DECISION MAKING PROCESS INFORMATION SYSTEM

By Mary De Faria and Virginia Metayer

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Engineering Management
Fall 2007

FLORIDA INTERNATIONAL UNIVERSITY
DEPARTMENT OF INDUSTRIAL ENGINEERING
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Introduction

The following project will illustrate how engineer managers in the Information Technology Industry make decisions on how to choose the best information system. In order to accomplish this project different decision making approaches will be used:

1. First of all, gather information
2. Secondly, formulate develop alternatives
3. Evaluate alternatives
4. Implement Best alternative
5. Follow up and review effectiveness

In this project we will first define the problem by using a scenario and we will specify premises and constraints and finally, a formulated value decision model will be demonstrated in order to choose the best medical scheduling system.
The Planning/decision-making process

RECOGNIZE THE PROBLEM OR OPPORTUNITY
Scenario

The Health Happy Care Medical Clinics (HHC) in Miami-Dade is looking for a solution to solve their scheduling system. The HHC serves patients who are on Medicare/Medicaid in Miami-Dade. Having 70% of their patients’ recipients of Medicare/Medicaid and mostly over 62 years of age, the biggest problem that the clinics are facing today is the waiting time. Patients do not have transportation to the clinics and also the 8 HHC clinics available can only schedule 40% of the patients for appointments. Due to this matter, the clinic has subcontracted local doctors who mostly of time can only
see patients twice a month, meaning that no more than 20 patients are seen on a monthly basis. The clinics are really concerned about customer’s satisfaction due to fact that the best advertising is done by the customers and most of their customers are really disappointed with the time that they need to wait for the next appointment. These clinics have four other major problems:

(1) There is no way of monitoring the waiting time and service times of their patients.

(2) There is no way of knowing when the next appointment will be available in order to better serve their patients.

(3) There is no schedule system that generates various reports on the number of patients seen by each doctor.

(4) The van drivers need to be waiting until 5PM to receive the appointment information for the next day.

Based on all these issues, these clinics decided to do patient satisfaction surveys. The results of these surveys are:

### Questions for which the clinic was ranked in less than the 50th percentile

<table>
<thead>
<tr>
<th>Questions</th>
<th>Percentile Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waiting time for a rad test</td>
<td>13% out of 50%</td>
</tr>
<tr>
<td>Courtesy of blood technician</td>
<td>22% out of 50%</td>
</tr>
<tr>
<td>Concern comfort when blood drawn</td>
<td>31% out of 50%</td>
</tr>
<tr>
<td>Waiting time to see doctor</td>
<td>34% out of 50%</td>
</tr>
<tr>
<td>Informed about delays</td>
<td>41% out of 50%</td>
</tr>
<tr>
<td>Doctor informative re-treatment</td>
<td>44% out of 50%</td>
</tr>
<tr>
<td>Courtesy of rad technician</td>
<td>47% out of 50%</td>
</tr>
<tr>
<td>Staff cared about you as a person</td>
<td>47% out of 50%</td>
</tr>
</tbody>
</table>

### Questions for which the percentage of respondents who replied Poor or Very Poor was greater than 10%

<table>
<thead>
<tr>
<th>Question</th>
<th>Poor &amp; Very Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informed about delays</td>
<td>18%</td>
</tr>
</tbody>
</table>
Waiting time to treatment area | 14%
Waiting time to see doctor | 12%
Waiting time for rad test | 10%

HHC clinics believe that a good scheduling system would minimize all these issues. One problem may bring other problems. Consequently, a good scheduling system would facilitate the management system of HHC. Therefore, a solution to create a scheduling system would bring better changes to these clinics. As a result of it, the clinics would become more organized enabling them to better serve their customers. Based on that HHC decided to either purchase a new scheduling system or develop a new one that would be designed to fulfil the clinics business requirements. The first step for HHC clinics was to request for information scheduling system services to the FIU IT Team.

FIU IT TEAM

REQUEST FOR INFORMATION SYSTEM SERVICES

Miami, FL
Website: www.FIT.com
Email: info@fitc.com

DATE OF REQUEST: 02/27/2006
SERVICE REQUESTED FOR DEPARTMENT(S): DESIGN OF A SCHEDULING SYSTEM

SUBMITTED BY (Key user contact) | EXECUTIVE SPONSOR (funding sponsor)
Name: Virginia Metayer | Name: Mary De Faria
Title: Business Analyst | Title: Vice President, Member Services
Phone: 123-456-0000 | Phone: 111-234-6890

TYPE OF SERVICE REQUESTED:
☐ Information Strategy Planning
☐ Existing Application Maintenance problem
☐ Existing Application Enhancement
Business Process Analysis Redesign
- New Application Development
- Other (please specify)

BRIEF STATEMENT OF PROBLEM OR DIRECTIVE (Attach additional documentation as necessary)

HHC clinics need a new software scheduling system that can generate various patient reports, such as number of visits per year, medical history, doctors seen per year as well as waiting time that the patient waited for the next appointment. All the 8 HHC clinics need to have access to a centralized database which will store all the patient’s records. This system needs to minimize the no-shows percentage. We envision a system that has different features and enables both doctors and employees to have access to certain patient’s information.

**ACTION (ISS office Use Only)**
- Feasibility assessment approved  
  **Assigned to:** Sandra Garcia
- Feasibility assessment waived  
  **Approved Budget:** $150.00
- Request delayed
- Request rejected

**Authorized Signatures:**

Mary de Faria  
**Virginia Metayer**  
Chair, ISS Executive Steering Body  
**Project Executive Sponsor**

### Assumptions for Annual Benefits

**Drivers’ expenses**

<table>
<thead>
<tr>
<th>Per Driver</th>
<th>With the old scheduling system</th>
<th>With the new system</th>
</tr>
</thead>
<tbody>
<tr>
<td>base salary per hour</td>
<td>$15</td>
<td>15</td>
</tr>
<tr>
<td>Number of hours /day</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>base overtime salary</td>
<td>$17.00</td>
<td>$17.00</td>
</tr>
<tr>
<td>Average overtime</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Daily salary w/out O.T</td>
<td>$120</td>
<td>120</td>
</tr>
<tr>
<td>Daily salary W O.T</td>
<td>$171</td>
<td>0</td>
</tr>
<tr>
<td>Monthly Salary</td>
<td>$3,420</td>
<td>$2,400</td>
</tr>
</tbody>
</table>

Drivers
As we can notice, with the old system, drivers have to work an average of 3 hours more per day. This is because drivers need to wait until 5 Pm to receive the appointment times of the patients that will be seen on the next day. After that, drivers need to organize themselves in order to know which patients they will be picking up and dropping first. Assuming that drivers are paid $17.00 dollars for overtime, it gives as a monthly total cost of $3424.00 dollars to pay for a driver. This amount yields an annual cost of $41,088 dollars. Thus with new system, drivers will not have to work overtime, and he/she will be paid $2400 monthly, giving a total annual cost of $28,800 dollars. Therefore, the clinics will then have an annual benefit of $12,288 dollars per year.

<table>
<thead>
<tr>
<th>Doctors’ expenses</th>
<th>Old System</th>
<th>New System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total daily payment</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>#of patients required to receive per day</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Average Actual # of patients received per day</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>Payment per patient</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Total amount used</td>
<td>30×18= $ 540</td>
<td>30×20= 600</td>
</tr>
<tr>
<td>Daily wasted money</td>
<td>$60</td>
<td>0</td>
</tr>
<tr>
<td>Monthly wasted money</td>
<td>$1800</td>
<td>0</td>
</tr>
<tr>
<td>yearly wasted money</td>
<td>21,600</td>
<td>0</td>
</tr>
</tbody>
</table>

As we can notice, each doctor is paid $600.00 per day in order to see 20 patients. Unfortunately, doctors only see 18 of their patients on a daily basis. Due to this fact, there is a daily waste of $60.00 dollars per day, resulting in a monthly waste of $1800.00 dollars. Subsequently, these amounts yield to a waste of $21,600 dollars per year. This problem is also related to the fact that all the 8 clinics don’t have access to each other patient’s reports. That is why, doctors see fewer patients then they should. There is
obviously, a poor communication system among these clinics. As a result of it, there is no way to automatically schedule patients on a waiting list, resulting in the fact that doctors only see 18 patients on a daily basis. Thus, this issue also would help to yield an annual benefit of $21,600 dollars.

