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SOFTCARE INFORMATION SYSTEM

Overview:

The Softcare Information System is a Patient Data Management System which can be integrated within a nursing clinic's environment. Nursing Clinic's need to manage patient data to perform daily operations. However, managing this data in the form of paper documents can lead to a cumbersome experience with an increase in the number of patients. For example, sensitive patient data can be lost or stolen. The Softcare Information Management System will allow hospitals to store and access patient data in an effective and efficient way through a secure and robust system.

This information management system has been initiated to allow hospital employees record, store and access patient and relevant diagnosis information in an efficient way. We expect the Softcare Information System will streamline data flow and eliminate the need for a paper-based system, providing an efficient and secure solution of managing data. In terms of business value, data security assurance will instill trust and confidence within the customer. Moreover, employees will be able to accomplish multiple tasks through this system, eliminating redundancy and paperwork. As a result of the reduced paperwork, nurses will be able to focus on higher priority tasks such as patient management, thus allowing the hospital to provide quality service at the highest level of efficiency.

End-State/Product:

A standalone Java application that supports data input and output through a Graphical User Interface (GUI) and can run on multiple operating systems.

SOFTCARE INFORMATION SYSTEM
PLANNING – SYSTEM REQUEST

Project Sponsor: Prof. Ankur Suri, Supervisor

Business Need: This information management system has been initiated to allow nursing clinic employees record, store and access patient and relevant diagnosis information in an efficient way, thus streamlining the data flow process.

Business Requirements: Through this system, nursing and administrative staff will be able to admit a new patient, input patient information, chart patient data and save the patient data for report generation. The system will support the following functionalities:

- Patient Check-in
- Record and update patient information.
- Data Charting
- Record and update Patient Diagnosis Log.
- Save patient data for text report generation.

Business Value: We expect the Softcare Information System will streamline data flow and eliminate the need for a paper-based system, providing an efficient and secure solution of managing data. In terms of business value, data security assurance will instill trust and confidence within the customer. Moreover, employees will be able to accomplish multiple tasks through this system, eliminating redundancy and paperwork. As a result of the reduced paperwork, nurses will be able to focus on higher priority tasks such as patient management, thus allowing the nursing clinic to provide quality service at the highest level of efficiency.

Special Issues or Constraints: Working model to be available by the following deadline - December 7th, 2016. The development team does not have all the technical skills to execute this project. This might limit the system development process.

SOFTCARE INFORMATION SYSTEM
PLANNING – FEASIBILITY ANALYSIS

Technical Feasibility
The Softcare Information System is feasible technically, although there is some risk.

Application Familiarity: Medium Risk
- Although users have little experience with Patient Data Management Systems, they are familiar with the functions of this system.
- Some members in the IT team are familiar with the operations of a Patient Data Management System, but have not worked the development of such systems before.

Technology Familiarity: Medium Risk
- All members in the IT team have knowledge of programming concepts and understand the working of this system.
- Two members in the IT team have knowledge of Object-Oriented-Programming in Java and Data Input/Output (I/O) programming.
- IT team is capable of troubleshooting and debugging programming issues, as they may arise.

Economic Feasibility
Not Applicable

Organizational Feasibility:
Not Applicable

SOFTCARE INFORMATION SYSTEM
PLANNING – AGILE METHODOLOGY

Why Agile?

- Requirements subject to change.
- Application processes are not very complex.
- Working model to be available within a short period of time.

Agile Charter:

Vision: To allow nursing clinic employees record, store and access patient and relevant diagnosis information in an efficient way, thus streamlining the data flow process.
Mission: To plan, develop and deliver an effective and efficient solution that employs a suitable technical platform while addressing the end-user's requirements.
Success Criteria: Application is available 99% of the time during the first year.

User Roles:

- Supervisor
- Nurse
- Certified Nurse Assistant (CNA)
- Admissions Nurse

User Stories:

Supervisor:

- As a supervisor, I should be able to login into the following modules - Authentication, Activities of Daily Livings (ADL) and Report Generation.
- As a supervisor, I should be able to access, edit and save a patient's ADL log.
- As a supervisor, I should be able to generate reports.

Nurse:

- As a nurse, I should be able to login into the ADL & Report Generation modules.
- As a nurse, I should be able to access, edit and save a patient's ADL log.
- As a nurse, I should be able to generate reports.

Certified Nurse Assistant (CNA):

- As a CNA, I should be able to login into the ADL & Report Generation modules.
- As a CNA, I should be able to access, edit and save a patient's ADL log.
- As a CNA, I should be able to generate reports.

Admissions Nurse:

- As an admissions nurse, I should be able to login into Patient Check-in Module.
- As an admissions nurse, I should be able to add and save new patient-information.
- As an admissions nurse, I should be able to edit existing patient information.

