**PATIENT’S APPOINTMENT MANAGEMENT SYSTEM**

**FOR AAR CLINIC**



**MAKERERE UNIVERSITY**

**COLLEGE OF COMPUTING AND INFORMATION SCIENCES**

**SCHOOL OF COMPUTING AND INFORMATICS TECHNOLOGY**

**GROUPNAME:** GROUP BRINDA

**COURSENAME:** SYSTEM ANALYSIS AND DESIGN

**COURSECODE:** BIS 1206

**LECTURER:** DR. NABUKENYA JOSEPHINE

**GROUPMEMBERS**

|  |  |  |
| --- | --- | --- |
| **Names** | **Reg. No** | **Sign** |
| Thakkar Brinda | 16/X/2271/PS |  |
| Nanyonga Lydia | 16/U/1852 |  |
| Mpirirwe Moreen | 16/U/7125/PS |  |
| Nsubuga Ibrahim | 16/U/0467/PS |  |
| Natwijuka Crispus | 16/U/10117/PS |  |
| Musumba Philip Mulindwa | 16/U/720 |  |
| Karegyeya Calvin | 16/U/354 |  |
| Abubakari Simba | 16/U/2618/PS |  |
| Ndiwalana Henry | 16/U/10208/PS |  |
| Natamba Racheal | 16/U/10067/PS |  |

TABLE OF CONTENTS

[1. INTRODUCTION 6](#_Toc483776043)

[1.1 BACKGROUND 6](#_Toc483776044)

[1.2 KEY FUNCTIONS OF AAR CLINICS 6](#_Toc483776045)

[1.3 VISION 6](#_Toc483776046)

[1.4 MISSION 6](#_Toc483776047)

[1.5 QUALITY PROMISE 6](#_Toc483776048)

[1.6 PATIENT APPOINTMENT MANAGEMENT BUSINESS SERVICES 8](#_Toc483776049)

[2. REQUIREMENTS TECHNICAL AND SYSTEMS DEVELOPMENT REPORT 9](#_Toc483776050)

[2.1 FACTFINDING TECHNIQUES 10](#_Toc483776051)

[2.1.2 INTERVIEWING 10](#_Toc483776052)

[2.1.2 OBSERVATION 11](#_Toc483776053)

[2.2 BUSINESS CASE 12](#_Toc483776054)

[2.3 POSSIBLE SOLUTIONS 13](#_Toc483776055)

[2.4 FUNCTIONAL REQUIREMENTS 13](#_Toc483776056)

[2.5 NON – FUNCTIONAL REQUIREMENTS 14](#_Toc483776057)

[2.5 PROPOSED SOLUTION OF THE PATIENT APPOINTMENT MANAGEMENT SYSTEM USING THE IN-HOUSE DEVELOPMENT METHODOLOGY. 14](#_Toc483776058)

[2.6 CONSIDERATIONS TO MAKE WHEN CHOOSING ALTERNATIVE DESIGN STRATEGIES. 15](#_Toc483776059)

[3. PROJECT PLANNING AND PRELIMINARY ANALYSIS REPORT 16](#_Toc483776060)

[3.1 PROJECT PLANNING AND MANAGEMENT DOCUMENT. 17](#_Toc483776061)

[**THE GANTT CHART** 17](#_Toc483776062)

[3.2 BASELINE PROJECT PLAN REPORT 18](#_Toc483776063)

[**INTRODUCTION:** 18](#_Toc483776064)

[**SYSTEM DESCRIPTION** 19](#_Toc483776065)

[**FEASIBILITY ASSESSMENT.** 19](#_Toc483776066)

[**MANAGEMENT ISSUES** 22](#_Toc483776067)

[3.3 STATEMENT OF WORK 23](#_Toc483776068)

[**PROJECT DESCRIPTION** 23](#_Toc483776069)

[4. REQUIREMENTS SPECIFICATIONS DOCUMENT 25](#_Toc483776070)

[4.1 REQUIREMENTS SPECIFICATIONS 26](#_Toc483776071)

[4.2 FUNCTIONAL PRIMITIVES /REQUIREMENTS DESIGN SPECIFICATIONS: 26](#_Toc483776072)

[**THE DATA FLOW DIAGRAMS FOR PATIENTS APPOINTMENT MANAGEMENT SYSTEM** 27](#_Toc483776073)

[4.3 CONTEXT DIAGRAM 28](#_Toc483776074)

[4.4 LEVEL ‘0’ DIAGRAM 29](#_Toc483776075)

[4.5 LEVEL ‘1’ DIAGRAM 30](#_Toc483776076)

[5. PROCESS SPECIFICATION DOCUMENT 33](#_Toc483776077)

[5.1 THE PROCESS TECHNIQUE 33](#_Toc483776078)

[**DECISION TABLE** 33](#_Toc483776079)

[6. DATA AND OBJECT-ORIENTED DESIGN DOCUMENT 33](#_Toc483776080)

[6.1 THE ERD MODEL 36](#_Toc483776081)

[6.2 UML DIAGRAMS 37](#_Toc483776082)

[6.2.1THE USE CASE DIAGRAM 37](#_Toc483776083)

[**THE USE CASE SCENARIO** 38](#_Toc483776084)

[6.2.2 THE ACTIVITY DIAGRAMS 40](#_Toc483776085)

[6.2.3 CLASS DIAGRAM 44](#_Toc483776086)

[6.2.4 SEQUENCE DIAGRAM 45](#_Toc483776087)

[6.2.5 STATECHARTDIAGRAMS 46](#_Toc483776088)

[7. SYSTEM IMPLEMENTATION REPORT 48](#_Toc483776089)

[7.1 INTRODUCTION 48](#_Toc483776090)

[7.2 IMPLEMENTATION OVERVIEW 48](#_Toc483776091)

[7.2.1 Implementation description 48](#_Toc483776092)

[7.2.2 Points of contact 48](#_Toc483776093)

[7.2.3 Major tasks 49](#_Toc483776094)

[7.4 Implementation schedule. 51](#_Toc483776095)

[8. REFERNCES 51](#_Toc483776096)

**INTRODUCTION**

# 

# 1. INTRODUCTION

## 1.1 BACKGROUND

**AFRICA AIR RESCUE** which is known as AAR was started by its founders Bengt Beckmann and his wife Maryjka. It was founded in 1984. When found, its speciality was in evacuation of medical and accident cases, both by road and air but now it is the leading private healthcare firm and largest providers of outpatient healthcare services in East Africa.

