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**ADDIS ABABA UNIVERSITY**

**School of Information Science**

**And**

**School of Public Health**

**M.SC in Health Information Programme**

**Design of a Web Based System to Support Nursing Care  
Planning For Wolaita Sodo Outona Referral Hospital**

**By: Siraj Sebhatu**

**ADDIS ABABA - ETHIOPIA, MAY, 2015**

Addis Ababa University  
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**DESIGN OF A WEB BASED SYSTEM TO SUPPORT NURSING CARE PLANNING  
FOR WOLAITA SODO OUTONA REFERRAL HOSPITAL**

By  
**Siraj Sebhatu**

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## Dedication

This project work was dedicated for my beloved wife **Zebiba Kedir** and my dear sweet son **Hamiza Siraj**.

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## List of Acronyms

<b>AAU</b>	Addis Ababa University
<b>AHR</b>	Automated Health Record
<b>CDC</b>	Center for Disease Control
<b>CDSS</b>	Clinical Decision Support System
<b>CEO</b>	Chief Executive Officer
<b>CPR</b>	Computer-Based Patient Record
<b>DFD</b>	Data Flow Diagram
<b>EC</b>	Ethiopia Calendar
<b>EHR</b>	Electronic Health Record
<b>EMR</b>	Electronic Medical Record
<b>FMOH</b>	Federal Ministry of Health
<b>GC</b>	Gregorian Calendar
<b>HI</b>	Health Informatics
<b>HO</b>	Health Officer
<b>HIS</b>	Health Information System
<b>HMIS</b>	Health Management Information System
<b>HSDP</b>	Health System Development Program
<b>HTML</b>	Hyper Text Markup Language
<b>ICT</b>	Information Communication Technology
<b>Kms</b>	Kilometers
<b>MWN</b>	Mid-Wife Nurses
<b>OS</b>	Operating System
<b>PHP</b>	Hypertext Preprocessor
<b>RHB</b>	Regional Health Bureau
<b>SDLC</b>	System Design Life Cycle
<b>SQL</b>	Structured Query language
<b>WSOH</b>	Wolita Sodo Outona Hospital

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<b>SQL</b>	Structured Query language
<b>WSU</b>	Wolaita Sodo University
<b>WSOH</b>	Wolaita Sodo Outona Hospital

## Abstract

**Background:** Nursing process is a systematic problem solving approach used to identify, prevent and treat actual or potential health problems and promote wellness. It has five steps- assessment, diagnosis, planning, implementation, and evaluation. The nursing care planning and documentation of patient care needs are important. The use of Information and Communication Technology (ICT) can impact on the work that nurses carry out. Involvement of nurses in the analysis and design phases of a web based nursing care planning is necessary to properly encapsulate their care planning and documentation requirements.

**Objective:** This project attempted to design a Web Based System to Support Nursing Care Planning for Wolaita Sodo Outona Hospital (WSOH).

**Methodology:** The proposed project uses object oriented analysis and design system development technique approach and different data collection tools i.e. (interview, observation and relevant document review techniques) to collect sufficient data needed for the system to be developed. Analysis and design of the proposed system was performed using the object oriented analysis and design tools i.e. (class diagram, inheritance of the class, and association of the class, UML diagram, ER diagram), PHP and HTML ,Java script for programming language and My SQL for database used.

**Result:** The developed design of a web based system to support nursing care planning for Wolaita Sodo Referral Hospital incorporates Register new /update repeat patient detailed information, Search patient detail, assesses the patient condition, to make nursing diagnosis ,prepares care plan ,implement goals, evaluate the outcome ,and prepared aggregate report information ; nurses give care service at In Patient Department (IPD). To capture all of these data relational data base system was designed. Finally, the three tire system architecture also designed to give a high level view of the new system.

**Conclusion:** A web based system to support nursing care planning system used by nurses should make time-saving possible, be easily used with easy menus, save all applications exactly, have warning and alarm systems, display necessary interventions at appropriate times, be a guide for patient care.

## Chapter One

### 1. Introduction

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, and political belief, economic or social condition. The health of all peoples is fundamental to the attainment of peace and security and is dependent upon the fullest co-operation of individuals and States. The achievement of any State in the promotion and protection of health is of value to all [1].

Web-based applications provide the power of desktop and server applications with the flexibility and accessibility of the web. Using web browsers, users can securely access applications from anywhere within the reach of the organization intranet or extranet. The special issue strives to explore the advanced web-based information systems and database applications in healthcare area. A web based system to support Nursing Care in healthcare organizations are undergoing major reorganizations and adjustments to meet the increasing demands of improved healthcare access and quality, as well as lowered costs. As the use of Information Technology (IT) to process medical data increases, much of the critical information necessary to meet these challenges is being stored in digital format. Web-enabled information technologies can provide the means for greater access and more effective integration of healthcare information system from disparate computer applications and other information resources [2].

Most nursing care plan records are still paper-based, which means it is difficult to be used to properly and consistently coordinate care, routinely measure quality, or reduce medical errors due to challenges with storage and difficulties to easily access or retrieve information when it is needed [3].

Nevertheless, in developing countries, quite often, the nursing care plan is recorded as well documented on the basis of paper. The rationale behind is that the absence of the Information Communication Technology (ICT) infrastructure, professional in the area of health informatics, lack of utilization the existing electronic based system, not counting other factors. On top of

this, the high commitment of the government in the process of implementation is commonly pronounced in the literature of health informatics. In similar fashion, in Ethiopia, the electronic based system is not commonly and widely observed when it is used by the health practitioners in general hospital as well as in referral hospitals [4].

To improve the routine Health Information System (HIS) there is a growing recognition that ICT can replace traditional routine paper-based HIS with flexible electronic means and could bring significant cost reduction and effectiveness in terms of timely delivery of health care services in developing countries [4].

Though this is being the case, the existing government developed and starting to implement the Health Sector Development Plan (HSDP) since 1991 as part of democratization and decentralization of the health policy. Even after two decades, the electronic based system is not reaching remarkable stage. Being engulfed by such kinds of problem, it would be difficult to achieve or boost the health care services as per the standard of the government itself as well as per the standards of World Health Organization (WHO). HSDP-IV is a policy level strategic document that will guide the development of sub-national plans and set the rules of engagement in the health sector [5, 6].

