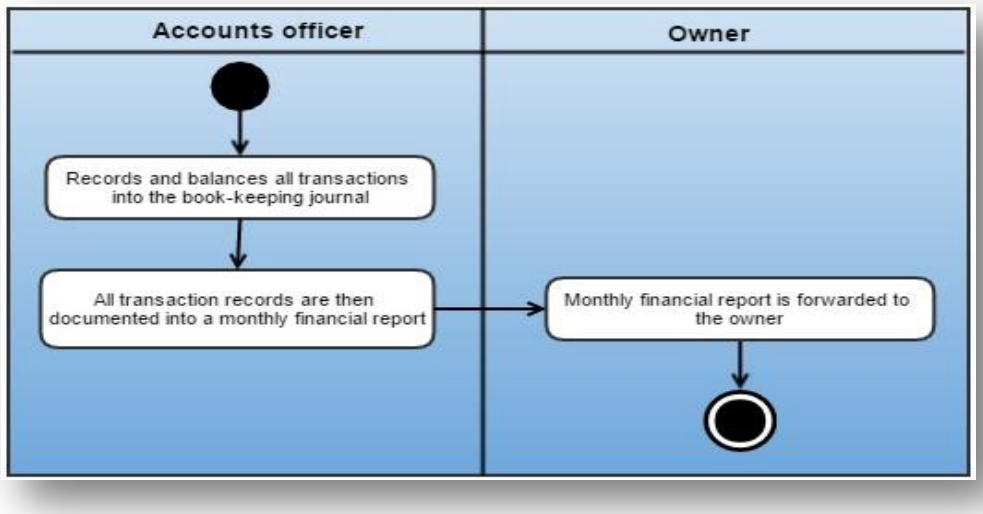


Figure 3.15 Activity diagram for financial reports at Taurama Fitness Centre

3.4 Evaluation of current system

After the analysis of the current Taurama Fitness Centre gym system, it can be seen that there are some problems in the current system. Most of the system flaws are data processing activities that can disrupt and hinder the performance of the existing system, due to most of the system procedures being done manually.

The following table shows the evaluation of the current system's problem as well as the proposed solutions to these problems.

Table 3.8 Evaluation of the Ongoing System

No	Problem	Part	Settlement Plan
1	Member registration procedures are sometimes slow due to handling data manually (handwritten). Having to register by usage of registration forms is an expensive measure and not	Registration	Creating a computer-based gym management system will be more efficient and less expensive when registering members, also there will be no need for any storage space required

	reliable having to use paper and have them stored in files which require more storage space.		for all records will be stored in the system's database.
2	It is time consuming when in the process of searching for membership data/records in terms of renewing membership, which is done manually by going through all the members' record files one by one.	Membership Renewal	Creating a computer-based gym management system which uses search engines, will simplify the search process of membership records more effectively and updating renewal dates will be faster.
3	It is less efficient when having to record daily non-members payment fees with only one duty staff available, this can be quite time and energy consuming	Non-member Transaction	Creating a computer-based gym management system where there is a non-members transaction section where records can be done more quickly and can reduce errors.
4	Recording of daily attendance of members and non-members is time consuming when being done manually by recording into the attendance log journal.	Attendance	Creating a gym management system where there is an attendance menu where exact correct date and time of each member/non-member entry and exit is recorded automatically when the cashier clicks on the Sign-In and Sign-off button.

			This system can generate an attendance report sheet in the case of any incident that may occur.
5	It is time consuming for the accounts officer to having to go through all the daily transaction activities when they are in the form of journal books, and getting to document into a monthly financial report errors can also arises.	Financial Reports	Creating a computer-based gym management system it will be more effective and efficient when managing all the monthly transactions by simply extracting from the database for all respective transactions. Documentation of monthly financial reports will be more effective hence reducing errors.