In Uganda, there are 9 clinics in total and the head office is at plot 16A Elizabeth Avenue Kololo in Kampala.

We went to AAR CLINIC Makerere Hill at Wandegeya which was opened on 15th April 2014.

Its working hours are 8am – 5pm from Monday to Friday, 9am – 12pm Saturday and it’s closed on Sunday.

## 1.2 KEY FUNCTIONS OF AAR CLINICS

* Medical Insurance – it ensures that products are relevant to every individual or organization both for locally and regionally for those clients with member or dependants in some or all the countries of East Africa.
* Fund Management – they also offer management services for organizations that prefer the flexibility of choosing their own network provider, determine their own limits and product dynamics.
* Rescue services – it provides professional rescue services during medical emergencies throughout East Africa.

## 1.3 VISION

The vision statement of AAR as a healthcare provider is “To be the provider of choice for innovative and quality healthcare solutions in Africa.”

## 1.4 MISSION

AAR’s mission: “We provide healthcare solutions that make a difference to life.”

## 1.5 QUALITY PROMISE

For AAR, the patient’s safety and best health care are their first priority. AAR guarantees the healthcare consumer caregivers who have their best interests at heart, technology, equipment and an environment designed to perform with the highest standards of safety and effectiveness.

AAR Healthcare is committed to providing quality healthcare that is safe, timely, effective, efficient, equitable, accessible and patient oriented. By following the most up-to-date medical evidence, measuring and analysing data and constantly improving practices based on that data, AAR works towards the best practice outcome for each patient who comes through their doors

**THE MATRIX.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| BUSINESS SERVICES | BUSINESS CASE | PROPOSED SOLUTIONS | FUNCTIONAL REQUIREMENTS | NON- FUNCTIONAL REQUIREMENTS | FUNCTIONAL PRIMITIVES |
| AAR’s mission: “We provide healthcare solutions that make a difference to life.”   * Appointments booking management. * Scheduling appointment. * Follow- up on patients. | **Patient Appointment Management System.**  The project team discovered that the following challenges were faced by AAR as a healthcare provider during the management of appointments at its clinics:   * Long waiting hours for patients waiting to see doctors for appointments. * Poor security with the patients appointments details. * Inconvenience for patients in accessing the telephone number for booking. * Challenge in identification of private patients who have appointments. * Unreliability of the current system. | * Compute the average time for an appointment and assign it to all the appointments. * Use access restrictions to control access to appointment details. * The patients should be able to book an appointment through a channel of their choice. * Generate unique appointments number for each patient who has an appointment. * The appointment telephone number should be available on the AAR website. | The system should;   * be able to compute and assign an average time to each appointment. * Authenticate all the users of the patient appointment management system. * Allow patients to choose a booking channel either book online or book by call. * Generate a unique appointment number for each patient. * Update and notify the doctor and the patient about appointment details. | The system should;   * assign an average duration of 40minutes to each appointment. * The maximum response time for the system should be 10 minutes. * The system should use passwords to authorize access to the appointment details. * The system should store all patient appointment details in a secure database. * The unique appointment number for each patient should be generated automatically | Appointment booking:  Choose booking channel.   * Book online. * Book by call. * Verify booking details. * Prepare appointment rejects notification.   Scheduling appointments:   * Approve appointment. * Update appointments.   Follow ups on patients:   * Prepare a follow up inquiry questionnaire. * Revise patients view. |

## 1.6 PATIENT APPOINTMENT MANAGEMENT BUSINESS SERVICES

In a bid to provide healthcare solutions that make a difference to life in communities throughout East Africa, AAR offers the following business services as relates to their current Patient Appointment Management System:

* Appointment booking management

This management includes the receiving and verification of booking details provided by the healthcare consumer. If the details provided by the patient are not valid, a rejection notification is sent to them indicating the invalid details. Feedback is given to the patient when details have been verified over email or phone depending on which booking channel the patient used.

* Appointment Scheduling

AAR schedules appointments for patients who would like to see doctors. This includes the scheduler verifying whether the patient's preferred schedule aligns with the doctor's availability. The scheduler then approves the appointment and notifies the patient by sending them their appointment details while providing a list of appointments to the doctor.

* Follow up on patients

At AAR clinics throughout Uganda, follow ups are made on patients who had appointments at their clinics not only to find out their current health status but also to know about their experience with the current patient appointment management system.

**REQIREMENTS TECHNICAL AND SYSTEMS DEVELOPMENT REPORT**

# 2. REQUIREMENTS TECHNICAL AND SYSTEMS DEVELOPMENT REPORT

## 2.1 FACTFINDING TECHNIQUES

The team visited AAR clinic Makerere branch in order to understand the business case which is the patients’ appointment management system. The team was able to acquire and comprehend the problems faced in using the current Patients’ appointment management system from the client AAR clinic using the fact finding techniques described below:

### 2.1.2 INTERVIEWING

The project team led by Thakkar Brinda had a planned meeting at AAR hospital on the 15th of April 2017. We were able to talk to the front desk personnel, Mr John Gimei, of AAR clinic who happened to be the scheduler of the patients’ appointment management system. During the interview we managed to understand more about the current patient appointment management system. In our interview we asked him the following questions;

1. ***How do you manage the patients’ appointments?***

Mr John narrated to us the whole of AAR patients’ appointment process. He showed the team a white board inside the clinic that had the patients’ appointments number with instructions that said, “call this number to book an appointment”. He continued to tell us that when the patients call this number, he is the one who picks that call and asks the patients for their booking details (Patient name and telephone number) which he writes down in a book and tells the patient on phone that he will give him feedback about the appointment after scheduling it. He checks for the available schedule of the doctor, if the doctor is available, then he schedules the appointment and notifies both the patient and the doctor otherwise he waits until the doctor is available then he schedules the appointment.

1. ***Which people work with the patients’ appointments and what do they do?***

These were the stake holders of the Patients’ appointment management system and they included;

Patients: Book appointments and see the doctors after the appointments have been approved.

Doctors: Provide their available schedule and attend to patients.

Scheduler: Verifies booking details submitted by the patient. He checks the doctor’s availability and schedules the appointments. He also coordinates all the communication between the patient and doctor.

Management: Receives reports from the scheduler and are responsible for managing the system.