No-Show and forecasting waiting time

Assuming that 50% of patients do not show for their appointments, there is then a daily waste of $300.00 dollars and a monthly waste of $9,000 dollars. This waste is due to the case that doctors are paid $30.00 per patient. In this case we are assuming that only 10 patients show per day. Assuming that a doctor is paid even if the patient does not show up for his/her appointment, we have a yearly waste of $108,000 dollars. Consequently, the main reason for this issue is the fact that the old system does not have ways of forecasting waiting time. Therefore, a patient may wait too long to be seen by a doctor, or to receive a medical procedure. Patient’s un-contentment about this issue may result in no-show up for the next appointment, resulting as well on an annual benefit of $108,000 dollars per year as well.

<table>
<thead>
<tr>
<th>PROJECT: SCHEDULING SOFTWARE SYSTEMS</th>
<th>PROJECT MANAGER: Virginia Metayer</th>
</tr>
</thead>
<tbody>
<tr>
<td>CREATED BY: MARY DE FARIA</td>
<td>LAST UPDATED BY: Virginia Metayer</td>
</tr>
<tr>
<td>DATE CREATED: 02/27/2006</td>
<td>DATE LAST UPDATED: MARY POMBARES</td>
</tr>
</tbody>
</table>

Problem Matrix Analysis

<table>
<thead>
<tr>
<th>Brief Statements of Problems, Opportunity, or Urgency</th>
<th>Visibility</th>
<th>Annual Benefits</th>
<th>Priority of Rank</th>
<th>Proposed Solution</th>
</tr>
</thead>
</table>

8
<table>
<thead>
<tr>
<th>Directive</th>
<th>1 month</th>
<th>Med</th>
<th>$108,000</th>
<th>1</th>
<th>New development.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. HHC clinics need ways of forecasting the waiting time of a patient</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Drivers need to have access to appointment times before 5PM</td>
<td>3 months</td>
<td>Med</td>
<td>$12,228</td>
<td>3</td>
<td>After System is ready, Drivers will have access to a certain area of database with client appointment time.</td>
</tr>
<tr>
<td>3. No-shows need to be considerably reduced.</td>
<td>1 month</td>
<td>High</td>
<td>$108,000</td>
<td>1</td>
<td>New development. Automated phone calls and email reminders may minimize the no-shows, thus new system needs to have these features.</td>
</tr>
<tr>
<td>4. All 8 clinics need to have access to all patient’s information,</td>
<td>2 months</td>
<td>High</td>
<td>$21,600</td>
<td>2</td>
<td>The system needs to have a centralized database.</td>
</tr>
<tr>
<td>5. Doctors need to see all the 20 patients per day</td>
<td>2 months</td>
<td>High</td>
<td>$21,600</td>
<td>2</td>
<td>Automatic appointment for patients in the waiting list, in order to assure all 20 patients are seen every day.</td>
</tr>
</tbody>
</table>

Table 1.1 Problem Matrix Analyses

The rank goes from 1-5, having one to be the highest rank followed by the rest of the numbers.

**Project Scope:** The goal of this project is to come out with a software scheduling system for the HHC clinics. This project must be completed in three months and it has a budget of $150,000 dollars allocated to either purchase or develop the new system. After the preliminary phase, the following deliverables will be accomplished:

**Design Deliverables**

1. *Problem Analysis Phase*
a. Problems, Opportunities, and Directive Matrix do Problem Analysis with PIECES

b. System improvement/change objectives, and system constraints

2. **Requirements Analysis Phase**
   a. Functional Requirements with Use Case Diagrams & Narratives
   b. Non-Functional Requirements in a table
   c. Context Diagram

3. **Decision Analysis Phase**
   a. Candidate Solutions Matrix (COTS and In-house alternatives)
   b. Candidate Solution Analysis, Decision, & Justification
   c. Feasibility Matrix

4. **Application Architecture**
   a. System Architecture (centralized, decentralized, servers, network, etc.)
   b. Physical Process Models
   c. Interface Prototypes
      i. One input interface
      ii. One output interface

**PROBLEM ANALYSIS PHASE**
*The PIECES Problem-Solving Framework and Checklist*
PERFORMANCE:
A. Throughput – We assume doctors take an average 20/day to see each patient.

B. Response Time- Assuming that new system has a response time of 15 seconds per transaction; the new system must be than 5 seconds per transaction since the new system must be very fast and efficient.

INFORMATION (and Data):
A. Outputs
   1. System lacks various reports.

B. Inputs
   1. Input data is not captured by all clinics.

C. Store Data
   1. Data is stored redundantly in multiple files such as excel spreadsheet.
   2. Data is not captured in time to be useful for clinics’ drivers.
   3. Data is not stored in a centralized database.
   4. Data is not accessible by all users such as doctors and drivers.

ECONOMICS:
A. Costs
   1. $150,000 to improve existing scheduling system.

B. Profits
   1. New System will increase the clinics’ profits.
   2. Patient satisfaction may bring new patients to the clinics.
   3. No-show will be reduced.

CONTROL (and security):
A. Too little Security or control
   1. Some of the input data is written on excels spreadsheet.
   2. Data may not be secured from accident or vandalism.
   3. Existing system does not facilitates decision making of the staff, thus Doctors see fewer patients than they should.

EFFICIENCY:
A. People, machines, or computers waste time
   1. Data is redundantly input or copied.
   2. Clerk send appointment reports to drivers too late.

SERVICE:
A. The system is inflexible to new or exceptional situations, such as an increase in the number of clinics.

Table 1.2 PIECES problem-solving framework and checklist.

Problems, Opportunities, Objectives, and Constraints Matrix
### CAUSE-AND-EFFECT ANALYSIS

<table>
<thead>
<tr>
<th>Problem or Opportunity</th>
<th>Causes</th>
<th>Effects</th>
<th>System Objectives</th>
<th>System Constraint</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. HHC clinics need ways of forecasting The waiting time of a patient.</td>
<td>1- Number of clinics has increased from three to eight.</td>
<td>1- Clinics have an increase on customers and the scheduling system is not been able to support all eight clinics.</td>
<td>1- Decrease no-shows appointments.</td>
<td>1- There will be no professional training available for staff to learn new system.</td>
</tr>
<tr>
<td>2. Drivers need to have access to appointment times before 5PM.</td>
<td>2- Existing system is too keyboard dependent.</td>
<td>2- System depends on the clerk data inputs in order for drivers have access to some patient’s information.</td>
<td>2- Eliminate Excel spreadsheets as much as 70%.</td>
<td>2- New system must be able to handle all the data that the existing system have.</td>
</tr>
<tr>
<td>3. No-shows need to be considerably reduced.</td>
<td>3- System was not designed in order for different staff members have access to patient’s information.</td>
<td>3- Doctors see fewer patients than they should on a daily basis.</td>
<td>3- Doctors, drivers, as well as staff from all the other 8 clinics will have access to certain areas of the system. Thus, system will provide a centralized database.</td>
<td>3- New system database must have restrictions for certain staff member in certain areas of the database.</td>
</tr>
<tr>
<td>4. All 8 clinics need to have access to all patients’ information.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Doctors need to see all the 20 patients per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1.3 Causes and Effects Analysis- System Improvement Objective
OVERAL MISSION, LONG RANGE OBJECTIVES AND

STRATEGY

System improvement

HHC truly believes that a poorly scheduling system eventually derivates other problems such as the fact that some patients do not show for their appointment, the fact that doctors do not see all of their patients per day and the fact the some of the clinics staff do not have access to the patients medical report as well as history. All of these problems help decrease the annual benefits of the clinics. As a result of it, the new system must be developed in order to improve all the problems that are stated in the problem statement analysis table on the previous page. The FIU IT Team decided that in order for the old system to be improved, there are five features that the new system must have:

1- A Centralized database that will link all the 8 HHC clinics to one another. As a result of it, all the clinics will have access to all the patients’ reports and it will eventually facilitate to schedule the next appointment for a patient.

2- The new system needs to have an automated system for telephone calls and email remainders. Thus, this would remind customers of their appointments, facilitating the communication between the patients and the clinics before the appointment day.