One of the strategies of health policy of Ethiopia is organizing Health Management Information System (HMIS) by: Managing the system appropriate and relevant for decision making, planning, implementation, monitoring and evaluation, maximizing the utilization of information of all levels and developing central and regional information documentation center [6].

Ensuring communities have access to health facilities that are well equipped, supplied, maintained and ICT networked as per the standards and are well staffed with qualified and motivated employees [4].

## 1.2 Statement of the Problem

Health information can be produced from health facilities in order to be used for sound decision making and problem solving in the health care which specifically used for the purpose of clinical management at the point of care, for management, planning and procurement purpose at district level, and for the governance of the health system at regional and national levels [7].

Electronic information systems also maintain quality and accurate data, and make reporting potentially more flexible and efficient. On the contrary, in paper-based systems the data is collected and compiled manually at each site where the data is collected, a process that hinders managers and decision makers at higher levels of the hierarchy from viewing the disaggregated data coming from lower levels of the system. Besides this, accessibility of data in the paper-based system is time consuming, potentially unreliable and inefficient when the number of records becomes very large [8].

Nursing documentation is often viewed as a written record of actions or a task completed by a nurse and is typically written in a chronological fashion. This chronological format of recording tasks does not capture the deliberation and knowledge used to support the nursing actions or tasks. Paper documentation systems often create fragmented and inconsistent health records that make it difficult to retrieve data and measure outcomes. In addition to the fragmentation of paper health records, the use of unstructured or narrative documentation limits the use of and ability to demonstrate the linkages or relationships between assessment findings, nursing diagnoses, interventions and expected outcomes in nursing care [9].

A research conducted in 2013 in Debremarkos and Finoteselam Hospitals, Northwest Ethiopia indicate that in the paper based system at all stages, and there is a need for change to speed up the work process and optimize the quality of actions in care and education [10].

On the other hand, the research conducted in 2013 showed that among the 192 participated nurses, who participated in the study 52.1% of them implemented nursing process while 47.9 % of them did not implement nursing process [11].

The interview made with the medical director of Wolaita Sodo Outona Referral Hospital (WSORH) showed that the current system of nursing care plan is paper based record, further, there are problems such as disintegration of health care assessment, using the standard operational guide line based on the nursing care plan process, and the perception of nurse using the guide line to apply treatments on patient care. [Dr.Chernet, 14th August 2014, Interview]

A preliminary study undertaken by the researcher at WSORH show that the large number of patients visiting the hospital has created burden of some task to the workers as well as the matron or the nursing staff program facilitator. The enormous work means that the increase data to be collected, stored and analyzed is also massive. [Dr.Chernet, September 2014, Interview] currently in WSORH health providers use paper record to document and deliver care. However, there are many problems with paper based nursing care plan records as found from the observations and interviews with the staffs and managers in the hospital. Some of the problems are:

- Problem with documentations of care services : those are not fully recorded every patients data, some patient follow up records are lost, they are disorganized and in general they have problems with data quality and completeness of the patient information records, illegible hand writing in records and also incompleteness of health care assessment records happened within the hospital.
- duplication of records are easily misplaced and can cause serious problems, such as the need for repeated diagnostic tests, delays in the planning of care, legal complications.
- Using paper-based nursing care plan record system which is prone to error, difficult for easy access, leading to lack of timely reliable and relevant information as well as use of information for action [Dr. Chernet September 2014, Interview].

Design of a Web Based System to Support Nursing Care Plan system for WSORH may solve many of the problems. Therefore having a design of web based system to support nursing care planning for WSORH will better to be introduced for easy access of patient information, delivery of comprehensive, reliable and timely information in the health facility level.

### **1.3. General objective**

The general objective of this project to design of a Web Based System to Support Nursing Care Planning for Wolaita Sodo Outona Hospital.

#### **1.3.1. Specific objectives**

To achieve the general objective, the following specific objectives were stated.

- To understand the existing nurse care planning system;
- To collect and analyze the system requirements and determine functional and non-functional requirements;
- To design a web based system to support nursing care planning ;
- To design user interface prototype ;

#### **1.4. Scope and limitation of the project**

This study delimited to in geographical, conceptual and departmental sense to tackle the research problem by gathering and design the web-based system to support nursing care plan. It was presented one after the other.

Geographically, the study focuses on Wolaita Sodo Zone, more particularly, Wolaita Sodo Outona Hospital. The rationale behind is that this hospital is visited by considerable number of patients of people in the zone and since it is referral hospital, it also serves other patients who are coming from adjacent of the zone. Add to this, though it is established before four decades, so far, it does not implement the web-based health system and serving the community as it could and should be.

Departmentally, this research project confined to inpatient department. The master justification behind is that in this department reasonable number of admitted patients but there is not well developed web based system that supports the nurses so as to deliver the required level of health care services. Add to this, nurses have workload that hinders their performance in association with searching and finding the patient records manually.

Conceptually, the study was emphasizing on the designing of the web-based system. The logic behind is that, it is the base to develop prototype and execute the system. Additionally, within the time span given to complete and submit the project as well as the costs it requires, it could be impossible to encompass whole process of the web-based system (i.e. from designing to implementing the system). To put mildly, the project will start by assessing the existing situation of the nurses who have worked inpatient department and identify user and system requirement. After identification of the system requirement made, analyzing and description was done using use case model. The designing process of the system was continue using the UML (Unified Modeling Language) for the web based system to support nursing care plan . The above mentioned scope of the project were done by the use of object oriented system analysis and design methodology between December 15 - May, 2015Gc.

## 1.5. Significance of the Study

This research project would help health practitioners as well as patients by providing multidimensional function in the process of delivering health services. Primarily, it helps to facilitate health services for considerable number of individuals who are demanding the services at the desirable quality by saving their time. This is realized through making the web based system able to providing patient information at required time and place, updating patient information, monitoring patient services, sending alert message to health professionals, providing report and security. Secondly, it helps to provide reliable aggregate information to the health bureau of the zone, woreda health office, researchers, and for those who have the concern on the issue. Thirdly, it can be integrated with other electronic health record and patient record system.

**For the Hospital and the Health Centre or other health facility:** designing a web based system to support nursing care planning system will help all health facilities to record appropriate Nursing care plan and for keep Quality records. Health professionals may feel accountable with the use of such a system.