1. ***What is wrong with the process of appointments management?***

Mr John Gimei said their patients’ appointment system was almost perfect but the biggest challenge was inconvenience for the patients in accessing the patients’ appointment number because it could only be obtained from the hospital on the white board that was behind him.

Mr. John Gimei also told us that the current system was also unreliable in that the telephone number for booking appointments often went off and patients wouldn’t book appointments. Also, on 22/05/2017, our respondent told us that there had been no appointments at AAR for two and half weeks due to disconnection of the lines as of a UCC directive.

John told us that some patients would wait in a queue to see the doctor for the appointment for about 25 to 30 minutes since they did not have an average duration for an appointment.

Mr John Gimei also told us that it was difficult for him to identify certain patients with appointments for example those would had similar names used in the booking details.

1. ***How do you allocate duration of appointment to each patient?***

Mr John Gimei told us that they had no average time for the appointment. The appointment would go on for as long as the patient’s problem took.

1. ***How does the Patient Appointment Management system coordinate with the other systems in the clinic?***

Mr John Gimei told us that that their system has zero coordination with other systems in AAR clinic and it is able to work independently.

1. ***What improvements would you like to see with the current system being used to manage appointments?***

Mr John Gimei said he would wish to have a web based system that would be able to manage the patients’ appointments for example capture patient booking details online save the details in databases and also notify the patients about the appointment.

**Justification as to why we chose interviewing.**

We used interview to acquire more detailed information. During an interview, you can react to anything that the client says and in case of anything you don’t understand, you can continue to ask some additional questions for clarification.

We also needed to get quick feedback from the client since we had a limited time for gathering requirements.

### 2.1.2 OBSERVATION

As we interviewed Mr John Gimei, we observed the following;

We observed that the patient’s appointment details were stored by the scheduler in a book which was left unattended to whenever he left the front desk. The book could easily be accessed by unauthorised people because it wasn't kept secure therefore unauthorised people could access the patient appointment details .

We observed that all the patients in AAR clinic wait in the same queue irrespective of their reason for coming to the outpatient clinic. The people waiting to see a doctor, for an appointment or waiting to see a patient all wait in the same queue.

We observed that the telephone number used to book appointments was on a board inside the hospital.

We also observed that the patient booking details were stored in a book which Mr John clearly showed to the team during the interview.

**Justification as to why we choose the observation**

As a fact finding technique, it not only allowed access to operations of AAR clinic in real life but also provided validity of data that we gained during the interview and it gave the project team in-depth understanding of the process of appointments management.

## 2.2 BUSINESS CASE

*Project name:* Patient Appointment Management System.

*Purpose:* The purpose of this project is to better the services offered at AAR clinics by making the services more convenient, reliable, secure and efficient.

The project team discovered that the following challenges were faced by AAR as a healthcare provider during the management of appointments at its clinics:

* There was long waiting time for patients with appointments at AAR clinics. Waiting time in this context is the total time taken between the patient entering the outpatient clinic for an appointment scheduled at a specific time and the actual time he/she sees the doctor. The patients with appointments see the doctor for as long as their problem takes and this often leads to delay of the next appointment, the next patient waits long for their appointment. When asked about the waiting time, interview respondent Mr. John Gimei said that patients often wait for about 25 to 30 minutes in case of delay of their appointment.
* A challenge of poor security with the patients' appointment details was also discovered. In the current appointment management system, appointment details are recorded in a book kept at the front desk by the scheduler. The project team then observed that as the scheduler moved about the clinic to partake of other duties, the book was left unattended to and that gave an opportunity to which ever unauthorized person to check the book for appointment details.
* There was a challenge of unreliability of the current patient appointment management system in that the telephone number for booking appointments can be off and patients cannot book appointments in that period when appointments’ telephone number is off. As of 22/05/2017, there had been no appointments at AAR clinic Makerere branch for two and a half weeks due to disconnection of the telephone lines used to book appointments as of a recent UCC (Uganda Communications Commission) directive to disconnect all unregistered SIM cards.
* There was an inconvenience in accessing the telephone number used for booking appointments at AAR clinics. The telephone number can only be found at a board inside the clinic and thus it requires that whoever wants to book an appointment has to go to the clinic physically. This greatly discouraged patients that wanted to book appointments and they sometimes resorted to waiting in line for the general doctor for whom an appointment is not needed.
* There was also a difficulty in patient identification. The current patient appointment management system at AAR doesn't have any unique identification for patients that have appointments with doctors. When a patient comes for an appointment at the clinic, their name is often used as the unique identifier and sometimes there is a possibility that some patients have same names irrespective of their reason of coming to AAR clinic. Therefore, it becomes hard to tell which patient has come for an appointment since all patients wait in the same queue. The names also confuse the scheduler as he sometimes misspells them during booking. This created a need for a simple way of uniquely identifying each patient who came for an appointment.

The above problems constitute the business problems that this project was created to address.

## 2.3 POSSIBLE SOLUTIONS

* Compute the average time for an appointment and assign it to all the appointments. We came up with this solution in order to solve the problem of long waiting time for the patients. In order to compute the average appointment time, we collected some sample values of appointments’ durations from Mr John Gimei.
* Use of access restrictions to control access to the patients’ appointments details. This solution recommends using computerised system that can enable use of database management systems that manage control and access over the patient’s appointment data which would restrict unauthorised people from accessing patient appointment details. This solution solves the problem of poor security of the patient appointment details.
* The patients should be able to book an appointment through a channel of their choice. This solution is for the unreliability of the current patient appointment management system in that if one of the booking channels is off or under maintenance, the patients are still able to book appointments using the alternative channel.
* The patient appointment telephone number should be available on the AAR clinic website to make it accessible for patients who are inconvenienced in accessing that number from AAR clinic. This enables the patients all over the world to be able to access the number at their places of convenience just by logging in to AAR website.
* The patients should be given unique appointment numbers to enable easy identification of patients who have appointments in AAR clinic. This solution solves the problem of difficulty of identification of patients who have appointments because all patients in AAR wait in the same queue and since their names are used to identify them, it becomes difficult to tell who has come for the appointment.