3- The new system needs to have database restriction for certain areas of the database. Therefore, drivers will only have access to patients’ appointment times, doctors will have full access such as patients’ reports and medical history and clerks will only have access to everything such as insurance, appointment dates and times but no medical history.
4- The new system must be just like a paper appointment book. Data entry must be easy as well as the viewing for appointments and patients reports. Thus, no need for training the personnel will be need.

5- The new System must generate an average of 60 reports per customers. These reports will have all the customers’ medical history, insurance information, and appointment cancellations as well as visits done per year and much more. Thus, these reports will facilitate to forecast the waiting time of a patient.

In an addition to the software issues that HHC clinics are having, the FIU IT Team may advise the clinics to improve the engaging conditions in each waiting room. Waiting rooms can be enhanced with TV, magazines, cookies, drinks, waters, laptops, games, moderated air conditioning as well as comfortable furniture. All these may contribute to an excellent customer satisfaction because a good software system alone will not be able to solve all the issues that the clinics are having.

Subsequent to FIU IT Team determined on the problems that the HHC is having and on most important features that the software system must provide, the next phase will be to design the new software system with these features.
GATHER INFORMATION AND SYSTEM ANALYSIS

Requirement Analysis

Functional Requirements

Based on the problems stated above, the medical system should have the following functional requirements:

1- Search appointments
2- Request for drivers
3- Schedule appointments
4- Cancel appointments
5- Change appointments
6- Login Users
7- View Patients’ Profile
8- View Patients’ Appointments
9- Request for Service
10- View Road Route
11- Overbook Appointments

Brief Explanations for the functional requirements stated above:

**Search for appointments**: This functionality will be initiated by the clerks. They will be able to search for appointments availability by date and hours.

**Request for drivers**: In this functionality, clerks will be able to fill out a form to request for a driver pick up on the day of the appointment.

**Schedule appointments**: Clerks will be able to schedule appointments by searching appointments availability by hours and dates.

**Cancel appointments**: Clerks will be able to cancel the appointments that they made, once they click on the cancel key functionality.

**Change appointments**: Clerks will be able to change the appointments that they made, once they click on the change key functionality.
**Login Users:** This functionality will prompt users to enter their username and password in order for them to have access to the database.

**View Patients’ Profile:** Doctors and Nurses will be able to have full access of patient’s profile that will include the patient’s medical history.

**View Patients, Appointments:** Clerks, Patients as well as drivers will be able to view the appointments made, once they click on the view appointment’s key.

**Request for Service:** In this functionality the nurse or medical assistant will be able to request additional services such as blood or rad test for the patient.

**View Road Route:** In this functionality the driver will be able to see the short-cut road routes. This road route will facilitate him/her to pick up the patients in a more efficient time matter.

**Overbook Appointments:** This functionality will be accessible by the clerk. He/She will be able to overbook appointments.

Based on the requirement functions, the following actors and function of the system are identified:

<table>
<thead>
<tr>
<th>Actors:</th>
<th>Functions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- Drivers</td>
<td>1-Search appointments</td>
</tr>
<tr>
<td>2-Doctors</td>
<td>2-Request for driver</td>
</tr>
<tr>
<td>3-Nurses</td>
<td>3-Schedule appointments</td>
</tr>
<tr>
<td>4-Medical Assistants</td>
<td>4-Cancel appointments</td>
</tr>
<tr>
<td>5- Clerks</td>
<td>5- Change Appointments</td>
</tr>
<tr>
<td>6- Insurance Company</td>
<td>6- Login Users</td>
</tr>
<tr>
<td>7- Patients</td>
<td>7-View Patients profile</td>
</tr>
<tr>
<td></td>
<td>8- View Appointments</td>
</tr>
<tr>
<td></td>
<td>9- Request for Service</td>
</tr>
<tr>
<td></td>
<td>10- View Road Route</td>
</tr>
<tr>
<td></td>
<td>11- Overbook Appointments</td>
</tr>
</tbody>
</table>
Based on our functional requirements, we will create a use case diagram that will model the system boundaries. After creating the use case diagram, we will create a use case narrative for each use case function.

**Use Case Diagram for the Medical Scheduling System**
This use case diagram only shows the primary actors of the system.

**Use Case Narratives**

**Scheduling Medical System**

**Author(s):** Mary De Faria and Virginia Metayer

<table>
<thead>
<tr>
<th>USE CASE NAME:</th>
<th>Search for Appointments</th>
<th>USE CASE TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE CASE ID:</td>
<td>N/A at this time</td>
<td>Business Requirements:</td>
</tr>
<tr>
<td>PRIORITY:</td>
<td>N/A at this time</td>
<td>✔</td>
</tr>
<tr>
<td>SOURCE:</td>
<td>N/A at this time</td>
<td></td>
</tr>
<tr>
<td>PRIMARY BUSINESS ACTOR:</td>
<td>Clerks</td>
<td></td>
</tr>
<tr>
<td>OTHER PARTICIPATING ACTORS:</td>
<td>Doctors, Nurses, Medical Assistants</td>
<td></td>
</tr>
<tr>
<td>OTHER INTERESTED STAKEHOLDERS:</td>
<td>N/A at this time</td>
<td></td>
</tr>
<tr>
<td>DESCRIPTION:</td>
<td>This use case describes the process of how clerks can search for appointments availability by dates and hours</td>
<td></td>
</tr>
<tr>
<td>PRE-CONDITION:</td>
<td>Patients need to be logged in, in order for she/he be able to search for appointments</td>
<td></td>
</tr>
<tr>
<td>TRIGGER:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TYPICAL COURSE OF EVENTS:</td>
<td>Step 1: This use case is initiated when clerks submit the search key functionality for the availability appointments dates and hours to be displayed.</td>
<td>Step 2: The clerk’s search criteria are compared against the database dates and hour’s availability.</td>
</tr>
<tr>
<td>ALTERNATE COURSES:</td>
<td>Step 2: If date is not available, a pop up window will be displayed, noticing the user to submit a new search criteria.</td>
<td></td>
</tr>
<tr>
<td>CONCLUSION:</td>
<td>N/A at this time</td>
<td></td>
</tr>
<tr>
<td>POST-CONDITION:</td>
<td>Appointments’ availabilities have been displayed to the user and as result user can schedule appointments based on the search criteria results.</td>
<td></td>
</tr>
<tr>
<td>BUSINESS RULES</td>
<td>N/A at this time</td>
<td></td>
</tr>
<tr>
<td>IMPLEMENTATION CONSTRAINTS AND SPECIFICATIONS</td>
<td>N/A at this time</td>
<td></td>
</tr>
<tr>
<td>ASSUMPTIONS:</td>
<td>N/A at this time</td>
<td></td>
</tr>
<tr>
<td>OPEN ISSUES:</td>
<td>N/A at this time</td>
<td></td>
</tr>
</tbody>
</table>
# Request for drivers

## USE CASE NAME:
Request for drivers

## USE CASE TYPE
**Business Requirements:**
☑

## PRIORITY:
N/A at this time

## SOURCE:
N/A at this time

## PRIMARY BUSINESS ACTOR:
Clerks

## OTHER PARTICIPATING ACTORS:
- Doctors
- Nurses
- Medical Assistants

## OTHER INTERESTED STAKEHOLDERS:
- N/A at this time

## DESCRIPTION:
This use case describes the process of how clerks request for drivers in order for patients to be pick up on the day of the appointment.

## PRE-CONDITION:
- Clerks need to be logged in, in order for she/he is able to request for a driver for to pick a patient.
- Clerks need to schedule for appointment before he/she is able to request for drivers.

## TRIGGER:
N/A at this time.

## TYPICAL COURSE OF EVENTS:

<table>
<thead>
<tr>
<th>Actor Action</th>
<th>System Response</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1:</strong> This use case is initiated when the clerk submits the request driver form.</td>
<td><strong>Step 2:</strong> Once request driver form has been received, this information is inserted into the database and placed at the patient’s appointments profile.</td>
</tr>
<tr>
<td><strong>Step 3:</strong> This use case concludes when clerks receive an approved request response with a pick up time.</td>
<td></td>
</tr>
</tbody>
</table>

## ALTERNATE COURSES:
N/A at this time.

## CONCLUSION:
N/A at this time

## POST-CONDITION:
Clerk request has been saved into the database and the picking up time has been displayed to the clerk and saved into the database.