**For Nurses and other Health professionals:** when the proposed well analyzed and designed a web based system support nursing care planning system, document deployed one of the users were health professionals. So, this analysis and design document was help to include all their needs so that the future software will be users friendly for them.

**For Medical research, Statistics and Teaching:** The proposed Web Based System will support Nursing Care Planning System that will help in the collection of statistics data on health care /services and the information within a health record supplies a practical and reliable source of material for the advancement of medical science and also show the incidence of diseases.

**For Non-Governmental Organizations:** The web based system to support nursing care plan has many benefits for NGO's and different program coordinators like to make information based-decision in identification and solving of problems faced in the health facility.

**For Policy makers:** Policy makers was used a data generated from design of a Web Based System to support nursing care planning system for their decision and to improve the effectiveness and efficiency of the health information system in the country.

# **Chapter Two**

## **Literature Review**

### **Literatures Overview**

The literature review section of this study enables the readers to gain a better understanding of the research topic. This study assesses and includes a wide range of resources: articles, journals, reports, magazines and books. Basic theoretical concepts about Web based health care system development and Nursing Care planning system on the view of designing requirement, methodology, and technology employed and system development discussed.

#### **2.1. General Literature**

#### **2.2. Web-based Health Care System Development**

WWW is the source of information over the internet. It is growing at a phenomenal rate. Delivering information over the web is cost effective and fast, and gives internet users easy access to databases from any locations. For this reason, technology will bring many opportunities for creating advanced information system management applications.

Web-based technology platforms allow for seamless, integrated delivery of desired services to users with requisite access right and privileges. Web-based and Web-enabled tools provide greater capacity to achieve efficiency in collecting and analyzing data and disseminating results [12].

Health informatics is crucial for hospital. Hospitals that have more accurate information systems than their competitors are also considered to be more efficient in ward performance. However, the existence of vast amounts of information related to a hospital may not necessarily help nurses to carry out their tasks efficiently. Instead, nurses frequently use irrelevant information for their routine tasks. For example, it may take a long time to

search for the reports or information they need. Sometimes, it results in information overload and redundant information. As a result, this can affect nurses' performance and increase the possibility of making errors. Although computerized systems have been introduced to improve efficiency in work practice, paper-based patient documentation is still operating in a lot of hospitals. A workflow management system that enables the workflow of nursing care is not easy to achieve and is also difficult to design to suit individual ward [13].

### **2.3. Nursing Informatics history definition and Importance**

Nurses has been working in the field of informatics near four decades, the term "nursing informatics" has been considered a specialization in nursing resources since 1984. Many aspects such as data recovery, ethics, patient care, decision support systems, human computer interaction, information systems, imaging informatics, computer science, information science, security, electronic patient records, intelligent systems, e-learning and telenursing have been added to the field [14].

Nursing Informatics as the application of IT in the nursing duties including education, management & practice in 1985. Integration of information science, computer science and nursing science to support nursing practice and knowledge management. The American Nurses Association published its aim and standards in 1994-1995 and presented the Nursing Informatics as a specialty that integrates nursing science, computer and information science to provide data communication management, knowledge and nursing work in 2001. Now most of nursing professionals believe that it is defined as the integration of information technology and all aspects of nursing such as clinical nursing, management, research or education [14, 15].

Nurses are integrated into the field of IT automatically. So they should be able to deal with it successfully to improve quality of care outcome. In this regard it is required to study the influence of nursing informatics on health care and make bold the appropriate information technology educational needs for nurses [15].

## **2.4. Competencies of nursing informatics**

The competency of nursing informatics specialists was determined through studying three categories including computer skills, informatics knowledge and informatics skills. It investigates four levels of nursing practice: beginning nurse, experienced nurse, informatics specialist, and informatics innovator. Some components of accepted competencies are shown below in brief [16].

computer skill competencies contain computerized searches and retrieving patient demographics data, the use of telecommunication devices, the documentation of patient care, the use of information technologies for improving nursing care, and the use of networks and computer technology safely [16].

Informatics knowledge competencies are the recognition of the use or importance of nursing data for improving practice, and the recognition of the fact that the computer can only facilitate nursing care and that there are human functions that cannot be performed by computers, the formulation of ethical decisions in computing, the recognition of the value of clinicians' involvement in the design, selection, implementation, and evaluation of systems in health care, the description of the present manual systems, the definition of the impact of computerized information management on the role of the nurse and the determination of the limitations and the reliability of computerized patient monitoring systems[16].

Informatics skills competencies includes the interpretation of information flow within the organization, the preparation of process information flow charts for all aspects of clinical systems, the development of standards and database structures to facilitate clinical care, education, administration or research. It also includes the development of innovative and analytic techniques for scientific inquiry in nursing informatics and new data organizing methods and research designs with the aim of examining the impacts of computer technology on nursing, and the conducting of basic science research to support the theoretical development of informatics. Information literacy skills, competencies, and knowledge are investigated among educators, administrators and clinicians of nursing groups nationally [16].

## **2.5. Nursing Care planning System**

The computer based information systems are designed to help nurses provide better patient care. A good NCIS can perform a number of functions and deliver benefits such as improving staff schedules, accurate patient charting and improve clinical data integration. The nursing department can have a better managed work force through schedule applications enabling managers to handle absences and overtime. The solution can also be used to monitor staffing levels and achieve more cost-effective staffing. Patient charting applications allow users to enter details regarding patients' vital signs. Nurses also use it for admission information, care plan and all relevant nursing notes. All important data is securely stored and can be retrieved when required. All these features in NCIS ultimately lead to a reduction in planning time and better assessments and evaluations. The chance of prescribing the wrong medication also decreases since there is always a reference for electronically prescribed drugs [17].

## **2.6 Functions of a Nursing care Information System**

The main tasks in the nursing care process include processes of patient care, of ward management, of communication and cooperation with other health professionals and education and research processes. The activities nurses perform when caring for patients have been identified and nursing roles have been categorized into three global categories [18].

The first is managerial roles or coordinating activities that involve the gathering and transmission of patient information, such as order entry, results reporting, requisition generation, and telephone booking of appointments. The second category is physician-delegated tasks. Current systems can capture these tasks from the physicians' order entry set and then incorporate them into the patient care plan. The third category is autonomous nursing function, characteristic of professional nursing practice, when knowledge unique to nursing is applied to patient care [18].