## 2.4 FUNCTIONAL REQUIREMENTS

This is the desired functionality of the proposed system in terms of what the system should do:

* The system should be able to compute and assign an average time to each appointment. This function will be able to solve the issue of long waiting time for patients as a fixed time for each appointment will ensure that no patient waits for their appointment and also AAR will have management over appointment time.
* The system should authenticate all the users of the patient appointment management system. Authentication will grant the system the ability to control access to the appointment details keeping out unauthorized individuals who may not have good intentions for AAR clinic.
* The system should allow patients to choose a booking channel either book online or book by call. In response to the unreliability of the current system which uses only the telephone channel which can be off at certain times, patients should have another option to allow them to book appointments.
* The system should be able to present and maintain appointments relevant information available for the users of the system such as the patients should be able to access the telephone number used for booking appointment on the web system. This also includes updating appointment details and sending relevant notifications to both patient and doctor.
* The system should generate a unique appointment number for all patients with appointments. This will provide an easy way of identifying the patients with appointments.

## 2.5 NON – FUNCTIONAL REQUIREMENTS

The following constraints describe how the proposed system should operate:

* The system should assign an average duration of 40minutes to each appointment. The computation that leads to that duration will be done using sample values of durations of appointments in typical day at AAR clinic Makerere branch. The following values were provided by Mr. John Gimei (scheduler for current system):

|  |  |  |  |
| --- | --- | --- | --- |
| Appointment | 1st | 2nd | 3rd |
| Duration (minutes) | 20 | 60 | 35 |

Average duration = 20 + 60 + 35 3

= 40 minutes.

* The maximum response time for the system should be 10 minutes. When a patient books an appointment online, the system should send them an email within 10 minutes to confirm the appointment.
* The system should use passwords to authorize access to the appointment details.
* The unique appointment number for each patient should be generated automatically by the system to avoid issues of duplication.
* The system should store all patient appointment details in a secure database.

## 2.5 PROPOSED SOLUTION OF THE PATIENT APPOINTMENT MANAGEMENT SYSTEM USING THE IN-HOUSE DEVELOPMENT METHODOLOGY.

This process allows for the creation of a more customized system that can have an exact fit in AAR clinic. This is because, there is direct contact between the project team and the people that would be using the system and so the system can be tailored in a way that it could incorporate some or most of the wishes of the users.

This approach requires that the project team possesses a group of or team of programmers, business analysts etc. that work closely together with a common reporting line which makes it easier to co-ordinate the groups in the project team and the client.

This approach allows you to have complete control over the functionality and gives you an in-depth knowledge of how the system operates.

## 2.6 CONSIDERATIONS TO MAKE WHEN CHOOSING ALTERNATIVE DESIGN STRATEGIES.

* The date when the proposed appointment management system is needed by AAR should be considered. This implies the duration of the project.
* Financial and human resources that will be consumed during the development of the proposed system following the chosen design strategy.
* The elements of the current appointments management system and the dynamics of its current problems should also be considered. The chosen alternative design strategy should be able to accommodate all the necessary changes while keeping constant some elements.

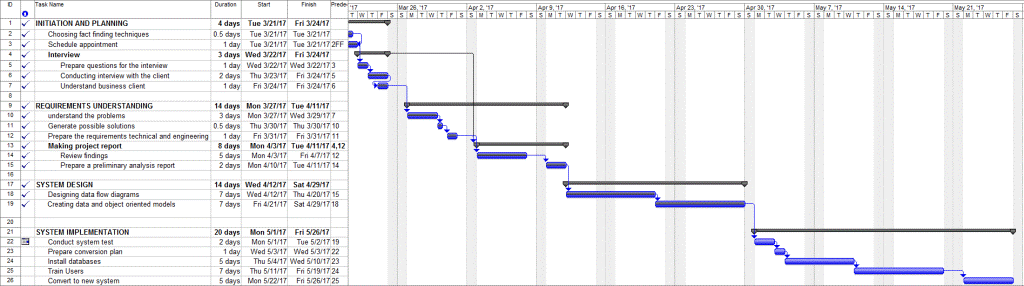
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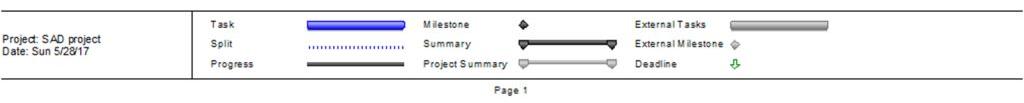
**PROJECT PLANNING AND PRELIMINARY ANALYSIS REPORT**

# 3. PROJECT PLANNING AND PRELIMINARY ANALYSIS REPORT

## 3.1 PROJECT PLANNING AND MANAGEMENT DOCUMENT.

### **THE GANTT CHART**

The Gantt chat enables the team to plan the schedules in which given tasks of system development will be accomplished as illustrated in the chart below for the patient appointment management system.



Tasks and schedule

This table is extracted from the Gantt chart to portray the tasks and schedules clearly since when we took a screen shot of our Gantt chart, the tasks and schedules were not clear.

## 3.2 BASELINE PROJECT PLAN REPORT

### **INTRODUCTION:**

**A. Project Overview**

This project is about designing a system for patients’ appointment management. The project start date was 21/03/2017 and end date is on 5/22/2017. The patients’ appointments management system connects patients to their respective/preferred doctors for special medical attention. The project team undertook this project because patients who have medical appointments at AAR clinic face problems of long waiting time, difficulty in identifying patients, inconvenience in accessing the telephone number used to book appointments and poor security with their appointments details. The project team then needs to generate solutions for all the problems of the current system and also come up with functional requirements which will be modelled and then implemented into the proposed system

**B. Recommendation**

We found out that the appointments system in AAR Clinic and involves a lot of paperwork. We recommend that the current patients appointments system should be enhanced to allow more automation with some process such as the appointment booking and scheduling processes.

### **SYSTEM DESCRIPTION**

**A. Alternative**

Patients will be able to call the scheduler (front desk person) to book appointments with their respective doctors in case the proposed web-based system is under upgrade or is undergoing routine maintenance checks.

**B. System description**

The proposed Patient Appointment Management System will allow for a more convenient, secure, efficient and easier interaction between the users and the system itself. Patients will book appointments using a web-based application by providing their booking details including their names, telephone numbers and preferred schedule and doctor type. These are verified by the system and the scheduler will check to see if the preferred schedule aligns with the preferred doctor’s schedule. He will then approve the appointment whose details like the duration, start time and venue will be sent in a notification to the patient. Follow ups would also be made allowing for the health care consumers to provide feedback about their experience with the system.

### **FEASIBILITY ASSESSMENT.**

**A. Economic feasibility**

This is the cost and logistical outlook of the patient appointments management system to analyse whether the cost of this system will ultimately be profitable (have benefits) to AAR clinic. We compared the costs and benefits of the project to see whether it is logical to complete the project.