SOFTCARE INFORMATION SYSTEM
PLANNING – AGILE METHODOLOGY

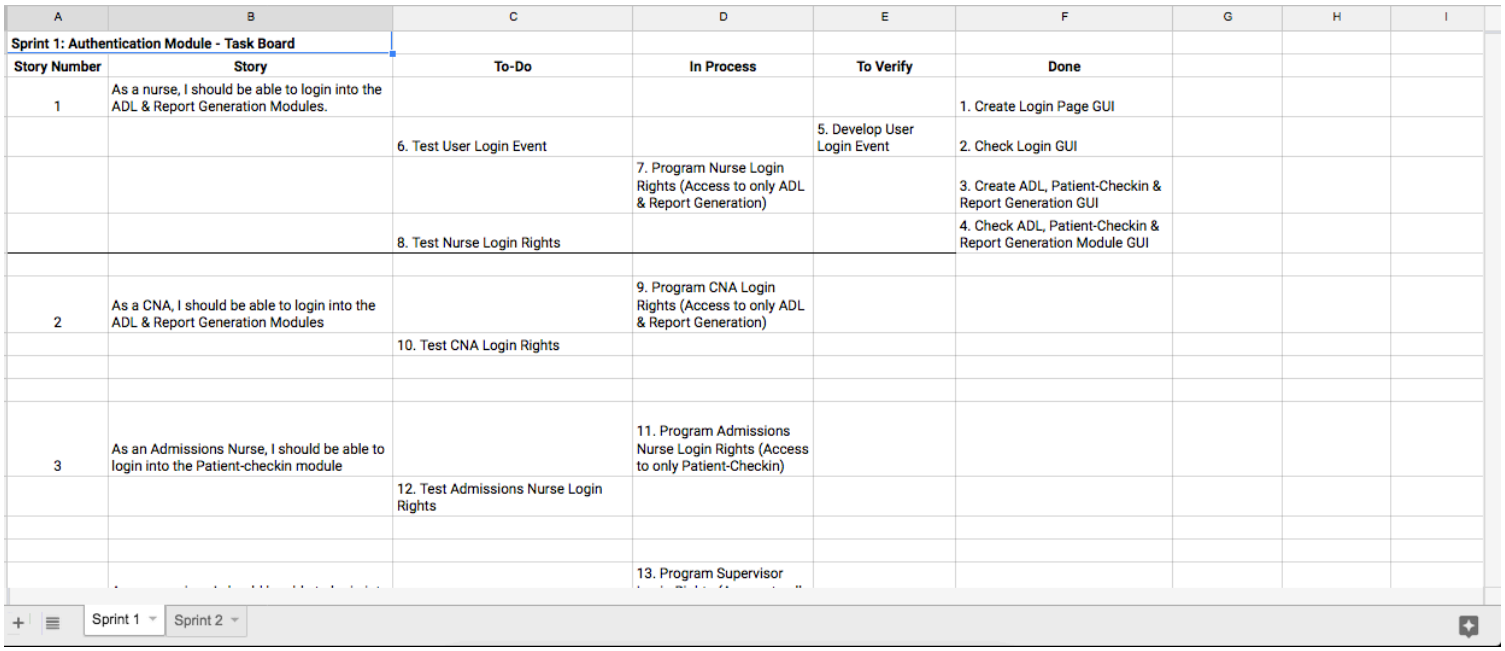
Project Plan:

Work Plan

Sprints:

1. Authentication Module:
   - 1.1. As a nurse, I should be able to login into the ADL & Report Generation modules.
   - 1.2. As a CNA, I should be able to login into the ADL & Report Generation modules.
   - 1.3. As an admissions nurse, I should be able to login into the Patient Check-in Module.
   - 1.4. As a supervisor, I should be able to login into all modules.
2. Information Management
   - 2.1. As a nurse, I should be able to access, edit and save a patient's ADL log.
   - 2.2. As a CNA, I should be able to access, edit and save a patient's ADL log.
   - 2.3. As a supervisor, I should be able to view the following modules - Authentication, Activities of Daily Livings (ADL) and Report Generation - within the system.
   - 2.4. As a supervisor, I should be able to generate reports.

Snapshot of Sprint Task Board at early stages of Implementation (Sprint 1):



A	B	C	D	E	F	G	H	I
Sprint 1: Authentication Module - Task Board								
Story Number	**Story**	**To-Do**	**In Process**	**To Verify**	**Done**			
1	As a nurse, I should be able to login into the ADL & Report Generation Modules.				1. Create Login Page GUI			
		6. Test User Login Event		5. Develop User Login Event	2. Check Login GUI			
			7. Program Nurse Login Rights (Access to only ADL & Report Generation)		3. Create ADL, Patient-Checkin & Report Generation GUI			
		8. Test Nurse Login Rights			4. Check ADL, Patient-Checkin & Report Generation Module GUI			
2	As a CNA, I should be able to login into the ADL & Report Generation Modules		9. Program CNA Login Rights (Access to only ADL & Report Generation)					
		10. Test CNA Login Rights						
3	As an Admissions Nurse, I should be able to login into the Patient-checkin module		11. Program Admissions Nurse Login Rights (Access to only Patient-Checkin)					
		12. Test Admissions Nurse Login Rights						
			13. Program Supervisor					

Sprint 1 | Sprint 2

SOFTCARE INFORMATION SYSTEM
PLANNING – AGILE METHODOLOGY

Burndown Chart at the end of Implementation Stage (Sprint 1)

Story No.	Story Name	Task No.	Task Description	Status	Estimated Effort(hours)	Effort Remaining(hours)
1	As a nurse, I should be able to login into the ADL & Report Generation Modules.	1	Create Login Page GUI	Closed	0.5	0
		2	Check Login GUI	Closed	0.2	0
		3	Create ADL, Patient-Checkin & Report Generation GUI	Closed	1	0
		4	Check ADL, Patient-Checkin & Report Generation Module GUI	Closed	0.5	0
		5	Develop User Login Event	Closed	3	0
		6	Test User Login Event	Closed	0.5	0
		7	Program Nurse Login Rights (Access to only ADL & Report Generation)	Closed	2	0
		8	Test Nurse Login Rights	Closed	0.5	0
2	As a CNA, I should be able to login into the ADL & Report Generation Modules	9	Program CNA Login Rights (Access to only ADL & Report Generation)	Closed	2	0
		10	Test CNA Login Rights	Closed	0.5	0
3	As an Admissions Nurse, I should be able to login into the Patient-checkin module	11	Program Admissions Nurse Login Rights (Access to only Patient-Checkin)	Closed	2	0

Staffing Plan:

Role	**Description**	**Assigned To**
System Analyst	Designs Information System with focus on process models, data models and interface design.	Bikram, Joe, Julian, Sheikh
Programmer	Codes System	Bikram, Sheikh

Project Charter:

Project Objective: The Softcare Information System team will create a working Java-based system-model so that hospital employees can start charting patient data electronically as rapidly as possible.

The Softcare Information System team will:

1. Conduct a weekly meeting regularly to discuss the status of project and future actions.
2. Update the workplan as task progress is made.
3. Post any issues or updates on the group communication portal.
4. Agree to support each other when help is needed, especially for tasks that could hold back the progress of the project.

SOFTCARE INFORMATION SYSTEM
ANALYSIS – REQUIREMENTS DETERMINATION

Requirements Definition:

Functional Requirements:

1. The system will allow the Admissions Nurse to admit new patients in the hospital.
2. The system will allow the Admissions Nurse to add and update patient contact information.
3. The system will allow allow the nurses, CNAs and Supervisor to add and update patient diagnosis information in the Activities of Daily Living (ADL) module.
4. The system will allow nurses, CNAs and the supervisor to generate reports based on retained patient contact and diagnosis data.