## BUSINESS RULES
N/A at this time

## IMPLEMENTATION CONSTRAINTS AND SPECIFICATIONS
N/A at this time

## ASSUMPTIONS:
N/A at this time

## OPEN ISSUES:
N/A at this time
## Schedule Appointment

**USE CASE NAME:** Schedule Appointment  

**USE CASE ID:** N/A at this time  

**PRIORITY:** N/A at this time  

**SOURCE:** N/A at this time  

**PRIMARY BUSINESS ACTOR:** Clerks  

**OTHER PARTICIPATING ACTORS:**  
- Doctors  
- Nurses  
- Medical Assistants  

**OTHER INTERESTED STAKEHOLDERS:** N/A at this time  

**DESCRIPTION:** This use case describes the process of how clerks can schedule appointments.  

**PRE-CONDITION:**  
- Clerks need to be logged in, in order for she/he to be able to schedule appointments.  
- Clerks need to search for available dates and hours before she/he can schedule appointments.  

**TRIGGER:** N/A at this time.  

### TYPICAL COURSE OF EVENTS:  

<table>
<thead>
<tr>
<th>Actor Action</th>
<th>System Response</th>
</tr>
</thead>
</table>
| **Step 1:** This use case is initiated when clerks submits the schedule appointment form. | **Step 2:** For each appointment request, the database is validated in order to check if the data and time requested is available.  
**Step 3:** Once data and time is validated true, the information is saved into the database.  
**Step 4:** The database generates a schedule appointment confirmation notice that has data and time.  
**Step 3:** This use case concludes when clerks receive an approved request response with a pick up time. |

### ALTERNATE COURSES:  

N/A at this time.  

### CONCLUSION:  

N/A at this time.  

### POST-CONDITION:  

Clerks schedule request has been saved into the database. A schedule confirmation appointment ticket has been displayed in the screen.  

**BUSINESS RULES:** N/A at this time.
## USE CASE NAME:
Cancel Appointment

## USE CASE ID:
N/A at this time

## PRIORITY:
N/A at this time

## SOURCE:
N/A at this time

## PRIMARY BUSINESS ACTOR:
Clerks

## OTHER PARTICIPATING ACTORS:
- Doctors
- Nurses
- Medical Assistants

## OTHER INTERESTED STAKEHOLDERS:
- N/A at this time

## DESCRIPTION:
This use case describes the process of how clerks can cancel appointments.

## PRE-CONDITION:
- Clerks need to be logged in, in order for she/he is to be able to cancel appointments.
- Clerks need to schedule an appointment in order for she/he be able to cancel it.

## TRIGGER:
N/A at this time.

## TYPICAL COURSE OF EVENTS:

<table>
<thead>
<tr>
<th>Actor Action</th>
<th>System Response</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1:</strong> This use case is initiated when clerks submits the key functionality to cancel an appointment.</td>
<td><strong>Step 2:</strong> For each cancellation request, the time and data reserved is marked from the database.</td>
</tr>
<tr>
<td><strong>Step 5:</strong> This use case is concluded when clerks receive a cancellation appointment confirmation notice.</td>
<td><strong>Step 3:</strong> The system sends a cancellation confirmation to the user.</td>
</tr>
<tr>
<td><strong>Step 4:</strong> The marked entrance is only deleted on the time of system maintenance.</td>
<td></td>
</tr>
</tbody>
</table>

## ALTERNATE COURSES:
N/A at this time.

## CONCLUSION:
N/A at this time

## POST-CONDITION:
- Clerk's cancellation request has been marked invalid into the database.
- A cancellation confirmation appointment ticket has been displayed in the screen.

## BUSINESS RULES
N/A at this time

## IMPLEMENTATION CONSTRAINTS AND
N/A at this time
## Scheduling Medical System

Author(s): Mary De Faria and Virginia Metayer

### USE CASE NAME: Change Appointments

### USE CASE TYPE

**Business Requirements:**

☑

### PRIMARY BUSINESS ACTOR:

Clerks

### OTHER PARTICIPATING ACTORS:

- Doctors
- Nurses
- Medical Assistants

### OTHER INTERESTED STAKEHOLDERS:

- N/A at this time

### DESCRIPTION:

This use case describes the process of how clerks can change appointments.

### PRE-CONDITION:

- Clerks need to be logged in, in order for she/he is to be able to change appointments.
- Clerks need to schedule an appointment in order for she/he is able to change it.

### TRIGGER:

N/A at this time.

### TYPICAL COURSE OF EVENTS:

<table>
<thead>
<tr>
<th>Step</th>
<th>Actor Action</th>
<th>System Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>This use case is initiated when clerks submits the key functionality to change an appointment.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>The data entered is automatically changed into the database.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>The system sends a confirmation message to the user with the new appointment information details.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>This use case is concluded when clerks receive a confirmation appointment change notice.</td>
<td></td>
</tr>
</tbody>
</table>

### ALTERNATE COURSES:

N/A at this time.

### CONCLUSION:

N/A at this time.

### POST-CONDITION:

- A change appointment confirmation appointment ticket has been displayed in the screen with appointment details.

### BUSINESS RULES

N/A at this time

### IMPLEMENTATION CONSTRAINTS AND SPECIFICATIONS

N/A at this time

### ASSUMPTIONS:

N/A at this time

### OPEN ISSUES:

N/A at this time
Login Users

Business Requirements: ✔

**Description:**
This use case describes the process of how the users mentioned above have to log in into the system in order to be able to have access to the database.

**Pre-condition:** N/A at this time

**Trigger:** N/A at this time.

**Typical Course of Events:**

<table>
<thead>
<tr>
<th>Actor Action</th>
<th>System Response</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1:</strong> This use case is initiated by the users mentioned above, when they send a request to login to the system.</td>
<td><strong>Step 2:</strong> Password and username is validated with the ones in the database.</td>
</tr>
<tr>
<td><strong>Step 4:</strong> This use case is conclude when the user logs out to exit the system.</td>
<td><strong>Step 3:</strong> Once validation is true, the system is open.</td>
</tr>
</tbody>
</table>

**Alternate Courses:** N/A at this time.

**Conclusion:** N/A at this time

**Post-condition:** Users logout to exit the system.

**Business Rules:** N/A at this time

**Implementation Constraints and Specifications:** N/A at this time

**Assumptions:** N/A at this time

**Open Issues:** N/A at this time
Scheduling Medical System
Author(s): Mary De Faria and Virginia Metayer

<table>
<thead>
<tr>
<th>USE CASE NAME:</th>
<th>View Patients’ Profile</th>
<th>USE CASE TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE CASE ID:</td>
<td>N/A at this time</td>
<td></td>
</tr>
<tr>
<td>PRIORITY:</td>
<td>N/A at this time</td>
<td></td>
</tr>
<tr>
<td>SOURCE:</td>
<td>N/A at this time</td>
<td></td>
</tr>
</tbody>
</table>
| PRIMARY BUSINESS ACTOR: | • Doctors  
• Nurses  
• Medical Assistants | |
| OTHER PARTICIPATING ACTORS: | N/A at this time | |
| OTHER INTERESTED STAKEHOLDERS: | N/A at this time | |
| DESCRIPTION:   | This use case describes the process of how the users mentioned above can view patients’ profile. | |
| PRE-CONDITION: | N/A at this time | |
| TRIGGER:       | N/A at this time | |
| TYPICAL COURSE OF EVENTS: | Actor Action | System Response |
|                | Step 1: This use case is initiated by the users mentioned above, when they send a request view patients’ profile. | Step 2: Password and username is validated with the ones in the database. |
|                | Step 4: This use case is conclude when the users receive a full profile of patient’s medical history as well as appointments scheduled before. | Step 3: Once validation is true, the user will have full access to the patient profile. |
|                | Step 4: System will display the patients’ profile to the user. | |
| ALTERNATE COURSES: | N/A at this time. | |
| CONCLUSION:    | N/A at this time | |
| POST-CONDITION: | Users receive a display list of patients’ profile. | |
| BUSINESS RULES | N/A at this time | |
| IMPLEMENTATION CONTRAINTS AND SPECIFICATIONS | N/A at this time | |
| ASSUMPTIONS:   | N/A at this time | |
| OPEN ISSUES:   | N/A at this time | |
## Scheduling Medical System