Patient care processes include all the treatments administered to patient by the nursing personnel. Nursing interventions describe the activities and behaviours used to deliver nursing treatments. As previously indicated, some of these respond to a physician's order but many do not. Data gathered for documenting nursing work includes nurse's observations, their examinations and

observations that formulate nursing diagnosis, scheduling of treatments and administration of medication, medical record charting, dietary registration, workload assessment, discharge or transfer of patient [18].

Clinical documentation is also written evidence of :Interactions among members of the healthcare team, administration of assessments, tests, procedures, treatments, and patient education, results or evaluation of a patient's response to diagnostic tests and interventions, outcomes, or expected outcomes, of the patient's interaction with, and as a part of, the plan of care [19].

Based on a nursing theory developed by Ida Jean Orlando in the late 1950's as she observed nurses in action, the Nursing Process is an essential part of the nursing care plan [20].

The Nursing Process is a systematic problem solving approach used to identify, prevent and treat actual or potential health problems and promote wellness. It has five steps; Assessment, Diagnosis, planning, implementation and evaluation [20].

Despite their knowledge of the nursing process, certain factors limited the ability of nurses to implement it in their daily practice, including lack of time, high patient volume, and high patient turnover. Despite these hurdles, the daily application of the nursing process is characterized by the scientific background of the professionals involved since it requires knowledge and provides individualized human assistance. However, the existence of failures was shown among the nursing diagnoses in the patients' history, as well as the implementation of nursing prescriptions without recording the evaluation of the expected results [20].

A nursing care plan is a written guide to the individual patient's nursing needs, purposefully stated so that appropriate nursing actions are specific or implied'. Therefore, care plans have been viewed as guidelines for care and incorporated into clinical practice to assess and document evidence of dedication to patient care. However, some researchers question whether this documentation process reveals the effects of nursing care or professionalism .The general benefits of adopting a computerized charting system have been viewed as time saving, effective and efficient, identifying more patient problems and implementing more interventions, and providing care guidelines [21].

Nurses who use nursing diagnoses need to identify the related factors, to define the characteristics (signs and symptoms) of patient problems, to provide the appropriate interventions and, finally, to observe patients' responses to the care process. However, nurses' use of nursing diagnoses has been affected by time constraints, lack of knowledge and experiences, and incomplete patient data. Similarly, studies have revealed that nurses' knowledge base and experience could affect their assessment process. Thus, constructing care plans requires that nurses integrate their knowledge base, long-term memory and problem-solving strategies to strengthen the diagnostic reasoning process [21].

Understanding nurses' perceptions of this computerized documentation process could not only enhance their adaptation to using this technology, but also improve the quality of patient care resulting from better designed care plan content and training programmes. Therefore, this study was conducted to explore further how the content of the CNCP system influences nurses' perceptions of this documentation process in making care plans [21].

## **2.7 Electronic Nursing Care Planning Management Information System**

The system have their own features: **Patient Charting:** A patient's vital signs, admission and nursing assessments, care plan and nursing notes can be entered into the system either as structured or free text. These are stored in a central repository and retrieved when needed. **Self-schedule their shifts** using scheduling rules provided in shift modules. The shifts can later be confirmed or changed by a scheduling coordinator or manager. Shift modules are designed to handle absences, overtime, staffing levels and cost-effective staffing, **Clinical Data Integration;** clinical information from all the disciplines can be retrieved, viewed and analyzed by nursing staff and then integrated into a patient's care plan and **Decision Support:** Nursing Information System, and they provide prompts and reminders, along with guides to diseases linkages between signs/symptoms, etiologies/related factors and patients populations, online access to medical resources can also be made available [22].

## **2.8 Web based Nursing Care Information Systems Architectures**

A common misperception in developing HISs for public health applications is the expectation that such systems are analogous to their counterparts in IT- intensive industries. Health is a

combination of many uncertain inputs. These inputs range from the unique biologic and behavioral characteristics of the individual patient or population under study, to health insurance characteristics and the accessibility of health resources, to the practice styles of physicians and other health professionals, as well as to thousands of possible diagnoses, comorbidities, risk factors, and interventions[23].

Architecture is a process by which stakeholder needs and concerns are captured, architecture to meet these needs is designed, and the architecture is clearly and unambiguously described via an architectural description [24].

To improve health care services, it is very important that there is consistency in clinical data. Traditionally, large amounts of data have been captured in unstructured formats, but the industry is applying structured data with standardized coding and terminology. Information system architecture can make sure that the data structures and taxonomies implemented throughout the organization are in coherence internally and well-suited externally with business partners, regulators, and payers [25].

While designing a web application uses the 3-tier system architecture, it has three tiers with each tier belonging to one layer, presentation, logical and database a view aids in understanding different perspectives of different users in the system [26].

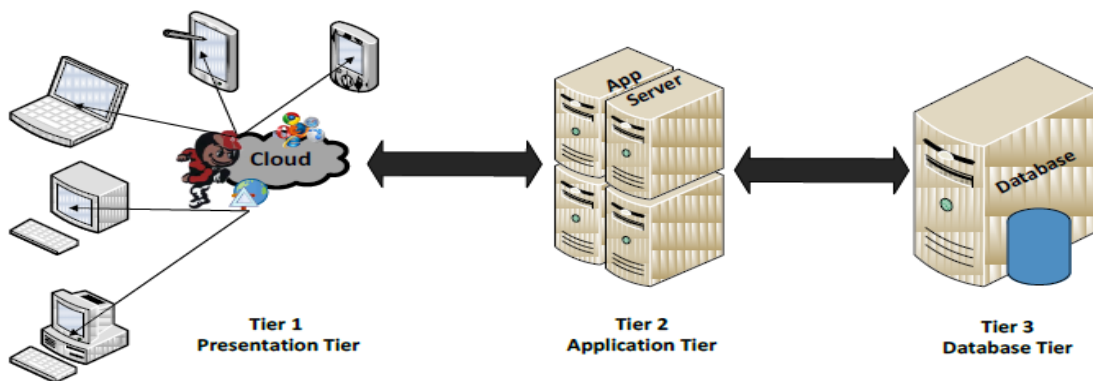


Figure 1: Three-Tier Architecture [26].