Non-functional Requirements:

Operational:

- Technical Environment - Users will be using Microsoft Windows 10 and Apple OS X computers and the system must be compatible with both operating systems (OS). The system will be installed on every user's computer.
- System Integration - Data format must be compatible with other Java-based systems used in the workplace.

Performance:

- Speed - Response time must be 30 seconds or less. Database must be updated in real time on each local machine.
- Capacity - The system will store data on approximately 200 patients for a total of about 1 GB of data. Since the system is a standalone application, an increase in the number of simultaneous users will not affect performance.
- Availability & Reliability - The system should be available 24/7 on each employee's computer, with the exception of scheduled maintenance and the system must have 99% uptime performance.
- The database on each machine must be updated everyday at mid-day such that database consistency is maintained.

Security:

- Access Control - Admissions Nurse cannot access the Activities of Daily Living (ADL) and Report Generation modules. Certified Nurse Assistants (CNAs), Nurses and the Supervisor cannot access the Patient Admission module. The supervisor can access the ADL and the Report Generation modules.
- Authentication - Every user will need to login with a username and password at the Authentication Module to gain access to the system.

Cultural

- No cultural/political requirements.

SOFTCARE INFORMATION SYSTEM
ANALYSIS - USE CASE ANALYSIS

Use Case Name: Login **ID:** UC-1

Actor: Employee

Description: The employee should login into the system with his/her username and password to gain access to relevant functions of the system.

Trigger (External): An employee needs to gain access to the system to perform specific tasks.

Pre-conditions:

- The employee has an existing account in the system.

Post-conditions:

- Employee credentials authentication is complete.
- Employee is logged in and is able to perform relevant tasks.

Normal Course:

1. For Login
   1.1. Employee enters username and password.
   1.2. The system verifies if the given username and password combination is valid.
   1.3. The user is provided access to the system.

Exception(s):

E1. For Login
   1.1. Employee enters username and password.
   1.2. Verification fails - Username/password combination is incorrect.
   1.3. User is prevented from gaining access to the system.

Use Case Name: Admit new patient **ID:** UC-2

Actor: Admissions Nurse (AN)

Description: The Admissions Nurse records general information from new patient and submits the recorded information to admit the new patient.

Trigger (External): The AN needs to admit a new patient.

Pre-conditions:

- The AN is logged into the system.
- The AN is logged in as an Admissions Nurse.

Post-conditions:

- Patient information has been saved and submitted.
- Data Store has been updated.

- The patient now is an admitted patient.

Normal Course:

1. Admit new patient:
   1.1. AN enters relevant information in the admissions form.
   1.2. The AN submits entered information in the system.

Alternate Course:

2. If the employee is not logged in as an AN.
   2.1. Employee logs out of the system.
   2.2. Employee logs in with an AN username and password.
   2.3. The employee is now an AN and enters the relevant information in the admissions form.
   2.4. The AN submits entered information in the system
3. If the AN is at another patient's general information form:
   3.1. AN accesses patient selection page.
   3.2. AN chooses to admit a new patient.

Use Case Name: Modify existing patient's general information **ID:** UC-3

Actor: Admissions Nurse (AN)

Description: The Admissions Nurse modifies an existing patient's general information.

Trigger (External): The AN needs to make changes to an existing patient's general information.

Pre-conditions:

- The AN is logged into the system.
- The AN has been logged in as an Admissions Nurse.
- The patient has been admitted and exists in the system

Post-conditions:

- Patient information has been modified and submitted.
- Data Store has been updated.

Normal Course:

1. Modify Patient Information.
   1.1. AN looks up patient in the Select Patient page.
   1.2. AN selects the required patient.
   1.3. AN modifies the data at relevant parts of the admission form.
   1.4. AN submits the admissions form in the system.

Alternate Course:

2. If the employee is not logged in as an AN.
   2.1. Employee logs out of the system.
   2.2. Employee logs in with an AN username and password.
   2.3. The employee is now an AN and modifies the data at relevant parts of the admission form.
   2.4. The AN submits the modified form in the system.
3. If the AN is at another patient's general information form:
   3.1. AN accesses patient selection screen.
   3.2. AN selects required patient.
   3.3. AN modifies the data at relevant parts of the admission form.

Use Case Name: Record and update patient's diagnosis in the ADL module. **ID:** UC-4

Actor(s): Nurse / CNA / Supervisor

Description: The nurse / CNA / supervisor records and updates an existing patient's diagnosis information at the ADL module.

Trigger (External): The nurse / CNA / supervisor needs to record and update an existing patient's diagnosis information.

Pre-conditions:

- The nurse / CNA / supervisor is logged into the system.
- The nurse / CNA / supervisor has been logged in as a nurse / CNA / supervisor
- The patient has been admitted and exists in the system.

Post-conditions:

- Patient Diagnosis data has been recorded and submitted.
- Data Store has been updated.

Normal Course:

1. Record and update patient's diagnosis in the ADL module.
   1.1. Nurse / CNA / supervisor looks up patient in the Select Patient page.
   1.2. Nurse / CNA / supervisor selects the required patient.
   1.3. Nurse / CNA / supervisor modifies the data at relevant parts of the ADL form.
   1.4. Nurse / CNA / supervisor submits the form in the system.

Alternate Course:

2. If the employee is not logged in as a nurse / CNA / supervisor.
   2.1. Employee logs out of the system.
   2.2. Employee uses a nurse / CNA / supervisor username and password to login into the system.
   2.3. The employee is now a nurse / CNA / supervisor and looks up patient in the Select Patient page.
   2.4. Nurse / CNA / supervisor selects the required patient.
   2.5. Nurse / CNA / supervisor modifies the data at relevant parts of the ADL form.
   2.6. Nurse / CNA / supervisor submits the form in the system.
3. If the nurse / CNA / supervisor is at another patient's ADL:
   3.1. Nurse / CNA / supervisor accesses patient selection page.
   3.2. Nurse / CNA / supervisor selects required patient.
   3.3. Nurse / CNA / supervisor modifies the data at relevant parts of the ADL form.