Author(s): Mary De Faria and Virginia Metayer

<table>
<thead>
<tr>
<th>USE CASE NAME</th>
<th>View Patients’ Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE CASE ID</td>
<td>N/A at this time</td>
</tr>
<tr>
<td>PRIORITY</td>
<td>N/A at this time</td>
</tr>
<tr>
<td>SOURCE</td>
<td>N/A at this time</td>
</tr>
<tr>
<td>PRIMARY BUSINESS ACTOR:</td>
<td>Clerk, Drivers</td>
</tr>
<tr>
<td>OTHER PARTICIPATING ACTORS:</td>
<td>N/A at this time</td>
</tr>
<tr>
<td>OTHER INTERESTED STAKEHOLDERS</td>
<td>N/A at this time</td>
</tr>
<tr>
<td>DESCRIPTION</td>
<td>This use case describes the process of how the users mentioned above can view the patients’ appointments.</td>
</tr>
<tr>
<td>PRE-CONDITION</td>
<td>Users need to enter her/his username and password.</td>
</tr>
<tr>
<td>TRIGGER</td>
<td>N/A at this time</td>
</tr>
</tbody>
</table>

### TYPICAL COURSE OF EVENTS:

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Actor Action</th>
<th>System Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>This use case is initiated by the users mentioned above, when they send a request view patients’ appointments.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td>Password and username is validated with the ones in the database.</td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td>Once validation is true, the user will have full access to the patient appointment details.</td>
<td></td>
</tr>
<tr>
<td>Step 4</td>
<td>System will display the patients’ appointment details to the user.</td>
<td></td>
</tr>
</tbody>
</table>

### ALTERNATE COURSES:

N/A at this time.

### CONCLUSION:

N/A at this time.

### POST-CONDITION:

Users receive a display list of patients’ appointment details.

### BUSINESS RULES:

N/A at this time.

### IMPLEMENTATION CONSTRAINTS AND SPECIFICATIONS:

N/A at this time.

### ASSUMPTIONS:

N/A at this time.

### OPEN ISSUES:

N/A at this time.
## Request for Service

**USE CASE ID:** N/A at this time

**PRIORITY:** N/A at this time

**SOURCE:** N/A at this time

**PRIMARY BUSINESS ACTOR:**
- Nurses
- Medical Assistants

**OTHER PARTICIPATING ACTORS:**
- Doctors

**OTHER INTERESTED STAKEHOLDERS:** N/A at this time

**DESCRIPTION:** This use case describes the process of how the users mentioned above can request for additional services for the patients.

**PRE-CONDITION:** Users need to enter her/his username and password.

**TRIGGER:** N/A at this time.

### TYPICAL COURSE OF EVENTS:

<table>
<thead>
<tr>
<th>Actor Action</th>
<th>System Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1:</td>
<td>Step 2: System saves the requested service into the database.</td>
</tr>
<tr>
<td>This use case is initiated by the users mentioned above, when they enter services for patients.</td>
<td></td>
</tr>
<tr>
<td>Step 3:</td>
<td></td>
</tr>
<tr>
<td>This use case is conclude when the users log out the system.</td>
<td></td>
</tr>
</tbody>
</table>

**ALTERNATE COURSES:** N/A at this time.

**CONCLUSION:** N/A at this time

**POST-CONDITION:** Users logout to exit the system.

**BUSINESS RULES**

**IMPLEMENTATION CONSTRAINTS AND SPECIFICATIONS**

**ASSUMPTIONS:** N/A at this time

**OPEN ISSUES:** N/A at this time
Scheduling Medical System
Author(s): Mary De Faria and Virginia Metayer

<table>
<thead>
<tr>
<th>USE CASE NAME:</th>
<th>View Road Route</th>
<th>USE CASE ID:</th>
<th>N/A at this time</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRIORITY:</td>
<td>N/A at this time</td>
<td>SOURCE:</td>
<td>N/A at this time</td>
</tr>
<tr>
<td>PRIMARY BUSINESS ACTOR:</td>
<td>Drivers</td>
<td>OTHER PARTICIPATING ACTORS:</td>
<td>N/A at this time</td>
</tr>
<tr>
<td>OTHER INTERESTED STAKEHOLDERS:</td>
<td>N/A at this time</td>
<td>DESCRIPTION:</td>
<td>This use case describes the process of how the drivers can view road routes to pick patients.</td>
</tr>
<tr>
<td>PRE-CONDITION:</td>
<td>Users have to log in into the system.</td>
<td>TRIGGER:</td>
<td>N/A at this time.</td>
</tr>
<tr>
<td>TYPICAL COURSE OF EVENTS:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 1: This use case is initiated by drivers when they send a request to view the road routes of the patients.</td>
<td>Step 2: Password and username is validated with the ones in the database.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 3: Once validation is true, the system is open.</td>
<td>Step 4: Road Route is displayed to the user.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 4: This use case is concluded when the user receives the road routes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALTERNATE COURSES:</td>
<td>N/A at this time.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONCLUSION:</td>
<td>N/A at this time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POST-CONDITION:</td>
<td>The road routes of the patients are displayed into the screen.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BUSINESS RULES:</td>
<td>N/A at this time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IMPLEMENTATION CONSTRAINTS AND SPECIFICATIONS:</td>
<td>N/A at this time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASSUMPTIONS:</td>
<td>N/A at this time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPEN ISSUES:</td>
<td>N/A at this time</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Scheduling Medical System
Author(s): Mary De Faria and Virginia Metayer

<table>
<thead>
<tr>
<th>USE CASE NAME:</th>
<th>Overbook Appointments</th>
<th>USE CASE TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE CASE ID:</td>
<td>N/A at this time</td>
<td>Business Requirements:</td>
</tr>
<tr>
<td>PRIORITY:</td>
<td>N/A at this time</td>
<td>✓</td>
</tr>
<tr>
<td>SOURCE:</td>
<td>N/A at this time</td>
<td></td>
</tr>
<tr>
<td>PRIMARY BUSINESS ACTOR:</td>
<td>• Clerks</td>
<td></td>
</tr>
<tr>
<td>OTHER PARTICIPATING ACTORS:</td>
<td>N/A at this time</td>
<td></td>
</tr>
<tr>
<td>OTHER INTERESTED STAKEHOLDERS:</td>
<td>N/A at this time</td>
<td></td>
</tr>
<tr>
<td>DESCRIPTION:</td>
<td>This use case describes the process of how clerks can overbook appointments.</td>
<td></td>
</tr>
<tr>
<td>PRE-CONDITION:</td>
<td>Users need to enter her/his username and password.</td>
<td></td>
</tr>
<tr>
<td>TRIGGER:</td>
<td>N/A at this time</td>
<td></td>
</tr>
<tr>
<td>TYPICAL COURSE OF EVENTS:</td>
<td>Actor Action</td>
<td>System Response</td>
</tr>
<tr>
<td>Step 1:</td>
<td>This use case is initiated by the user mentioned above, when they send a request to overbook appointments.</td>
<td>Step 2: Overbook appointments are temporarily stored into the database.</td>
</tr>
<tr>
<td>Step 3:</td>
<td>User can read and print the overbook appointment list.</td>
<td></td>
</tr>
<tr>
<td>Step 4:</td>
<td>This use case is concluded when user receives a confirmation of the overbooking appointment made.</td>
<td></td>
</tr>
<tr>
<td>ALTERNATE COURSES:</td>
<td>N/A at this time</td>
<td></td>
</tr>
<tr>
<td>CONCLUSION:</td>
<td>N/A at this time</td>
<td></td>
</tr>
<tr>
<td>POST-CONDITION:</td>
<td>User receive a confirmation of the overbook appointment made.</td>
<td></td>
</tr>
<tr>
<td>BUSINESS RULES</td>
<td>N/A at this time</td>
<td></td>
</tr>
<tr>
<td>IMPLEMENTATION CONSTRAINTS AND SPECIFICATIONS</td>
<td>N/A at this time</td>
<td></td>
</tr>
<tr>
<td>ASSUMPTIONS:</td>
<td>N/A at this time</td>
<td></td>
</tr>
<tr>
<td>OPEN ISSUES:</td>
<td>N/A at this time</td>
<td></td>
</tr>
</tbody>
</table>
**FORMULATE/DEVELOP ALTERNATIVES**

Non-Functional Requirements

<table>
<thead>
<tr>
<th><strong>Interface requirements</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The systems should be able to accommodate users at different locations</td>
</tr>
<tr>
<td>The system should allow the public to interact with the clinic’s personnel</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Performance requirement</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The system should have response time of 5 secs</td>
</tr>
<tr>
<td>The system should be able to hold 100 users at 200 kb</td>
</tr>
<tr>
<td>The system should be accessible by the public</td>
</tr>
<tr>
<td>The system’s database should only be changed by authorized maintenance personnel</td>
</tr>
<tr>
<td>The system should allow only registered users to view database information</td>
</tr>
<tr>
<td>The systems should request different types of access codes according to the type of user</td>
</tr>
<tr>
<td>The system should provide reports as word documents and Excel</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Environmental requirements</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The system should operate in a room with a temperature between 5 and 45 degrees Celsius</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Economics requirements</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The system’s update cost should not be more than 15% of the total cost, and requires financial management approval</td>
</tr>
</tbody>
</table>
CONTEXT DIAGRAM
Above is the context diagram that shows the Medical Scheduling System’s boundaries.