## **2.9 Related work on Nursing care planning process**

The study conducted in USA was used to Design a Web Based Nursing Home Information System. Most of the nursing homes in the United States do not have clinical information systems at their facility due to which elderly people who reside in the facilities are not reaping the benefits that these systems are thought to have. Some Nursing homes that do have clinical information systems deployed are not primarily designed to support nursing care coordination [27].

The purpose of this study is to explore the emerging need for Nursing Home Information Systems (NHIS) in long term care facilities and the promise they hold for increased efficiency, better accuracy, reduced cost, and improved outcomes. With Internet becoming an important topic in health care industry due to its capability for increased accessibility to information, a web based information system proves more beneficial to organizations [27, 28].

The emergence of World Wide Web technology constitutes one significant milestone on the road to efficient developments and deployment of clinically useful systems. Considering these benefits of web technology, this study first analyzes differences between traditional stand-alone clinical systems and web based clinical systems. Further study concentrates on the need for TigerPlace facility to develop and implement a web based clinical information system, the process adopted towards developing the required system, its implementation and use at the facility, success of the system, and future enhancement possibilities for the system [28, 29].

The web-based EHR system at TigerPlace is an integrated set of a comprehensive EHR project that manages health care and personal data for residents at the facility. The system is tightly linked with other clinical systems used at the TigerPlace and facilitates the capability to share data with these systems. Apart from health care data, the system database was designed to support additional functions related to administrative processes. With a simple interface design, staff members found the system very easy and user friendly to use [29].

The capability of being able to access the EHR system from any remote area with Internet access proved to be the most beneficial feature of the system. Compared to the previously used commercial EHR system which required nurses to manually update the data from their local

system to the server, the new EHR automatically updated the data in the database server in real time. Furthermore, many of the paper based assessment forms used by care givers at the facility were integrated into the new EHR system. This feature of real time update and automation of paper based assessment forms helped to save nurses time in documentation, thereby freeing them up to spend more time with residents [29].

Research project conducted in Florida to implement a Web-based Automated Classification System for Nursing Language Based on Nursing Theory Health care systems consist of various individuals and organizations that aim to meet the health care needs of people and provide a complete and responsive health care solution. One of the important aspects of a health care delivery system is nursing. The use of technology is a vital aspect for delivering an optimum and complete nursing care to individuals; and also for improving the quality and delivery mechanism of nursing care [30].

The model proposed in this thesis for Nursing Knowledge Management System is a novel knowledge based decision support system for nurses to capture and manage nursing practice, and further, to monitor nursing care quality, as well as to test aspects of an electronic health record for recording and reporting nursing practice. As a part of a collaborative research of the Christine E. Lynn College of Nursing and the Department of Computer Science, a prototype toolset was developed to capture and manage nursing practice in order to improve the quality of care [30].

The study conducted in Columbia, designing the a Diabetes Disease Management System .The researcher show the role of modeling clinical work flow in the design philosophy of our application, and summarize the application's feature and usage. Next, the researcher describes observations made during and after design and implementation, and how they relate to the informatics literature. Finally, the researcher elaborates on the application, and its use as an organizational frame work for the roles of information technology in diabetes care [31].

In designing the DMA, the researcher wanted to develop an application that would integrated with the work flow of clinicians as seamlessly as possible (given realistic and pragmatics constraints). In doing so the researcher concurrently addressed each of the three steps of the

process detailed. In incorporating various functionality for each of the steps listed in the research project, the researcher explored one several potential applications of IT in diabetes care [31].

The paradigm of feedback control systems can help guide the systematic development and exploration of other diabetes related IT applications. The feedback control paradigm embodied in DMA is at the level of individual patients one can also use this paradigm on a population based level. Currently the researcher exploring the potential applications of information technology in diabetes care on population level basis [31].

In Korea development of the ICNP Based Cancer Nursing Information System. Therefore, development of the nursing information system that uses the ICNP, as an integrated nursing language classification system, for efficient management of the cancer patients' nursing data is needed. System contributes to improvement of clinical usability under the nursing process and to enlargement of range of nursing records. In addition, the system developed in this study was based on ICNP, a standardized unified nursing terminology system, for controlling data related to cancer nursing effectively [32, 33].

A cross sectional study conducted on nurses who had used a computerized nursing care planning system (CNCP) in Taiwan which are implemented CNCP system in all inpatient department units to document patient care plans, the development of information systems has given healthcare providers rapid access to patient records through network terminals. This electronic access has generated concern about the confidentiality and security of patient information [33].

The system had an automatic format for selection of nursing diagnosis from nursing assessment, nursing intervention from nursing diagnosis. Nursing evaluation consists of the change of the nursing phenomenon in patients between the times of assessment. As a result of the verification, 96 nursing phenomena statements, 44 nursing diagnoses, 117 nursing action statements and 78 nursing interventions were remained, and cross-mapping of these statements was executed according to the guidelines of cross-mapping of ICNP beta version with the experts group [20].

The study conducted in South Korea using object oriented approach it address the analysis and design requirements of a terminology-based ENRS that was implemented in May 2003 at

Bundang Seoul National University Hospital. The use case view describes the behavior of the ENRS as seen by a nurse, a nurse manager, and a physician. The static aspects of this view were captured in a use case diagram. The use case diagram comprised eight use cases addressing record management. The part devoted to the management of nursing terminology was specialized to the ICNP Term Management use case, Statement Management use case, and three other use cases supporting functions of terminology management. Physician, Nurse, and Nursing Term Manager were identified as the actors that use these use cases [34, 35].

The Physician is an actor who also represents other healthcare professionals that need to refer to nursing documents, such as nutritionists, pharmacists, radiation therapists, and staff of the insurance department. The Nurse (including the nurse manager) is an actor who participates in writing nursing documents, and supervises them for service quality assurance. The Nursing Term Manager is an actor that takes charge of terminology management, including the ICNP concepts and controlled pre coordinated statements [34, 35].

A cross-sectional study was conducted on the assess factors affecting implementation of nursing process among nurses on selected governmental hospitals in Addis Ababa. Both quantitative and qualitative methods were used. That covers five hospital and 202 respondents. Nursing process implementation is affected by various factors. The study has identified organizational factors, patient related factors, and level of knowledge and skill were among those factors highly influenced nursing process implementation. This factors cause poor quality of nursing care, disorganized caring system, conflicting role, medication error and readmission with similar problem, dissatisfaction with the care patients have received, and increased mortality [11].