Use Case Name: Generate Patient Diagnosis report. **ID:** UC-5

Actor(s): Nurse / CNA / Supervisor

Description: The nurse / CNA / supervisor generates a report based on existing patient's general and diagnosis information.

Trigger (External): The nurse / CNA / supervisor needs to generate a report based for a particular patient.

Pre-conditions:

- The nurse / CNA / supervisor is logged into the system.
- The nurse / CNA / supervisor has been logged in as a nurse / CNA / supervisor
- The patient has been admitted and exists in the system.
- The patient's diagnosis data exists in the data store.

Post-conditions:

- Report has been saved in the data store.

Normal Course:

1. Generate Report.
   1.1. Nurse / CNA / supervisor looks up patient in the Select Patient page.
   1.2. Nurse / CNA / supervisor selects the required patient.
   1.3. Nurse / CNA / supervisor generates diagnosis report from the ADL page.
   1.4. Nurse / CNA / supervisor accesses report from the data store.

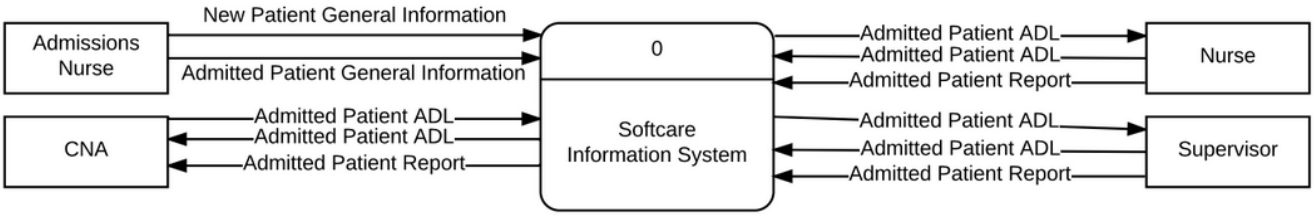
Alternate Course:

2. If the employee is not logged in as a nurse / CNA / supervisor:
   2.1. Employee logs out of the system.
   2.2. Employee uses a nurse / CNA / supervisor username and password to login into the system.
   2.3. The employee is now a nurse / CNA / supervisor and looks up patient in the Select Patient page.
   2.4. Nurse / CNA / supervisor selects the required patient.
   2.5. Nurse / CNA / supervisor generates diagnosis report from the ADL page.
   2.6. Nurse / CNA / supervisor accesses report from the data store.
3. If the nurse / CNA / supervisor is at another patient's ADL:
   3.1. Nurse / CNA / supervisor accesses patient selection page.
   3.2. Nurse / CNA / supervisor selects required patient.
   3.3. Nurse / CNA / supervisor generates report from the ADL form.

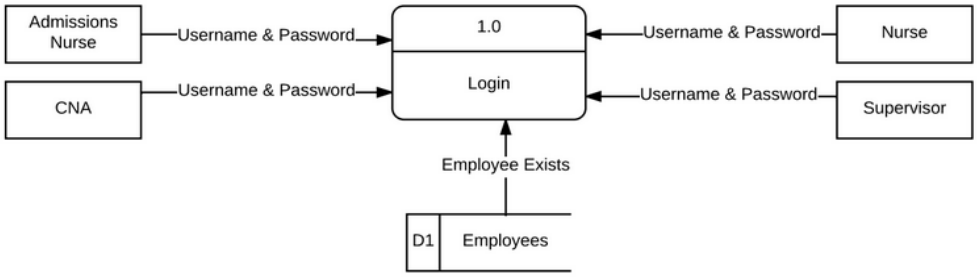
SOFTCARE INFORMATION SYSTEM
ANALYSIS – PROCESS & DATA MODELLING

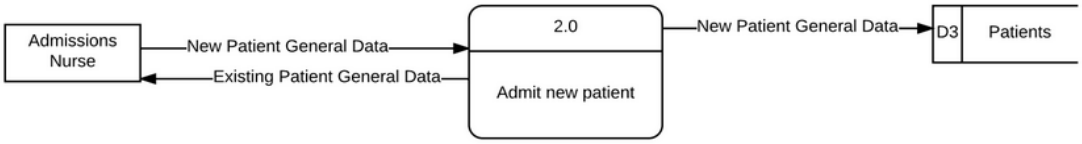
Data Flow Diagrams:

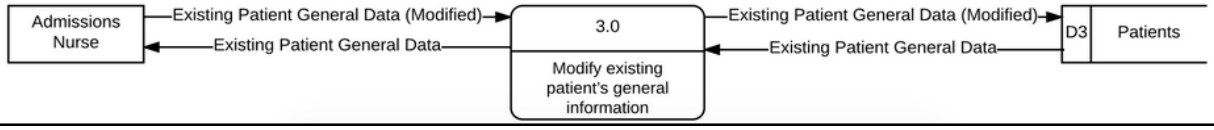
CONTEXT DIAGRAM



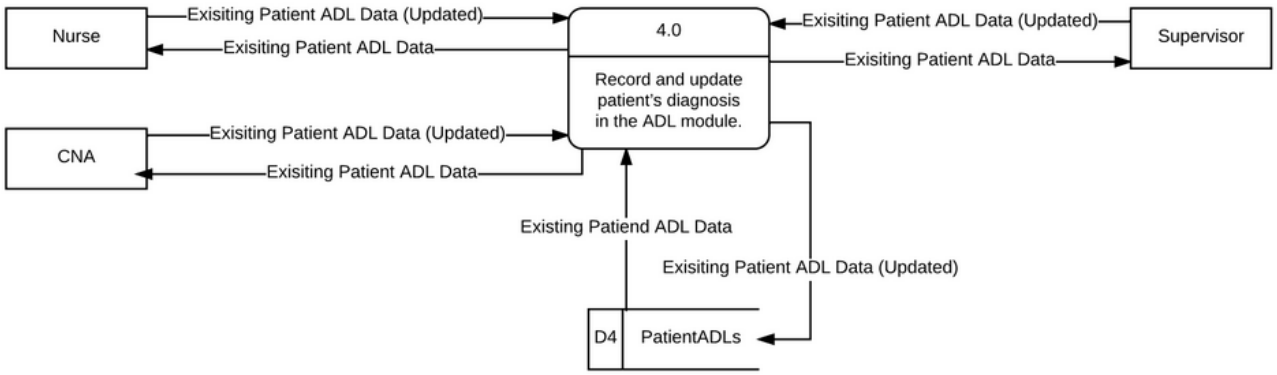
LEVEL 0:

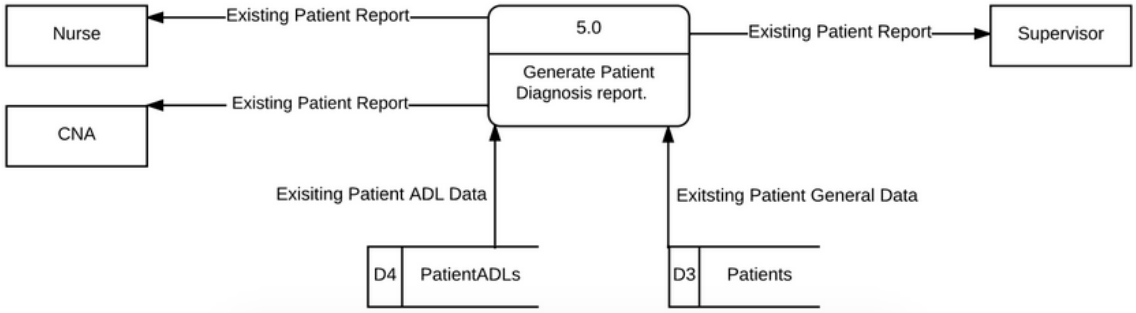




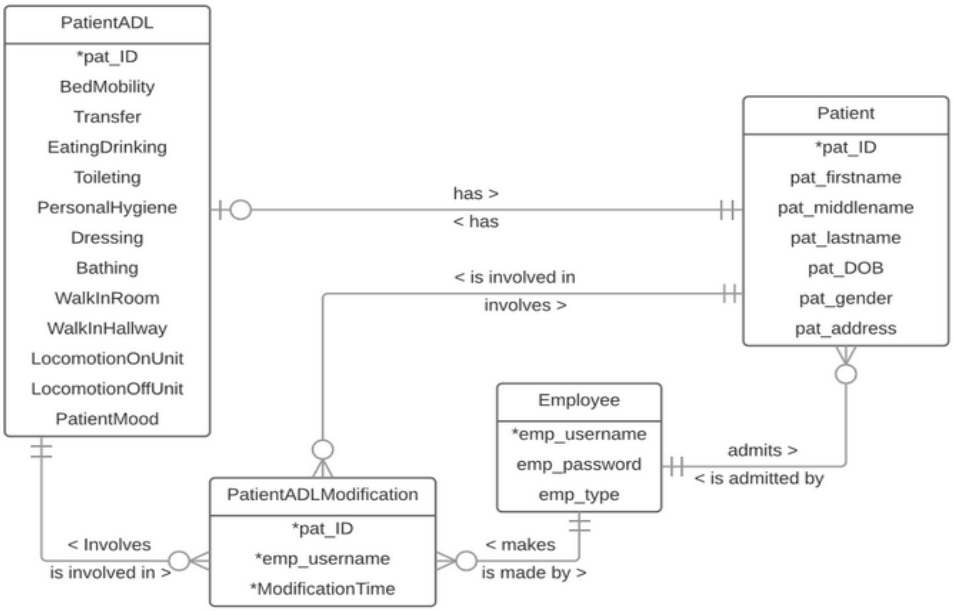


ANALYSIS – PROCESS & DATA MODELLING





Entity Relationship Diagram (ERD):



SOFTCARE INFORMATION SYSTEM
DESIGN

Design Strategy: Custom Development

Custom Development was the preferred design strategy as it allowed the organization to retain the skills needed to design and develop applications. A packaged software was not a suitable option because the nursing clinic's requirements were unique. Since the nursing clinic was handling sensitive patient data, outsourcing didn't seem to be a viable strategy too.

Architecture Design: Standalone

A Standalone Architecture design was selected based on the following factors:

- *Organization size & volume of data*: Since this application was being developed for a small number of users (20 employees) and the volume of data being managed was about 1 GB, a standalone architecture seemed to be a suitable option.
- *Organization Location:* The nursing clinic operates at one location only and the user's did not require data access from any other locations apart from the clinic.
- *Complexity & Time:* Implementing a standalone system is less complex as compared to client-server architectures and is less time consuming.
- *Skills Availability:* The skills required to implement a client-server architecture were not available.

Hardware/Software Specification:

	Standard Client
Operating System	• Windows 7 (any edition) or later / Apple OS X 10.8.3 or later / Linux (not tested)
Special Software	• Java Version 8 Update 111 or later, Integrated Development Environment (IDE) for Java: NetBeans 8.2 or later (preferred) / Eclipse / jGRASP
Hardware	• 64-GB or higher disk drive • 11-inch LCD/LED monitor or higher • Keyboard • Mouse (Optional)

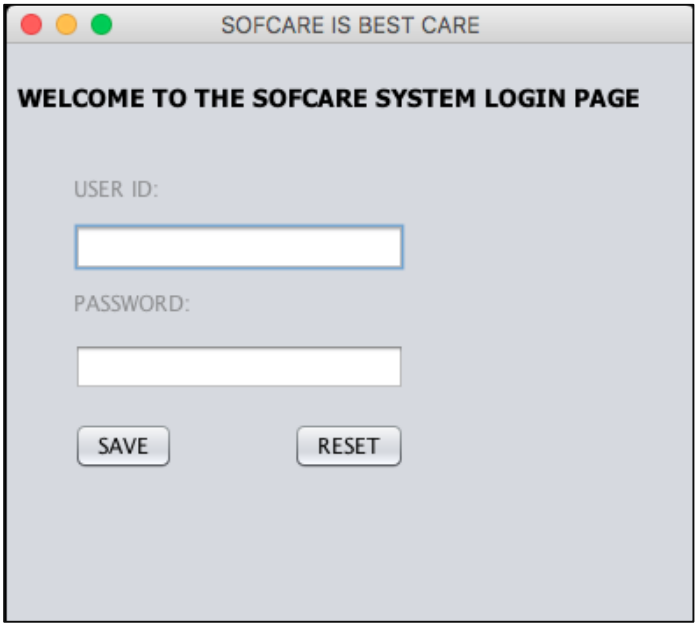
Data Storage Format: Flat Files

Flat file(s) is the selected data storage format based on the following factors:

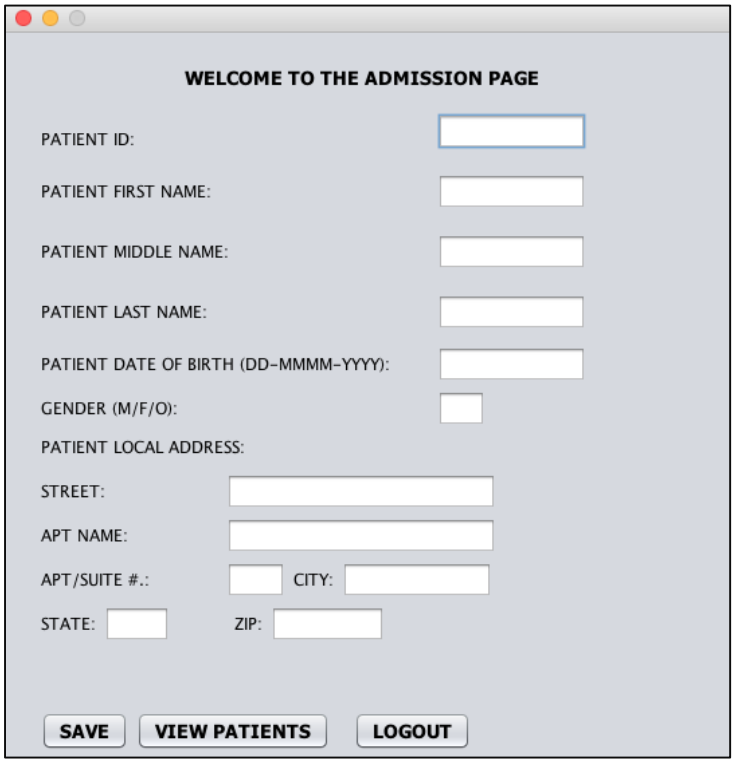
- *Standalone Architecture Design:* The system follows the standalone architecture. Since the Presentation Logic, Application Logic, Data Access Logic and the Data Storage existed on the client machine, the flat files format seemed to be a suitable option.
- *Size of Data:* Since the current and predicted future volume of data was not large, scalability was not seen as a requirement.

- *Complexity of Data:* The system did not conduct any data analysis, and the relations between various types of data were simple.
- *Skills Available*: The skills required to implement a database storage format such as Relational or NoSQL were not available.

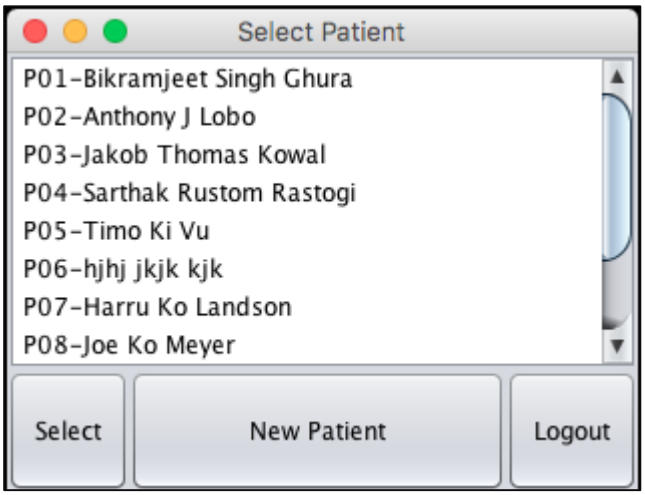
Graphical User Interface (GUI) Design:



Login Screen



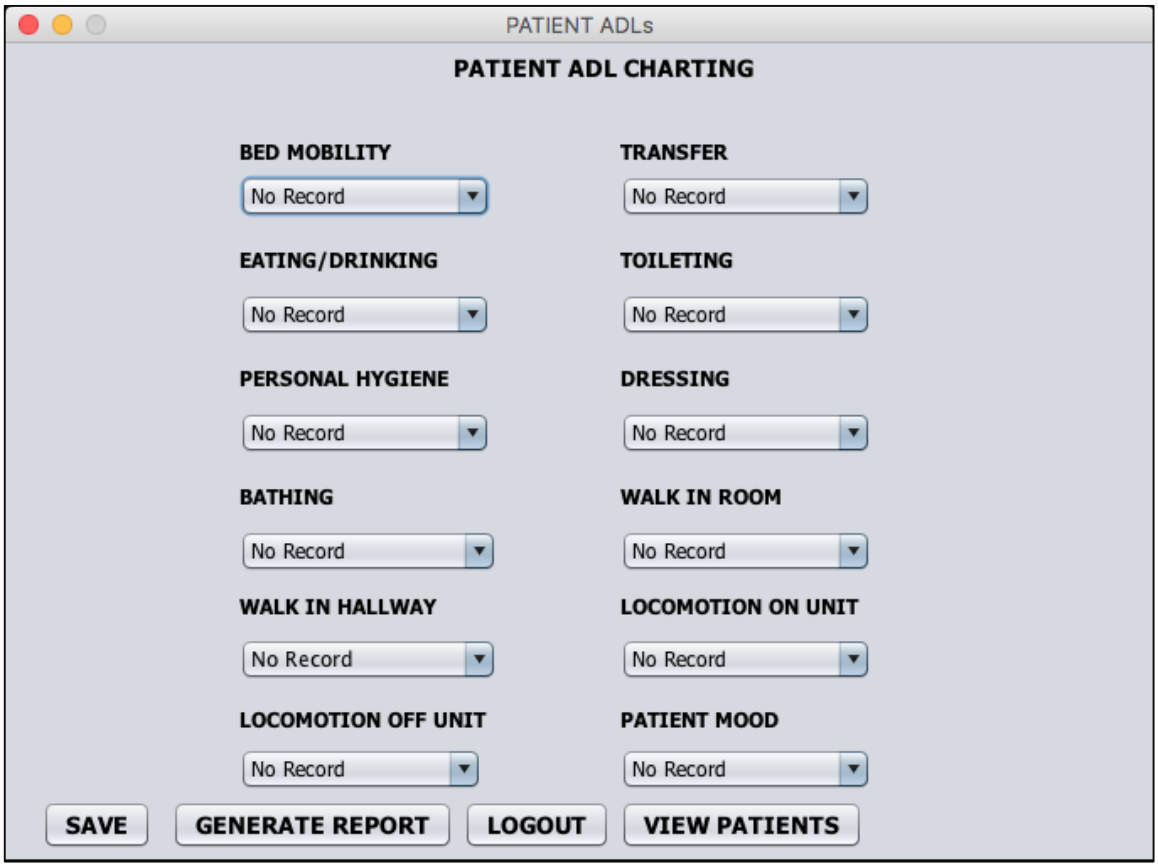
Patient Admit Form (Admissions Nurse)