**Tangible costs**

|  |
| --- |
| **Project team earnings**  Project manager shs1.0M  Programmers shs1.2M  Database administrator shs850,000  Data administrator shs500,000  System analyst shs300,000  **Internet charges**  Hosting fee shs300,000  Domain name price shs500,000  Band width costs shs200,000  **Hardware purchases**  Desktops shs900,000  Data storage shs600,000  Database servers shs650,000 |

**Intangible costs**

• Less appointments due to system maintenance.

**Onetime costs**

* Development costs: Include the salary to the development team, setting up the site of development.
* New hardware: Hardware costs. Include the servers that will provide necessary appointment information on-line, network cables, routers to connect the Patient Appointment Management System to the Internet.
* New software: Purchase of software packages such as software that could allow real time backing up of appointment information.
* User training: Equipping the different persons in AAR clinic with the necessary skills on how to use the system such as the scheduler.
* Data conversion: Changing from the current system (paper based system) to the new system (computer based system) and transferring all the required data (appointment details of previous appointments) from the appointment book to the new installed databases.

**Recurring costs:**

* Repairing of the patient appointment management system – the cost of repairing the system when it breaks down due to some faults.
* Software maintenance – the cost of maintaining the software regularly on which the patient appointment management system operates.
* Upgrading the patient appointment management system – the cost for upgrading the patient appointment management system.
* Updating the software – the cost of updating the software when it is updated by the engineers and programmers.
* Incremental data storage – the cost for buying new hard drive for the data storage when it exceeds the storage of the old hard drive.

**Tangible benefits**

* Management of the average appointments time.
* Increase in ease and convenience of booking appointments.
* Increased security with appointment details through authentication and verification of users.
* Stability and reliability of the new appointments management system.

**Non- tangible benefits**

* User- friendly system. The patient appointment system is easily understood by the users
* More timely information. The system provides relevant information to the users of the system as soon as possible
* Ability to investigate more alternatives. The system allows to get the user experience in order to assess whether they like the system

**B. TECHNIICAL ANALYSIS**

This is an assessment that will involve determining project management team ability to construct the proposed system.

**Project size**

* Team size: 10 people
* Project duration: 3 months

**Development team:**

* Use the spiral development methodology and the team fairly familiar with the methodology.
* Well experienced with the platform.

**User group:**

* Familiar with the team development process.

**C. Operational feasibility**

This involves assessing whether the proposed system will be used effectively after it has been developed.

* Both management and users support the system
* The proposed patient appointment mangement system will manage appointment time, easily verify patient appointments and make appointment booking easier.

**D. Schedule feasibility**

This involves assessing whether the proposed system will be implemented in an acceptable time frame.

* The project manager created a Gantt chart that divides tasks and shows deliverables and time allocated for their completion will illustrate how the patient appointment management system is will be developed.

### 

### **MANAGEMENT ISSUES**

**Team Configuration and Management**

|  |  |
| --- | --- |
| **ROLES** | **MEMBERS** |
| **PROJECT MANAGER:** | BRINDA THAKKAR |
| **DATABASE ADMINISTRATOR:** | MUSUMBA PHILIP MULINDWA |
| **SYSTEM ANALYSTS:** | NANYONGA LYDIA |
| NSUBUGA IBRAHIM |
| NATAMBA RACHEAL |
| MPIRIRWE MOREEN |
| NDIWALANA HENRY |
| **PROGRAMMERS:** | KAREGYEYA CALVIN |
| NATWIJUKA CRISPUS |
| ABUBAKARI SIMBA |

**Communication Plan**

Communication between the team members will be accomplished through email, telephone, planned discussions and different social media platforms like WhatsApp. In the planned discussions, the project team will sit down in order to come up with functional requirements for the new system which will be implemented into the proposed system. The project manager will also arrange meetings with the business client to provide the deliverables of the system to the client as scheduled.

**Project Standards and Procedures**

The project team is committed to observed protocol and provide the necessary deliverables to the business client as promised. The project team will follow the Gantt chart as a guide of what tasks to accomplished in a given time as they are schedule. The project manager will supervise the team to ensure that they are able to deliver the required quality of the system with all the functional requirements. The quality of the system will also be validated by the quality manager on the side AAR clinic to prove that the system meets user needs

## 3.3 STATEMENT OF WORK

**Project name: PATIENTS APPOINMENT MANAGEMENT SYSTEM**

**Project manager: BRINDA THAKKAR**

**Customer: AAR CLINIC**

**Project sponsor: AAR CLINIC**

**Project start/end: 21/03/17 – 21/06/2017**

**Development staff estimates (man- months):**

**Programmers: 2.0**

**System analysts: 1.5**

**Supervisors: 0.3**

**Consultants: 0.2**

**Total: 4.0**

### **PROJECT DESCRIPTION**

**GOAL**

To develop a patient’s appointment management system for the AAR Clinic. The purpose of this system is to reduce long waiting hours for the patients who have appointments, increase security of appointment relevant information, make patient identification more clear and to make more accessible the telephone number used by patients to book appointments.

**Objective**

* To manage appointment time for the patients who have appointments in AAR clinic to see doctors.
* To make access to the appointments booking telephone number convenient for patients.
* To improve the security of the patients’ appointments details
* To make patient identification easier.
* To provide an alternative channel for booking appointments.

Phases of work

* **In planning:**

In this phase we establish a relationship with AAR clinic and also using the fact finding techniques, we gather problems for our business client. The other tasks under planning will include assessing feasibility, creating a preliminary budget and schedule and also constructing a communication plan

* **In analysis**:

The project team understands the client’s problems, generates solutions to the problems and the generate functional requirements that the proposed system will do.

* **In design**:

The project team will then construct data flow diagrams, data and object oriented models that represent the proposed patient appointment system diagrammatically in design which will be implemented in the implementation phase

* **In implementation**:

This is the last phase of system development and it involves actual deployment and installation of the new patient appointment management system

# 

# **REQUIREMENTS SPECIFICATIONS DOCUMENT**

# 4. REQUIREMENTS SPECIFICATIONS DOCUMENT

In this document, we are able to analyse the patient appointment system using data flow diagrams that graphically represent data flow within the system. The data flow diagrams enable us to generate functional primitives which are the business processes that cannot be broken down anymore.