**PROCESS MODEL**
This decomposition diagram shows a high-level system, in this case the medical system, broken down into lower level functions. For instance, this decomposition diagram represents the medical scheduling system that will be constructed for the HHC clinics.

**Functional Decomposition Diagram**

The first level is the system, followed by the second level which has the subsystems and finally, the third level had events of the system.
As we can notice, doctors and nurses are able to see patients and request additional services by logging into the system. In addition to that, patients need to register first in order for them have access to the Patient profile system. In the patient profile system, patients will have access to search for appointments, schedule, change, as well as cancel it. Once they have registered, the patient will be sent an email confirmation with their username and password information. Every time, a patient wants to see his/her profile, he/she will need to login into the system. Finally, in order for clerks, be able to search for appointment, schedule, change and cancel it, he/she will also have to log into the system.

**Logical Data Flow Diagrams**

In this data flow diagram, we assume that the user is already logged in into the system.

We have three square drawings. The first one represents the user interfaces, the second represents the process functions and finally, the last one represents the database. Below are the data flow diagrams of the following events:

**Search appointments**
Change appointments

View Patients Appointments

View Patients’ Profile
<table>
<thead>
<tr>
<th>Subsystem</th>
<th>Actor</th>
<th>Event (or Use Case)</th>
<th>Trigger</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appointment Scheduling</td>
<td>Clerk</td>
<td>Change appointments</td>
<td>Change appointment request</td>
<td>Display Patient ID, Name, New Date, Time, Clinic’s address and/or pick up time</td>
</tr>
<tr>
<td>Patients History</td>
<td>Doctors and Nurses</td>
<td>View Patients’ Profile</td>
<td>View Patients’ Profile request</td>
<td>Display patients’ full medical history and visits to the clinics’ details.</td>
</tr>
<tr>
<td>Van Scheduling</td>
<td>Clerks, Drivers</td>
<td>View Patients’ Appointment</td>
<td>View patients’ appointment request</td>
<td>Display Patient ID, Name, Time, Clinic’s address and/or pick up time</td>
</tr>
<tr>
<td>Van Scheduling</td>
<td>Drivers</td>
<td>View Road Route</td>
<td>view Road Route request</td>
<td>Show Patient’s address, clinic’s Address, pick up time, appointment time, Road route and estimated time</td>
</tr>
<tr>
<td>Appointment Scheduling</td>
<td>Clerks</td>
<td>Overbooking</td>
<td>Overbooking request</td>
<td>Display the patient’s name, address, and confirmation number.</td>
</tr>
<tr>
<td>Appointment Scheduling</td>
<td>Clerks</td>
<td>Cancel Appointments</td>
<td>Cancel appointments request</td>
<td>Display patients’ cancellation confirmation</td>
</tr>
<tr>
<td>Appointment Scheduling</td>
<td>Clerks</td>
<td>Schedule Appointments</td>
<td>Schedule appointments request</td>
<td>Display patients’ schedule appointment confirmation details such as Name, time, Date, and clinic’s address</td>
</tr>
<tr>
<td>Patients History</td>
<td>Nurses and Medical Assistants</td>
<td>Request for Service</td>
<td>Request for additional services for patients</td>
<td>Patients request service confirmation</td>
</tr>
</tbody>
</table>
**EVALUATE ALTERNATIVES**

**Decision Analysis**

Since, we already know that one of the crucial problems that HHC clinics are facing is the waiting time; we decided to choose the best scheduling software that clinics and hospitals have been using in today’s market. Thus, in order to come out with the best solution as possible to solve the scheduling issues of HHC, three scheduling system candidates were deeply evaluated in order to choose the best one. Candidate 1 is assumed to be In-house solution and candidate 2 is assumed to be COTS system. COTS system’s development continues to involve significant technical risk and promises of lower cost, higher reliability and easier modernization. Candidate 3 will be an extension of candidate 2 in case candidate 2 does not fulfil all the requirement analysis that the new medical system must have.

**Candidate 1**

**Scheduleview Software**

Scheduleview Software designed by Quick Books is used by a lot of small businesses. This ultimate appointment scheduling software has features of programs that cost thousand of dollars. These features are:

(1) Synchronization with QuickBooks;
(2) Synchronization with Outlook Calendar;

(3) Ability to create QuickBooks(tm) invoices from an appointment;

(4) Ability to prevent double of appointments;

(5) Ability to customize what shows on the main schedule screen and appointment grid report;

(6) Ability to create POPUP appointment reminders;

(7) Ability to print birthday labels for birthday cards or letters;

(8) Ability to print advanced reports such as Customer Analysis Report;

(9) Provider Analysis Report;

(10) Service Code Analysis Report;

(11) Ability to Customize the terms we use for Customers

(12) Ability to print the Waiting List report

**Candidate 2**
**Scheduling Software**

The scheduling Software is one of the ultimate management software available for hospitals in today’s market. This software has been used in more than 3000 national hospitals as well as overseas hospitals and clinics. The software has the following features:

(1) **Resource-centric scheduling** – This gives you a traditional "appointment book" view of resources, making the work very quick and facilitating the basic scheduling.

(2) **Procedure-centric scheduling** – It allows your central administrator to simply request a procedure such as patients medical history. Then the system searches the entire enterprise for the resource that most closely matches the patient's need and location.
(3) **Protocol-based scheduling** -- It takes complex treatment protocols involving multiple visits and resources, and allows you to schedule an entire patient regimen with a single click. If the patient misses an appointment, the system automatically adjusts future appointments to maintain the protocol.

(4) **Rules-based scheduling** – It analyzes clinical protocols, insurance requirements and any other inputs your organization requires to validate every scheduling request. For instance, the system will flag a series of incompatible procedures that would lead to an adverse reaction, or notify you of a scheduling request that is not authorized by the patient’s insurance plan.

This solution can be integrated with three different modules:

1) Automated phone reminder System
2) Automated Email reminder System
3) Off-Site Data Backup
4) Billing Data Transmission

**Candidate 3**  
**The Ultimate Scheduling Soft**

The Ultimate Scheduling Soft is also assumed to be a COTS system that will be modified by FIU IT Team, in order to fully solve the HHC scheduling Issues. Having in consideration that the two other candidates may not fully fulfil the HHC Requirement analysis, the FIU IT Team would redesign a system that would use mostly of the candidate 1 and 2 features and some additional ones that may complete the HHC clinics.
scheduling system requirement analysis. Therefore, besides the features that candidate 1 and 2 have this system also has the following features:

(1)- Allow the driver to have access to all the appointments made throughout the day

(2)- Network connection with a database and a touch down screen in the waiting room, to automatically forecast the waiting time once a patient touches the screen.

Every time a customer enters the waiting room, a computer would be available in order for the customer to be able to touch on the screen to sign in. When the customer touches the screen the customer’s name and time of arrival would then go to a centralized database. Once a doctor is ready for the patient, he or she then would touch the screen again to sign out. By doing so, the waiting time would be registered and forecasted in the future.

**Network Infrastructure:** It will run on a single PC or local network area. It addition, it will also run with MYSQL server databases and it will connect multiple sites via internet.