Patient List (Admissions Nurse)

Patient List (Nurse, CNA, Supervisor)

SOFTCARE INFORMATION SYSTEM
DESIGN



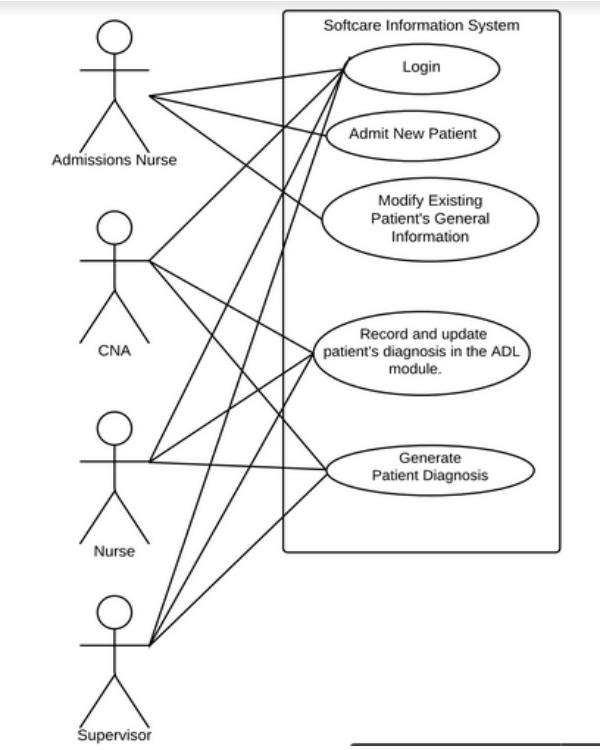
Patient ADL Charting (CNA, Nurse, Supervisor)

SOFTCARE INFORMATION SYSTEM
IMPLEMENTATION

Deliverables:

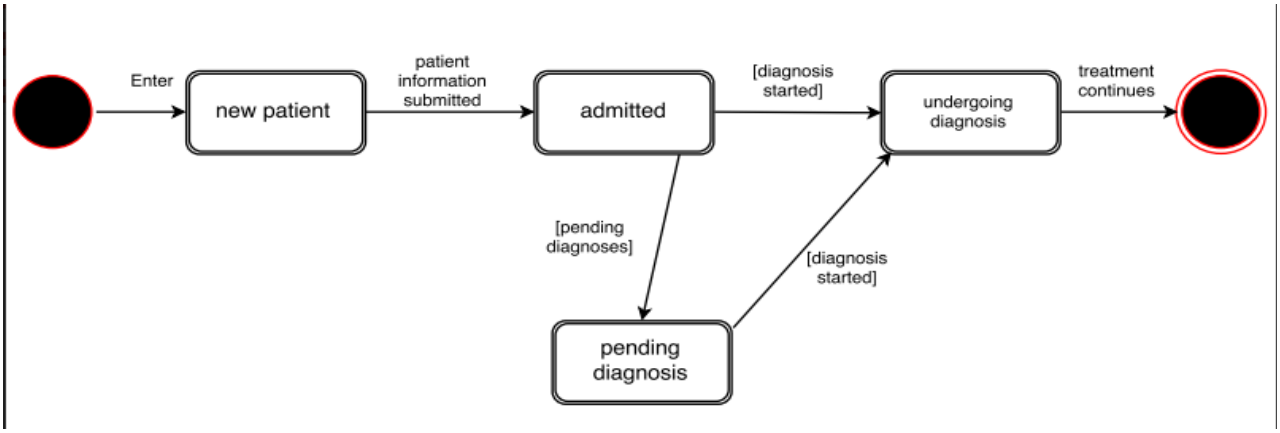
- Unified Modelling Diagrams
  - Use Case Diagram
  - Behavior State Machine for Patient object
  - Class Diagram
  - Sequence Diagram for UC-4: Update patient ADL chart
  - CRUDE Matrix
- System Development & Programming in Java: Java was used to develop the program and all development was conducted on NetBeans 8.2 Java IDE.
- Testing
  - *Unit Testing* - Each class was considered to be a unit for Unit Testing and Black-box testing was performed on each class to check whether the class functioned according to the requirements. White-box testing needed in some cases too, especially during debugging.
  - *Integration & System Testing* - User Interface Testing was performed to test the functions of each application interface. System Interface Testing was performed to test flow of data and interaction between the application interfaces.
  - *Acceptance Testing* - Acceptance testing was performed with mock data to ensure that data input, output and the access rights functioned according to the requirements.