## 4.1 REQUIREMENTS SPECIFICATIONS

* The system should be able to generate an appointment number that uniquely identifies patients with appointments with the doctors.
* The system should compute the average appointment time for each appointment a patient is to have with a doctor.
* The system should use usernames and passwords to restrict unauthorised users from accessing patient appointment details.
* The system should have the patient appointment telephone number available for the patients online on AAR hospital website.
* The system alternative channel for booking appointments should be an alternative channel.

## 4.2 FUNCTIONAL PRIMITIVES /REQUIREMENTS DESIGN SPECIFICATIONS:

These are processes which cannot be broken down anymore in the level 1 in the data flow diagram.

*LEVEL 1 PROCESS 1.0: APPOINTMENT BOOKING FUNCTION PRIMITIVES.*

**1.1 Choose booking channel.** This involves the patient selecting his preferred booking channel in which they are to book appointments

**1.2 Book online.** This is a booking channel within which a patient can book an appointment.

**1.2 Book by call.** This is a booking channel within which a patient can book an appointment.

**1.3 Verify booking details.** With the patient appointment details submitted, they have to be verified to check if they are valid.

**1.4 Prepare appointment rejects notification.** This process is executed if the patient appointment details that were submitted by the patient are not correct or valid.

*LEVEL 1 PROCESS 2.0: SCHEDULING APPOINTMENTS FUNCTION PRIMITIVES.*

**2.1 Approve appointment.** This process involves the scheduler checking the doctor’s available schedule to see whether the doctor is available to see the patient for the appointment.

**2.2 Update appointments.** When the appointment has been approved, then it is added to the database of appointments to store the records of the appointments.

*LEVEL 1 PROCESS 3.0: FOLLOW UPS ON PATIENTS FUNCTION PRIMITIVES.*

**3.1 Prepare a follow up inquiry questionnaire.** The questionnaire that is made in this process involves questions inquiry about the service that was provided to him by AAR hospital

**3.2 Revise patients view.** This process is done basing on the customer’s feedback in order to assess the patients’ health experience.

## **THE DATA FLOW DIAGRAMS FOR PATIENTS APPOINTMENT MANAGEMENT SYSTEM**

Data flow diagrams are structured analysis and design tools that allow the system analysts to comprehend the system and sub systems visually as a set of interrelated data flows.

The data flow diagrams for the patient appointment system are graphical representations of the processes and flows of data of the proposed system. They will be important to the team of programmers in helping them to write the actual code. It will also help them in case they need to explain the work flow of the system to lay people who may not understand computer code.

## 

## 4.3 CONTEXT DIAGRAM

The diagram below gives the broadest possible overview of the proposed systems’ inputs, processes and outputs. The context which is the patient appointment management system represents all the business processes within the system.

**Description**: If a patient books online, the *booking details* are submitted in the system. If the patient books by call, the scheduler receives an *appointment request* where he asks for the *booking details* from the patients which then he submits in to the patient appointment system on that patients behalf .The scheduler checks for a preferred schedule which includes both the doctors availability and the patients requested time for the appointment. If the doctor is available in that time, then he gets a schedule approval. The doctor provides his available schedule and will receive back an appointment list. After the appointment, the patient is sent an follow up inquiry notification for which he has to provide his/her patient's experience about the appointment.



## 

## 4.4 LEVEL ‘0’ DIAGRAM

Level ‘0’ diagram include the data stores Appointments and Reviews and also contains the major processes (book appointment, schedule appointment and follow up) for which we draw the resulting child diagrams. Here the patient appointment system is broken down into its major business processes which are book appointment, schedule appointment and follow up on patients.



## 4.5 LEVEL ‘1’ DIAGRAM

**PROCESS 1.0 Book Appointment**

This diagram is decomposed from a the book appointment business process from the level'0' diagram. It portrays a broader view and understanding of what happens in the book appointment business process.



**LEVEL ‘1’ DIAGRAM**

**PROCESS 2.0**

In this level '1' diagram, the appointment scheduling process is broken down also to illustrate the functional primitives which represent the processes that cannot be broken down any more in the schedule appointment process. The functional primitives include approve schedule and notify patient and doctor.

****

**LEVEL ‘1’ DIAGRAM**

**PROCESS 3.0**

The follow up process is broken down into its functional primitives which include preparing inquiry questionnaire and also revising patient's view. This diagram is also decomposed from the level '1' diagram to illustrate the functional primitives within this process.

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# 5. PROCESS SPECIFICATION DOCUMENT

## 5.1 THE PROCESS TECHNIQUE

### **DECISION TABLE**

This is one of the process techniques that help us to specify process specifications from the functional primitives of the patient appointment management system. It helps us the project team to analyse and understand the system better since it breaks down the system into its smallest possible processes which are the functional primitives.

**Patient appointment process**

If a patient books an appointment online and gets an appointment number then they are able to get the appointment or if the patient calls using the patient appointment telephone number and gets the appointment number, then that patient is entitled to have the appointment. If the patient is a member of the hospital and has a patient id and calls the clinic using the patient appointment telephone number, then that patient can get an appointment otherwise the appointment is rejected.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Rule** | | | **Else** |
| **Condition** | **1** | **2** | **3** |  |
| Booked online? | Y | . | . |  |
| Called? | . | Y | Y |  |
| Has appointment number? | Y | . | Y |  |
| Has patient id? | N | Y | N |  |
| **Action** |  |  |  |  |
| Get the appointment | X | X | X |  |
| Reject appointment |  |  |  | X |

**Justification as to why we chose decision tables as our process technique.**

Decision tables help the project team to describe the related decision rules which we have in our business case such as getting appointment for those who book online (Y), have appointment number (Y) and with no patient ID (N) as our first set of rule where a patient gets an appointment if this rule is fulfilled. These decision tables can also improve the communication and documentation achievable by other techniques such as flow charts and narrative descriptions. The decision of get appointment corresponds to a relation whose possible values are booked online or called, has appointment number or patient ID which are the condition alternatives.

The advantages of decision tables is that the rules (rule 1,2,3 in the table above) for developing the table for patient appointment process, as well as eliminating redundancy, inconsistencies, contradictions and impossible situations, are straightforward and manageable. For example, its impossible for a patient to call (Y), have appointment number (Y) and a patient ID (Y). the decision tables help eliminate such impossibilities thus promoting completeness and accuracy in analyzing our actions which are get appointment or reject appointment for a patient. When all conditions are not fulfilled then a reject appointment action is performed.