**Scheduling:** It will

- Schedule appointments with multiple resources,

- Assign unique time lengths for each procedure,

  Schedule patients at multiple sites and it will have an automated waiting list as well as overbooking functionality.

In addition to that, the will give the driver the ability to see the patients’ road routes in order for him/she be able to find the best route to minimize the pick up time.

**Viewing:** It will have

- Daily, weekly and monthly viewing

- Appointment’s history
• View appointments at other locations
• Mouse-over appointment to see details
• Complete audit trail to each appointment

**Reports:** The system will print

• Appointment Lists
• No-shows cancellations
• Print patients reminder letters and it will also print the full patient’s medical history

**Candidates Software Issues**

**Candidate 1:** The biggest problem of it, is that, although this candidate is very friendly use, it does not easily integrated with other software that may be necessary to fully fulfil the HHC medical system issues. In addition to that, this system does not have any data restriction to the user and it does not allow the customer to do all the customizations necessaries to perform the clinics requirement analysis.

**Candidate 2:** This system would solve almost all the scheduling issues that HHC clinics have but this system does not provide the overbooking function and the ability for the drivers to see the patients’ road routes as well as appointment times. Although, this is a very sophisticate system, it lacks on some functionalities that the HHC clinics scheduling system may need in order to solve the scheduling issues that the clinics are facing.

**Candidate 3:** The only problem of this solution is that, this system would be re-designed to meet the HHC requirement analysis and time might be an issue since only 3 months
were given to implement the project. Although, COTS systems have been purchased more and more, there are still problems and challenges for COTS products because they come with their own architectural concepts that may not match those of HHC system has. COTS products also have built-in assumptions about how they will be used, which in some cases as mentioned before, time and money could be issues.

Assuming that these three systems have compatible technologies with the current system a candidate matrix as well as feasibility analysis will be made in the next pages in order to decide which of the system will be implemented in order to solve the HHC clinics scheduling problems.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Candidate 1</th>
<th>Candidate 2</th>
<th>Candidate 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Portion of System</strong></td>
<td><strong>Computerized</strong></td>
<td><strong>Computerized</strong></td>
<td><strong>Computerized</strong></td>
</tr>
<tr>
<td>Some functions of the system are very quick and easy to use and they work just like the Paper-Based System</td>
<td>Almost all functions are very quick and easy to use just like paper-based system and the also this system integrates with automated phone call and email systems.</td>
<td>Same as candidate 2. All the 8 HHC Clinics would have access to the same database. Driver would have access to a restricted area of the database</td>
<td></td>
</tr>
<tr>
<td><strong>Benefits</strong></td>
<td>This solution Can be implemented quick because it is a purchased</td>
<td>Same as Candidate 1</td>
<td>This solution may fulfil all the requirement analysis that the HHC</td>
</tr>
</tbody>
</table>

Candidate Matrix Analysis
<table>
<thead>
<tr>
<th><strong>Servers and Workstations</strong></th>
<th>Pentium IV, MS windows 2003 class servers and workstations</th>
<th>Pentium IV, Linux or Apache class servers</th>
<th>Pentium IV, Windows 2005 Server</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Software Tools Needed</strong></td>
<td>Java and MS Outlook Express for email</td>
<td>PHP for customization of package to provide report writing and integration</td>
<td>Visual Basic, HTML and Windows 2003 GUI</td>
</tr>
<tr>
<td><strong>Application Software</strong></td>
<td>Package Solution</td>
<td>Package Solution</td>
<td>Custom Solution</td>
</tr>
<tr>
<td><strong>Method of Data Processing</strong></td>
<td>Client/Server</td>
<td>Client/Server</td>
<td>Client/Server</td>
</tr>
<tr>
<td><strong>Output Devices And implementation</strong></td>
<td>HP4MV laser printer</td>
<td>1-Network Router 2- HP Scan jet 4C Flatbed Scanner 3- HP4MV laser printer</td>
<td>1-Network Router 2- HP Scan jet 4C Flatbed Scanner 3- HP4MV laser printer</td>
</tr>
<tr>
<td><strong>Input Devices and Implications</strong></td>
<td>Keyboard &amp; mouse</td>
<td>Same as candidate 1</td>
<td>Same as candidate 1</td>
</tr>
<tr>
<td><strong>Storage Devices and Implications</strong></td>
<td>MYSQL Server DBMS with Up to 100GB arrayed capability</td>
<td>MYSQL Server DBMS with Up to 100GB arrayed capability</td>
<td>MYSQL Server DBMS with Up to 200GB arrayed capability</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Table 1.4 Candidate Matrix Analyses</strong></th>
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<tbody>
<tr>
<td><strong>Feasibility</strong></td>
</tr>
<tr>
<td><strong>Operational Criteria</strong></td>
</tr>
<tr>
<td><strong>Functionality</strong></td>
</tr>
<tr>
<td><strong>Technical Feasibility</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Score</strong></th>
<th><strong>Score</strong></th>
<th><strong>Score</strong></th>
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</thead>
<tbody>
<tr>
<td>60</td>
<td>75</td>
<td>100</td>
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</tbody>
</table>

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### Table 1.5 Feasibility Analyses

<table>
<thead>
<tr>
<th>Economic Feasibility</th>
<th>Score: 90</th>
<th>1- Approximately $20,000</th>
<th>1- Approximately $6525 per each five users and $1000.00 per location</th>
<th>3- Total cost to develop will be $85,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- Cost to purchase</td>
<td>30%</td>
<td>2- $125.00/hr</td>
<td>2- $75.00-$95/hr</td>
<td>2- $25/hr to maintain</td>
</tr>
<tr>
<td>2- Cost to maintain</td>
<td></td>
<td></td>
<td>If a system failure occurs</td>
<td></td>
</tr>
<tr>
<td>3- Cost to develop</td>
<td></td>
<td></td>
<td><strong>Score: 85.00</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Schedule Feasibility</th>
<th>Score: 95</th>
<th>Less than a week to be shipped and less than one hour to install.</th>
<th>Less than a month to be shipped worldwide and less than a day to be installed nationwide</th>
<th>Less than 3 months to be developed</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td></td>
<td><strong>Score: 95</strong></td>
<td><strong>Score: 100</strong></td>
<td></td>
</tr>
</tbody>
</table>

| Ranking                       | 100%      | 72%                                                               | 85%                                                                                | 89%                                    |

#### Feasibility Matrix Analysis

**Candidate 1:**

1. Approximately $20,000

2. $125.00/hr maintenance fee

It is a very affordable system but maintenance fee is too high.

For example: If it takes an average of 10 hours/ per week to maintain the system

Then, the clinic would spend:

- $125.00 x 10 = $1250.00 per week to maintain the system
- $125.00 x 4 = $5000.00 monthly maintenance fee
- $5000.00 x 12 = $60,000 per year maintain the system

Thus the total price for the system would be:

Maintenance costs + system cost

$60,000 + $20,000 = $80,000

Although, candidate 1 seems to be way cheaper than the rest of the candidates, in a one year cycle it would basically cost as much as the other candidates.
Candidate 2

Costs Involved

<table>
<thead>
<tr>
<th>(Per person)</th>
<th>(Per Clinic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$6525 for every five person</td>
<td>$1000.00</td>
</tr>
</tbody>
</table>

Thus an increase in the workforce of the clinics throughout the years would dramatically increase the cost of this system.

For Example: If 50 staff including doctors and drivers uses this system, it would cost

\[
\frac{50 \text{ (staff members)}}{5} = 10 \text{ (every five person)} = 10 \\
10 \times ($3525) = \$65,250
\]

50 (staff members)/5 (every five person) = 10

Thus, 10x ($3525) = \$65,250

Thus so far, we have a total cost of

8x1000,00= \$8000.00

Thus, assuming that the system has an annual maintenance fee of

\$2000.00

\$73,250 + \$2000.00

Total: \$93,250.00

**Problems:** The biggest problem is that an increase in the workforce would be an increase in the software usage. Meaning that in the long run, this software may be very costly.

Candidate 3:

Since candidate 3 has the highest ranking in the feasibility analysis matrix, this candidate will be the solution for the new scheduling system for HHC clinics. Candidate 1 is the cheapest solution but the problem is that this candidate lacks on the requirement necessary for the new scheduling system.