## **2.10 System Analysis and Design Approaches**

### **2.10.1 System analysis and design aapproach**

The most common approach to (SDLC) is a structured methodology based on Waterfall model. It adopts a formal step-by-step approach to the SDLC phases and activities – the activities of one phase must be completed before moving to the next phase. At the completion of each activity or phase, a document is produced that must be approved by the stakeholders before moving to the next activity or phase [36].

### **2.10.2 The object oriented approach**

This methodology views a system as a bottom up approach to systems development. To start with, it describes the system through a set of business processes it performs as well the object classes that these processes deal with. It uses a set of diagrams or models to represent various views and functionality of a system and is commonly known as UML. When these models are used along with a particular method of systems development, the Object-Oriented approach later became known as the Unified process [36].

Unified Process follows an iterative and incremental approach to systems development. The systems development life cycle is viewed as consisting of several increments or phases: inception, elaboration, construction, and transition, In each increment or phase, the developers move through the activities of gathering requirements, analyzing the requirements, designing the system, implementing the design, and testing the system[36].

### **2.10.3 Rapid Application Approach**

Rapid Application Development (RAD) refers to a type of software development methodology that uses minimal planning in favour of rapid prototyping. The "planning" of software developed using RAD is interleaved with writing the software itself. The lack of extensive pre-planning generally allows software to be written much faster, and makes it easier to change requirements. RAD is a software development methodology that involves techniques like iterative development and software prototyping [37].

When organizations adopt rapid development approach, care must be taken to avoid role and responsibility confusion and communication breakdown within the development team, and between the team and the client. In addition, especially in cases where the client is absent or not able to participate with authority in the development process, the system analyst should be endowed with this authority on behalf of the client to ensure appropriate prioritization of non-functional requirements [37].

## Chapter Three

### Methodology

#### 3.1. Study Area and period

Wolaita Sodo Outona Referral Hospital was found in, SNNP Regional State of Wolaita Sodo town which 395 km away from Addis Ababa in southern direction. The hospital was established in 1929 e.c by missionaries in 20 hectares of land and handover to local government by the year 1938. The institution was upgraded to referral hospital in 2004 E.C and currently serves to more than 2 million people by 361 employees (annex III). The study was conducted from January 1, 2015 to May, 2015 in Wolaita Sodo Outona Referral Hospital.

#### 3.2. Study Design

This study employs Object Oriented (OO) methodology to design Web-based System to Support Nursing Care Planning for the health facility. It is an appropriate method to develop the system hence there are different objects interacting within the system like patient, Nurses, and their service operation like assessment, diagnosis, Care plan, implementation or intervention and evaluation, report. This is because the focus of object oriented system development is on interacting Objects in the real-world [38].

Object Oriented (OO) analysis and design is a way to develop information system by building self-contained modules (Objects) that can be more easily replaced, modified and reused; that is why the investigator use this method to integrate the patient data that could be produced from the health facility during service delivery to users [38, 39].

#### 3.3. Source Population

All health professionals who are 74 in number give service in inpatient department of Wolaita Sodo Outona Referral Hospital.

### **3.4. Study Unit**

Based on study conducted in Oromia Regional Health Bureau, licensing and inspection department revealed 25% of study populations were addressed for interview [40]. Taking in consideration of non-respondent rate 7% totally 24 inpatient health workers were purposively selected for interview in this study .The following table presents sample size and sampling technique (table 1 and annex II).

Samples taken													
	Total Number of Population Respondents						Total Number of Sample Population Respondents						Sampling technique
Inpatient Ward Type	Nurse			Physician			Nurse			Physician			Purposive sampling
	Male	Female	Total	male	Female	Total	Male	Female	Total	Male	Female	Total	
Matron head of nurse	2	-	2	-	-	-	1		1				PS
Medical Ward	5	7	12	-	-	-	1	2	3	1	-	1	PS
Surgical Ward	4	8	12	-	-	-	1	1	2	1	-	1	PS
Guyenne Ward	1	14	15	1	-	1	2	1	3	1	-	1	PS
Pediatric Ward	5	7	12	-	-	-	2	1	3	-	-	-	PS
Neonatal Ward	1	5	6	-	-	-	1	2	3	-	-	-	PS
Emergence Ward	3	7	10	-	-	-	2	2	4	-	-	-	PS
Clinical Medical Director	-	-	-	2	-	2	-	-	-	1	-	1	PS
<b>Total</b>	<b>21</b>	<b>48</b>	<b>69</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>10</b>	<b>9</b>	<b>19</b>	<b>4</b>		<b>4</b>	
	<b>HMIS Officer</b>						<b>HMIS Officer</b>						
HMIS	<b>Male</b>	<b>Female</b>					<b>Male</b>	<b>Female</b>					
	<b>1</b>						<b>1</b>						
<b>All Study Population</b>	<b>76</b>												
<b>Total Number of Samples</b>							<b>24</b>						

Table 1: Sample for the Study; WSSNCP, March to April 2015

### **3.5. Method of Data collection**

This research project used primary data which was collected through interviews, Observation, and document analysis. The data were collected by the principal investigator.

#### **3.5.1. Interview**

The face to face interview was conducted with 24 health professionals who are working in inpatient department. The responses of the respondent were recorded in audio based and taking short notes in paper form. These interviews have their own importance to gain information about the existing nursing care planning process that serve as an input for web based design of nursing care planning.

#### **3.5.2. Observation and Document Analysis**

Systematic observation and document analysis have their own importance and create a chance to observe what actually implemented regarding nursing care planning. During observation and document analysis the business process of manual (paper) based record system of seven wards were assessed .Regarding the documentation: registration book form, assessment form, nursing diagnosis form, care plan form, implementation form, evaluation form, report form, nursing national guide line and other formats were taken as initial requirement for system design .

### **3.6. Data Quality Assurance**

Data collection instrument were shaped according to answer need of information from study unit before the actual data collection. Data collections were conducted by principal investigator. Finally collected data were checked for its completeness before taking to use as requirement tool for design.

### **3.7. Data Processing and Analysis**

The collected data through interview, observation and document review was summarized in relation with the ideas found in different phases of nursing care planning process. This aggregation was conducted based on the Federal Ministry of Health nursing care planning operational guide line.