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Decision tables will also enable the team to determine if it has considered all of the possible decision rules (rules 1,2,3) that can be formed from a set of conditions which is booked online, called, has appointment number, has patient ID.

**DATA AND OBJECT – ORIENTED DESIGN DOCUMENT**

# 6. DATA AND OBJECT-ORIENTED DESIGN DOCUMENT

## 6.1 THE ERD MODEL

The entity relationship diagram enables us to model the system diagrammatically showing the entities of the proposed system and the relationships between them. This helps developers to get a better understanding of the system. Also, the database administrator will use this breakdown to implement the appointment details database.

The constraints represented in the diagram below include:

* A doctor can see only one particular patient at a time.
* It’s optional for a patient to book an appointment but the patient can book only one appointment at a time.
* One scheduler schedules many appointments.
* One scheduler notifies and checks with many patients and doctors respectively.



## 6.2 UML DIAGRAMS

### 6.2.1THE USE CASE DIAGRAM

The use case diagram below illustrates what the patient appointment management system will do and reflects the outside view of the system for the users which are illustrated as actors i.e. the patient scheduler and doctor.



### **THE USE CASE SCENARIOS**

*USE CASE SCENARIO FOR BOOK APPOINTMENT*

|  |
| --- |
| IDENTIFIERS   * Patients * Scheduler |
| STEPS   * Choose booking channel * Book appointment * Verify booking details * Approve appointment |
| CONDITIONS   * Book by call or book online |
| ASSUMPTIONS   * Patients who don’t know how to book appointment online can book by calling. |

USE CASE SCENARIO FOR FOLLOW UP

|  |
| --- |
| IDENTIFIERS   * Scheduler * Patients |
| STEPS   * Prepare inquiry questionnaire * Follow up inquiry * Patients experience * Revise patients view * Patients feedback |
| CONDITIONS   * Patients give feedback when the questionnaire is sent to the patient. |
| ASSUMPTIONS   * Patients would tell the scheduler about their experience with the new appointments booking system. |

USE CASE SCENARIO FOR APPROVE APPOINTMENT

|  |
| --- |
| IDENTIFIERS   * Scheduler * Doctor |
| STEPS   * Appointment details * Check doctor availability * Give feedback to the patients * Patients see the doctor |
| CONDITIONS   * Scheduler cannot approve appointments without the patients confirmation |
| ASSUMPTIONS   * Some patients would like to see the doctor as their preferred timings. |

USE CASE SCENARIO FOR SCHEDULE APPOINTMENT

|  |
| --- |
| IDENTIFIERS   * Scheduler * Doctor * Patients |
| STEPS   * Check doctor availability * Schedule appointment * Send list of appointments to the doctor * Give feedback to the patients * Patients see the doctor |
| CONDITIONS   * The scheduler cannot schedule appointment without checking doctor’s availability. |
| ASSUMPTIONS   * A patient might not see the doctor due to long queues in the clinic. |

### 

### 6.2.2 THE ACTIVITY DIAGRAMS

The activity diagrams portray the sequence of activities in a process. The project team came up with activity diagrams that came from some of the use cases as shown below;

**ACTIVITY DIAGRAM FOR USE CASE BOOK APPOINTMENTS**



**THE ACTIVITY DIAGRAM FOR USE CASE FOR SCHEDULE APPOINTMENT**



**THE ACTIVITY DIAGRAM FOR USE CASE FOLLOW – UP**



### 6.2.3 CLASS DIAGRAM

The class diagrams illustrate classes, attributes and methods of the patient appointments. The methods are actions that can be requested or initiated by a class. The class diagram also includes multiplicities which illustrate constraints on relationship between the classes.

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### 6.2.4 SEQUENCE DIAGRAM

A sequence diagram shows interactions between classes over time. The left most class is the starting class and time sequence is from top to bottom.

In this case patient is the starting class. There are four classes: Patient, Scheduler, Appointment and Doctor.

Horizontal arrows represent messages between different classes. Solid arrows represent messages which need response while dashed arrows represent messages which don’t need response.

Activation boxes show the time a class needs to complete a task.

Lifelines indicate the class’s presence overtime.

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### 6.2.5 STATECHARTDIAGRAMS

The state chart diagrams are diagrams that show states of classes and the events that lead to those states. In the patient appointment classes, we illustrated the patient and appointment classes. We constructed these state chart diagrams basing on the classes that change state in the patient appointment management system which clearly illustrate a state of a particular class and the event that leads to it.

**PATIENT STATECHART DIAGRAM**

This diagram illustrates the states and events that lead to these states for a patient using the patient appointment management system. It clearly shows that the patient begins with submitting his booking details and ends with seeing the doctor for the appointment and between these events the patient's state changes depending on which event happens.



**APPOINTMENTS STATECHART DIAGRAM**

The appointments class also changes state due to certain events that happen as shown below. The first event in the appointments class is booking details verified and ends with patient and doctor notified.

****

# 7. SYSTEM IMPLEMENTATION REPORT

## 7.1 INTRODUCTION

7.1.1 System description

The project team intends to implement a patient appointment management system that manages patients in AAR clinic at wandegeya. This system only deals with patient appointments and provides business services such as appointment booking, appointment scheduling and follow up on patients who have appointments with doctors in AAR clinic.

## 7.2 IMPLEMENTATION OVERVIEW

### 7.2.1 Implementation description

System implementation is process of building and assuring that a proposed system is fullly operational which may include conversion of data into the new system files, training of users and transitioning from the old system to the new system. During implementation, the project management team intends to implement a complete patient appointment management system. The project team will install the necessary equipment on which the system will be able to run such as a desktop computer on the scheduler’s front desk where he will be able to manage appointments. The scheduler will manage appointments using applications such as web applications where he views the patients who have booked appointments, the database applications where he stores patient appointment data to enable him carry out his responsibility in the patient appointment process. The system analyst will plan arranged training sessions for the scheduler to learn how to use the new implemented system The implementation of the proposed patient appointment management system will be done following the four major activities which are;

1. Conduct system test
2. Prepare conversion plan
3. Install system
4. Train users

### 7.2.2 Points of contact

This table below is important for providing relevant information of the names of the responsible personnel, their roles and contact numbers of the staff who serve as points of contact for the system implementation. The points of contact include only the people who are who serve a specific purpose in system implementation.