On the other hand, candidate 2 has almost all the features needed for the new scheduling system but the problem is that this system can get very expensive in the long-run, due to the fact, that its costs are calculated per number of person that uses the software.

**Estimated Costs for upgrading a COTS system**
Since the FIU IT Team has decided to purchase a COTS solution, the upgrading costs for the candidate 3 (The Ultimate Schedule Software) will be:

**COTS- SYSTEM COSTS**

**Personnel:**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>System Analysts (400 hours/ea $50.00/hr)</td>
<td>$40,000</td>
</tr>
<tr>
<td>4</td>
<td>Programmer/Analysts (250 hours/ea 35.00 hr)</td>
<td>$35,000</td>
</tr>
<tr>
<td>1</td>
<td>System Architect (100 hours/ea $50.00/hr)</td>
<td>$5,000</td>
</tr>
<tr>
<td>1</td>
<td>Database Specialist (15 hours/ea $45.00/hr)</td>
<td>$675</td>
</tr>
</tbody>
</table>

**New Hardware and Software**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DBMS server software</td>
<td>$1,500</td>
</tr>
<tr>
<td>1</td>
<td>DBMS Client software (950.00 per client)</td>
<td>$950.00</td>
</tr>
</tbody>
</table>

**TOTAL DEVELOPMENT COSTS:**  $83,625

**SOFTWARE ANNUAL OPERATING COSTS**

**Personnel:**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Programmer/Analysts (125 hours/ea $35.00/hr)</td>
<td>$8,750</td>
</tr>
<tr>
<td>1</td>
<td>System Librarian (20 hours/ea $15.00/hr)</td>
<td>$300.00</td>
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</table>

**Expenses:**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
<th>Cost</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Maintenance Agreement for Server</td>
<td>$995.00</td>
</tr>
<tr>
<td>1</td>
<td>Maintenance Agreement for Server DBMS software</td>
<td>$525.00</td>
</tr>
<tr>
<td></td>
<td>Pre-printed forms ($15,000 year @ .22/form)</td>
<td>$3,300</td>
</tr>
</tbody>
</table>

**TOTAL PROJECTED ANNUAL COSTS:**  $13,870

Since, there is a total budget of $150,000 dollars allocated for the development or purchase of the new system but only $96,995 dollars would cost to update it, then the
new system would have maintenance and pre-printed forms provided for approximately 3½ years more.

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Not Available</th>
<th>Available Poor Fit</th>
<th>Available</th>
<th>Available Good Fit</th>
</tr>
</thead>
<tbody>
<tr>
<td>View Patients Appts</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

**IMPLEMENT BEST ALTERNATIVES**

**GAP ANALYSIS**

**Candidate 1**

**Customization Options:**

1. Vendor will customize: Up to certain extent  
2. Access to database: No  
3. Access to source code: No  
4. Designed for Bolt-On: Only to some programs

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<thead>
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<th>Schedule Appts.</th>
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<tbody>
<tr>
<td>Cancel Appts.</td>
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<td>Change Appts.</td>
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<td>Search Appts.</td>
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<tr>
<td>View Road Route</td>
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<tr>
<td>Request Driver</td>
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<tr>
<td>Request Services</td>
<td>X</td>
<td></td>
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<tr>
<td>View Patient Profile</td>
<td></td>
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<td>Overbook</td>
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<td>Security Login</td>
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<td>Reporting Features</td>
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<td>Feature</td>
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<tr>
<td>Multi-Lng. Interface</td>
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<td>Reminder Letters</td>
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<td>Network Optimized</td>
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<td>Requirements</td>
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<td>Available</td>
<td>Available Good Fit</td>
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**Candidate #: 2**

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<table>
<thead>
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<th>Network Opt.</th>
<th>Requirements</th>
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<th>Poor Fit</th>
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<th>Good Fit</th>
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**Customization Options:**

1. Vendor will customize: Yes
2. Access to database: No
3. Access to source code: No
4. Designed for Bolt-On: Limited

**Candidate #: 3**

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**Customization Options:**

1. Vendor will customize: Yes
2. Access to database: Yes
3. Access to source code: Yes
4. Designed for Bolt-On: As needed

**APPLICATION ARCHITECTURE PHASE**

**System Architecture**

The software architecture is the structure of the system, which comprise software elements, the externally visible properties of those elements, and the relationships among them. On the next pages, there will be diagrams of how the system will be structured.

The scheduling system will consist of:

**System characteristics**

- Client/Server
- My SQL Server – Windows 2003
- Server connected by WAN and PBX and VPN Link
- Centralized Database (My SQL DBSM) with up to 200GB arrayed capability
- Programming Languages:
  Visual Basic
Physical Process Models

Network Diagram
As we can see, the main server will be connected at Coral Gables office and the information will be transmitted by VPN Link to the other remote office.

Physical Data Flow Diagram
As we can see, the database will have 4 tables. The tables are Patients’ Insurance Information, Appointments, Medical History, as well as arrival and departure time. All of the information will be stored in a centralized database which will be located at the Coral Gables office. The Coral Gables Server will be connecting to the other services by using WAN (Wide Area Network) PBX Link communication.

**Network Diagram**
Interface Prototypes

i) One input Interface ---- Physical Data Flow Implementation (as on-line Input)

Schedule Appointment

First Time Patient
Yes [ ] No [ ]

First Name * ________________________ Last Name * ______________________

Email (Optional) ______________________

Street Address* ______________________

Miami * ________________________ State* ______________________

State* Florida

Zip Code * ______________________

Date of Birthday* ______________________ (mm/dd/yyyy)

Appointment Date* ______________________ (mm/dd/yyyy)

Select Location
Kendal [ ] Coral Gables [ ] Miami Beach [ ] Doral [ ] Sweetwater [ ]
Coconut Grove [ ] South Beach [ ] Little Havana [ ]

Doctor Name (Optional) ______________________
Reasons for Appointment ______________________

Submit Form

ii) One output interface------ Physical Data Flow Implementation (as on-line Output)
Schedule Confirmation

Thank you for scheduling an appointment with HHC Clinics. Your form has been submitted. Below is your appointment schedule details, please print this information for your personal records. **Confirmation# 123456**

First Time Patient: No

First Name: Mary

Last Name: Pombares

Email: stelafaria@yahoo.com

Street Address: 12558 NW 11th Lane

City: Miami

State: Florida

Zip Code: 33182

Date of Birthday: 04/14/1942

Appointment Date: 03/27/2006

Selected Location: Little Havana

Doctor Name: Bruno Pombares

Reason for Appointment: Back Pain

From the moment the clerk schedules for an appointment, the clerk will receive the details for the patient’s appointments on the computer screen, as well as an email to the clerk’s accounts which will be also saved on the HHC centralized database.

**Schedule Confirmation Email Message**
Please do not reply to this email because it was generated by the system. Below are the details for your appointment. Please any additional question call customer service at 1-800-HHC-Service. Confirmation # 123456

First Time Patient: No

First Name: Mary

Last Name: Pombores

Email: stelafrica@yahoo.com

Street Address: 12558 NW 11th Lane

City: Miami

State: Florida

Zip Code: 33182

Date of Birthday: 04/14/1942

Appointment Date: 03/27/2006

Selected Location: Little Havana

Doctor Name: Bruno Pombores

Reason for Appointment: Back Pain

**Conclusion**

In order to choose the best solution for the scenario presented in this project, a planning/decision-making process had to be designed and followed.
First of all, the engineer managers had to recognize the problem or opportunity. Once the problem was defined and the premises specified, all the information had to be gathered in order for the engineers to go forward with the different develop alternatives for the system. Formerly, the best alternative system was chosen, the engineers designed different high level diagrams in order to help them determine how the system will work. These diagrams make the software development process easier by allowing software developers to become more efficient and have lesser bugs in their system.

In conclusion, it is necessary to have a plan of approach of every single project. A good plan helps achieve the mission for the project and helps in the success of the process. The most important factors while implementing a project are: deadline, budget, and achievement of the customer requirements.

In this project different steps were applied to assure that the best medical scheduling system was chosen.

A problem cannot be solved until it is recognized and by recognizing it, we had the chance to come out with different alternatives for the system and pick the best one. It was definitely a very rewarding project, due to the fact that we had the chance to apply the entire “Planning/decision making process” stated in the Making Engineering and Technology Book.