### **3.8. System Development Phases**

In this web based system design Object Oriented were used as a methodology followed that the system was designed put in consideration the principle of object oriented analysis and design phases.

#### **3.8.1. Analysis and Design Technique**

In this design of a web based system to support nursing care planning the following technique were used.

- Context diagram
- Use case diagram
- Analysis class diagram
- Design class diagram
- Sequence diagram
- System Architecture
- Subsystem
- ER diagram
- Unified Modeling Language (UML modeling), was used to modeling the components of the system

#### **3.8.2. Analysis and Design tools**

- ✚ In this design of a web based system to support nursing care planning Visio 2010 and Argo UML were used as software tools.
- ✚ Front end: HTML enable the construction of easy and intuitive user interface for accessing the database and any browser can display and html document [41].
- ✚ Middle ware: PHP enables links of the text entered in the created graphic user interface to be sent to the database [41].

Back end: My SQL it's easy to use, inexpensive database language it can run on a variety of operating system such as window, Linux, and others. It is secure and technical support is widely available on the internet but most of all it supports large databases [41].

### **3.8.3. Object-Oriented Analysis (OOA)**

OOA emphasizes an investigation of the problem and requirements, rather than a solution. It concerns with determining the system requirements and identifying classes and their relationships that make up an application. This phase also called requirement analysis. The classes identified in this phase represented using the domain model or conceptual model class and also their attributes and relationship are expressed. Therefore the investigator develops the domain model in this phase using one of UML artifacts (class diagram).

Finally the response for interview was summarized and used in requirement document. Then it is described using essential use case modeling that helps the researcher to understand the existing system very well, helps to identify difficulties for current system detailed and helps identify gaps to be filled by the new designed system. This requirement serves as an input for the next stage of system development.

### **3.8.4. Object-Oriented Design (OOD)**

The study uses OOD to define objects and how they collaborate to fulfill the requirements independent of implementation. During object oriented design phase of the system in this study emphasizes on designing web based system objects, classes with their attributes, methods, and interfaces using UML artifacts class diagram. Then designing entity objects in the system database with their attributes and association between entity objects and designing/prototyping user interface for the system where a user in the health facility interacts. More over the design prototype user interface were evaluated based on heuristic evaluation method.

## **4.9. Ethical Consideration**

Ethical clearance was brought from Addis Ababa University School of Public Health to conduct this project .Beside this official letter was written to Wolaita Sodo Outona Referral Hospital from school of information science to assess the requirement.

## **4.10. Dissemination of Results**

This project final report will disseminated to Addis Ababa University and Wolita Sodo Outona Referral Hospital

### 3.11. Operational Definitions

- **Health facilities:** health institutions like health centers, clinics, hospitals, etc.
- **HMIS:** routine health information system or information systems in the health system producing service generated routine data, which includes data that can be used for managing services.
- **Patient, client:** people who get service from health facilities
- **Triage officer:** Triage officer refers to a professional who screens patients status
- **Nursing Assessment :** a systematic and ongoing collection of data relating to the patient; pertinent data are collected using appropriate assessment techniques;
- **Problem Identification or Diagnosis:** consists of the analysis of the collected assessment data to identify the patient's problems/diagnoses, needs, and resources. Diagnoses are documented in a manner that facilitates the determination of expected outcomes and plan of care.
- **Care Plan:** developing a plan of care that prescribes interventions to attain expected outcomes; i.e. linkages are established among diagnoses, interventions, and outcomes. The plan is individualized to the patient and priorities for care reflecting current practice are established.
- **Nursing procedure Implementation:** identified interventions are carried out, the plan of care is put into action, and the interventions are documented in a timely manner.
- **Nursing procedure Evaluation** - the accuracy of diagnoses and effectiveness of the interventions are evaluated in relationship to the patient's progress; actual outcomes are determined. The effectiveness of interventions is documented in relation to the attainment of the outcomes.
- **Entity relationship diagram:** An entity-relationship diagram (ERD) is a data modeling technique that graphically illustrates an information system's entity and the relationships between those entities.
- **Heuristic evaluation**

## **Chapter four**

### **Discussion of Results**

### **Analysis and Design of the System**

## **4.1 Analysis**

### **Introduction**

In this chapter the current system, the business process, the functional and non-functional requirements, use cases, process models, data models, and the design of the system are presented.

#### **4.1.1 Current System**

Currently, in Wolaita Sodo Referral Hospital used to record nursing care planning service information management system is a system that is been carried out in terms of manual operation, a system in which all the methods of care service administration is a manual approach. The approach is such that the hospital staff will record duty information on a paper or record and kept in a file. Critical analysis of this system reveals that it is a system prone to a lot of errors and it is not effective. Searching for workers duty information is time consuming and boring. The system is in such a way that the office is full of files. This tends to make the office untied. Careful analysis also shows that because of the complexities of the manual system, information stored is difficult to retrieve. Also because of the inconsistency of the manual system; at times files are lost because of mismanagement.

#### **4.1.2. Findings of the current organizational system**

##### **4.1.2.1. Data and Process**

In the data and information process of the existing system the following points are addressed. Information processed in the current system is patient history, patient assessment, nursing diagnose, medication administration information and vital sign information are recorded using paper based. Manual information recording format sample are taken to identifying data included in each type of information processed. All patient data are recorded in different formats, collected in individual patient card and filed in central card room. The problems identified on the existing forms are listed below;

- ✓ There is data redundancy in all recording format.
- ✓ Recording formats are changing frequently.
- ✓ Recording data on the formats are very time consuming.
- ✓ Incomplete data records occur frequently.
- ✓ Loss of filled formats from individual patient card.
- ✓ Shortage of formats.

Patient information is retrieved by reviewing patient individual cards that recorded previously. The patient history is captured verbally from patient him/herself or from patient relatives. The nursing care process is started when patient is admitted in one of inpatient departments. The problems identified from the existing data processing are;

- ✓ Difficult retrieving patient file.
- ✓ Loss of complete patient file.
- ✓ -Difficult in information accessing.

The error happens most in nursing care recording process is miss management of patient, due to unclear handwriting and incomplete of records.