Use Case Diagram:

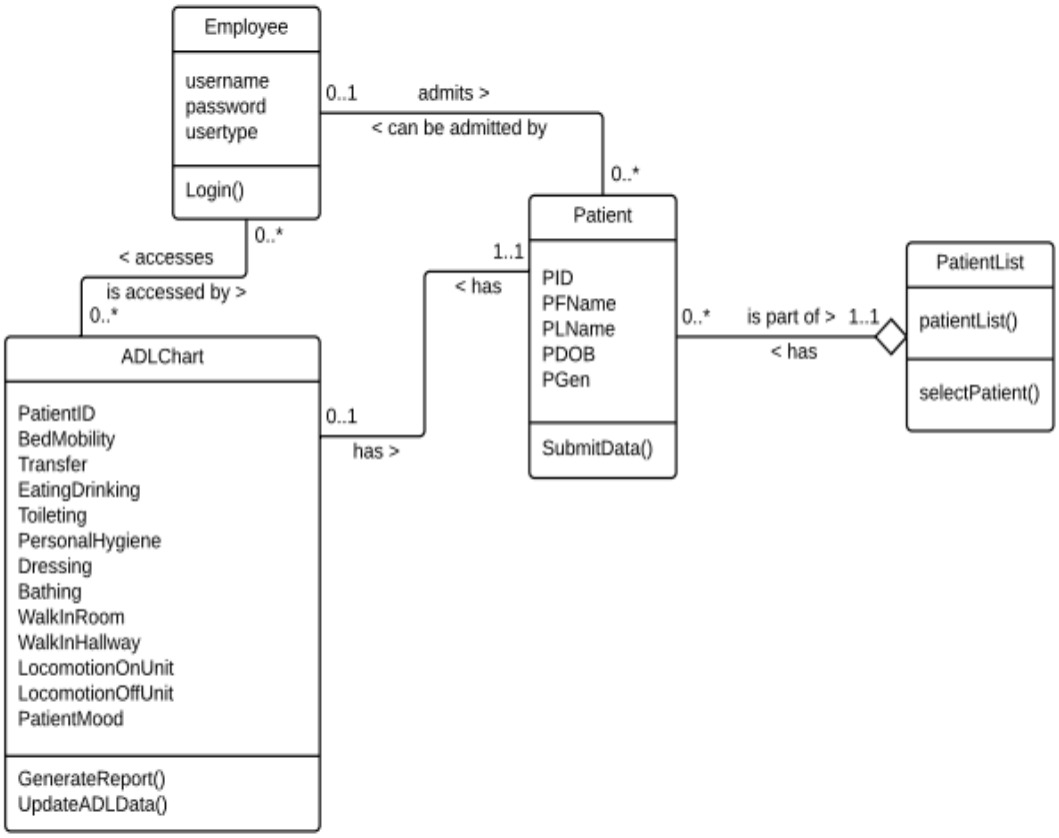


SOFTCARE INFORMATION SYSTEM IMPLEMENTATION

Behavior State Machine for Patient object:

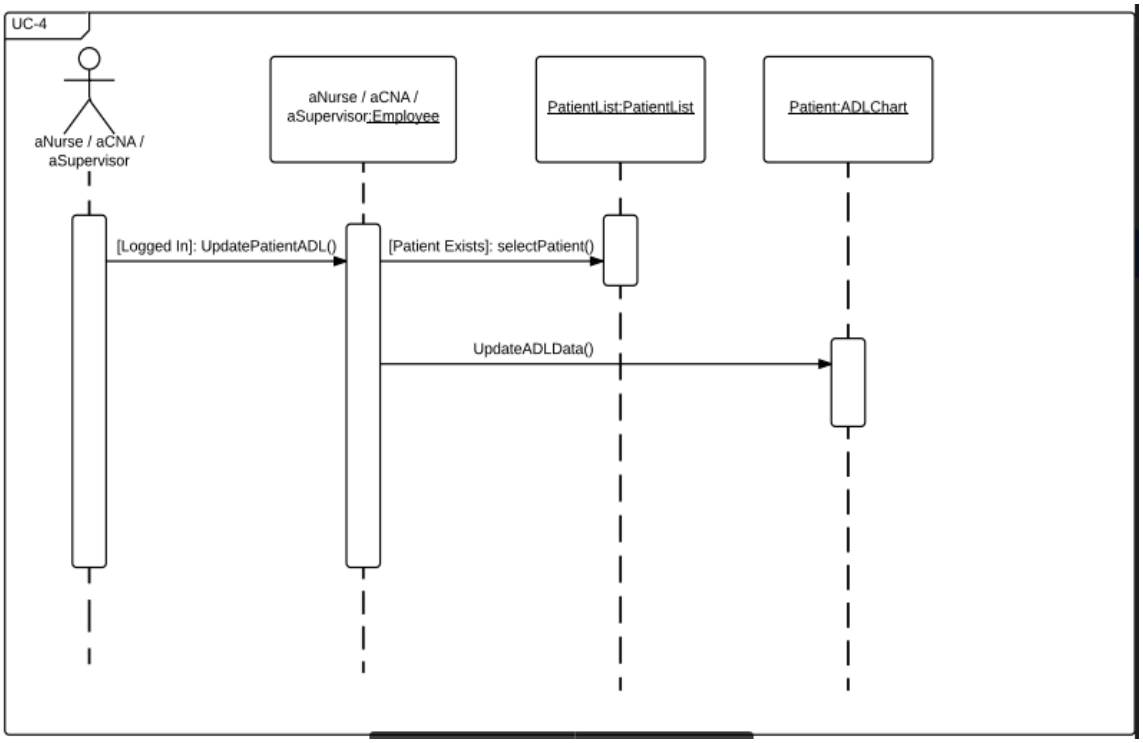


Class Diagram:



SOFTCARE INFORMATION SYSTEM
IMPLEMENTATION

Sequence Diagram for UC-4: Update Patient ADL:



CRUDE Matrix:

	Admissions Nurse Actor	Nurse Actor	Certified Nurse Assistant Actor	Supervisor Actor	Employee Class	Patient Class	PatientList Class	ADLChart Class
Admissions Nurse Actor					E	C, R, U	E	
Nurse Actor					E		E	R, U, E
Certified Nurse Assistant Actor					E		E	R, U, E
Supervisor Actor					E		E	R, U, E
Employee Class						C, R, U	E	R, U, E
Patient Class							U	
PatientList Class								
ADLChart Class								