|  |  |  |
| --- | --- | --- |
| Role | **Name** | **Contact Number** |
| Business Sponsor | Bengt Beckmann | +44745552879 |
| Project/Program Manager | Thakkar Brinda | 0755616180 |
| System Developers | Programming team | 0782349043 |
| Quality Assurance Manager | Dr. Peter Ntege | 0752354903 |
| Configuration Management Manager | Karegyeya Calvin | 0753500046 |
| Database Administrator | Musumba Philip Mulindwa | 0705015686 |
| Site Implementation Representative | Mr. John Gimei | 0778281590 |
| System analyst | Nsubuga Ibrahim | 0703733732 |

### 7.2.3 Major tasks

**Conduct system test**

In this task, the project management team together with the AAR clinic will work together to carry out various tests on the new system in order to identify the system defects. The project proposes to carry out the various tests on the systems to check whether that it is able to meet its functional requirements;

1. **Unit testing**

This test is a test that is carried out on individual methods, classes or components of the proposed patient’s appointment management system for example we check the method of book appointments which enables the team to detect all the defects in the events in this method before the system is implemented. The programming team can carry out a test by filling in some sample data in the online form for booking appointments which they are submit and then checked to see whether these sample booking details are able to reach the schedulers interface for approval and scheduling. The sample patient booking details may include patient name, patient type, doctor type and insurance status which have to be verified before they are submitted to the scheduler’s interface. If correct sample patient details are submitted and they reach the reach the scheduler’s interface, then this method is proved to have no defects

1. **Integration testing**

This is a test will be carried out to evaluate the behaviour of a group of methods or classes in the proposed patient appointment system. We can consider testing all the methods of the appointment class, for example the system can be tested to check whether the patient can book appointments which he submits the booking details and then, these details are able to reach the scheduler’s interface which approves before he schedules the appointment.

1. **Usability testing**

This test will be basing on the users of the patient appointment system which includes the patients doctors and scheduler. It is intended to check whether the users of the system can easily understand how to use the system in order to get the required services of get desired information from the system..

Criteria for the usability test for the patient appointment management system;

* Are the patients able to fill in all the booking details as required online and also submit the form? If all patient can easily fill the booking form, then it implies that the system is easy to use for the patients and also get the required service from the system.
* Is the scheduler being able to check for the available schedule of all the doctors in order to schedule the patient appointment at all times? We test whether the scheduler is able to navigate through all available schedules of doctor in order to know which appointment to schedule. This ensures that the scheduler efficiency is able to increase and the project team will know that the system is usable for the scheduler.
* Is the doctor able to provide his available schedule to the system to let the scheduler know that he will be able to meet the patients for the appointments? If the doctor can provide their available schedule, then we know that the system is usable for the doctor.

1. **Acceptance testing**

This test will be conducted on the patient appointment management system to check if the system is able to fulfil the desired functional requirements. All the functional requirements that were proposed in the analysis phase must be able to be fulfilled by the system in order for our business client to accept the system . The project team does the verification to check whether the system works correctly and then AAR does the validation to prove that the system meets user requirements as planned.

Criteria for the acceptance test for the patient appointment management system;

* Is the patient appointment system able to compute and assign an average time for each appointment in the clinic? The project management team checks to see whether each appointment is assigned the average time and AAR clinic will have to prove that it is true.
* Is the proposed patient appointment system able to authenticate the users who access the patient appointment data for example the scheduler?
* Is the patient appointment management system able to present to present and maintain relevant information available for the users of the system?
* Is the system able to allow the patients to choose a booking channel either online or by call?
* Is the system able to generate unique appointment numbers for all patients who have appointments in AAR clinic?

**Prepare conversion plan**

At this point, the project team selects the best conversion strategies suitable for the proposed patients’ appointment management system. After analysing the strategies, the project team proposed to use the direct cutover conversion strategy.

**Direct cutover strategy**

The direct cutover is a conversion strategy in system implementation where the old system is changed into a new system. Below are the aspects that will be completely changed when the new system is implemented.

* In the current system for patient appointments, the patient appointment details are stored in a book which results into poor security with the patient appointment details. So using the direct cutover strategy, the new system will convert patient appointment data from a book into a database management system which runs on a server of AAR clinic website where all the patient appointment data will be stored in databases.
* The current patient appointment system uses patient names to identify patients who come for appointments and the new patient appointment system will directly eliminate use of names as identifiers and use the assigned patient unique appointment numbers to overcome the challenge of difficulty in patient identification
* When the new system is implemented, it will allow patients to choose a booking channel thus enable them to book either online or by call instead of using calls only which was the means of booking in the old system.

Advantages

It is less costly as the project team has will only maintain the new proposed patient appointment systemwhich is operational and the old system will be discarded compared to other strategies.

It saves time when implementing the new system because there is no need for integrating the new patient appointment system with the old one

Disadvantage

It is risky because if the new patient system fails, there is no backup system so the data may get lost.

**Install system**

In this task we shall fully implement a finished patient appointment management system that is able to manage appointments in AAR clinic.

Items to install in the proposed patient appointment management system include;

* Databases where patient appointment details will be stored.
* New software which will be able to manage patient appointments
* Desktop computer at the schedulers front desk that he will use to manage appointments

**Train users**

The users of the system i.e. scheduler, patients and doctors will be trained separately by the system analysts on how to use the new appointment management system and will be given the necessary documentation (user guides/manuals) to help them learn.

The patients will be trained on how to log in and out of the system, the major system functions for example choosing a booking channel, booking appointments online and receiving feedback from the system about their appointments. The patients will also be provided with online and external help on top of troubleshooting guides in case they encounter system bugs.

The scheduler’s training will also involve most of the training for the patients but will include how to communicate to both the patients and doctors using the new appointment management system. He will also be trained on how to approve an appointment.

System analysts will also train the doctors specifically on how to submit their available schedule to the system and how to communicate in case the submitted schedule changes.

All users of the system will have security training which will include authorization and authentication.

## 7.4 Implementation schedule.

As from our Gantt chart in the preliminary analysis report, implementation was scheduled to take 20 days and in this period the project manager is responsible for conducting all the activities of the implementation to ensure that they are accomplished as planned.

# 8. REFERNCES

**[Gary\_B.\_Shelly, \_Harry\_J.\_Rosenblatt] \_Systems Analysis and design**

**JOHN GIMEI (FRONT DESK) – AAR CLINIC**

**www.tutorialspoint.com**