#### **4.1.2.2. Report/ Communication**

The data collected is used only by reviewing previously recorded patient data from his/ her card. There is no system or supporting ways for data analysis in the existing system. Nurses need patient history and assessment result to identify nursing diagnosis and evaluate patient outcome. In the existing system patient information flow among the professionals using morning session, daily patient summary book, and medication cardex form. Reports are prepared daily, weekly and monthly made on patient information and submitted to hospital HMIS officer and hospital management using paper based in the existing system. Communication is made only using manually recorded documents.

#### **4.1.2.3. People**

All health professionals can access patient records in the existing system. The one who record the information of the patient is responsible for the record error. All nurses are responsible to make report as required. Almost all nurses have no computer skill within the organization.

#### **4.1.2.4. Management (Procedure)**

In the existing system national guided line for nursing care processes is being used to give care. The patient information recording procedures include;

- ✓ Patient history taking
- ✓ Patient Assessment
- ✓ Patient diagnosis
- ✓ Care plan
- ✓ Patient care implementation
- ✓ Care evaluation

Problems on patient information recording process reviewed and handled by the department head nurse randomly.

#### **4.1.2.5. Software**

As per the response of the medical director of the hospital there is planning to purchase computer and provide training on computer usage for the staffs to improve the current system. In the existing system there is no software and computer network for sharing information.

#### **4.1.2.6. Hardware**

The existing computer hardware available in the organization is only two computers for medical director and one for head nurse. They use these computers for writing letters.

The above interview response help to show the current activity of the system, the existing system problems, available resources, help to find actors of the system, and to understand the business domain.

## 4.1.2 The Proposed System

The introduction of the new proposed system is designing for nursing care service process inpatient department of the Wolaita Sodo Referral Hospital; it helps to facilitate the services of the department. This system will be used as record management system, nursing care decision support system, report generating system, nurse staff management system. The researcher use objects oriented method for analysis and design of the system. This proposed system would have a great importance and will solve the problem of manual system. The new system will reduce errors and helps proper documentation for each and every step of nursing care process treatment data of patients.

This means that they must ensure that nursing records are correctly maintained, that report is correctly given at the shift change, and generate aggregate report and so for.

### 4.1.2.1 System Requirement

This section describes the hardware components and software requirements needed for effective and efficient running of the system.

COMPONENT	RECOMMENDED
CPU	2Quad Core Intel® / Core i(X) or Xeon processors at 2.33 GHz – 3.5 GHz Series Processor (implementing 64 bits architecture)
Hard disk	3 TB SAS disk array at 10k rpm (3 TB).
DVD-ROM	48 DVD+/-RW
Memory	From 12 GB up to 64 GB
Screen/Video adapter	17" Flat Panel
Backup streamer	Digital tape streamer with the same capacity as the total disk space
NIC	1GB, Network card supported by the network installed 100 Mbps for best performance
Number of users	2,200 to 3,600 users available access the system. Database Engine with 2,200 to 3,600 users easily to manage.

**Table 2:** Server Side Hard ware Requirements [41, 42]

<b>COMPONENT</b>	<b>RECOMMENDED</b>
CPU	Intel Pentium (R) Dual Core CPU ES400@ 2.33 GHz / 2.49 GHz processor
Hard disk	<b>160 GB SATA</b>
RAM	2 GB or more of RAM
Screen/Video adapter	A monitor with a resolution of 1024 × 768
NIC	Network card supported by the network installed  100 Mbps for best performance
Printer	Windows compatible printer

**Table 3:** Client Side Hardware Requirements [41, 42]

### Software Requirements

<b>COMPONENT</b>	<b>RECOMMENDED</b>
Operating System (OS)	Windows Server 2003/2008 64bit (Server edition is required for networks with > 10 workstations)
Microsoft.NET Framework	.NET 3.5 SP1 is a requirement for SQL Server 2008 when you select Database Engine, Reporting Services, Master Data Services, Data Quality Services, Replication, or SQL Server Management Studio

**Table 4:** Server Side software Requirements [41, 42]

<b>COMPONENT</b>	<b>RECOMMENDED</b>
Operating System (OS)	Window XP /Vista/7
Anti-virus program	Licensed (updated).

**Table 5:** Client Side software Requirements [41, 42]

### 4.1.2.2 Functional Requirements

The functional requirement of the system is concerned with the functionality that the system should provide to users. This system is designed to enable users to collect and gathered health care service records related to Nursing Care Planning service. It can also provide a means for health Professionals to request assistance and get information on how to give a care service to the patient. The functional requirements are listed as follows.

<b>ReqID</b>	<b>Requirement</b>	<b>Mapping to WSSNCP System Component</b>	<b>Use case</b>
RQ-1	The System shall enable the identification of different users and their roles	Application Layer: Admin UI Presentation Layer: Admin UI	UC-2
RQ-2	The System shall support the management of System Actors relationships (mainly Medical Doctors/ HMIS Officer/ Nurses relationships) The system should have a feature to manage group of system users	Application Layer: Admin UI Presentation Layer: Admin UI	UC-10
RQ-3	The System shall use for recording of vital signs and physical activity, monitored individuals patient.	Application Layer: Admin UI Presentation Layer: Admin UI	UC-5
RQ-4	The System shall enable the registered healthcare professionals to register new patients	Application Layer: WSSNCP UI Presentation Layer: WSSNCP UI	UC-2
RQ-5	The System shall enable the registered user to view / edit monitored person's demographics	Application Layer: WSSNCP UI Presentation Layer: WSSNCP UI	UC-10

RQ-6	<p>The system will keep track of patient's medical history and basic information.</p> <p>A patient's record will include their Nursing care planning history, provided by the patient at The system will keep track of treatments undergone both past and present from patients.</p>	<p>Application WSSNCP UI</p> <p>Presentation WSSNCP UI</p>	<p>Layer:</p> <p>Layer:</p>	<p>UC-2</p> <p>UC-6</p>
RQ-7	The System shall give the healthcare professionals the ability to assign questionnaires to their patients to assess or gather information.	<p>Application WSSNCP UI</p> <p>Presentation WSSNCP UI</p>	<p>Layer:</p> <p>Layer:</p>	UC-3
RQ-8	The system shall provide for the recording patient assessment information	<p>Application WSSNCP UI</p>	Layer:	UC-3
RQ-9	The system shall provide for the recording Nursing Diagnosis alternative option for expected symptom.	<p>Application WSSNCP UI</p>	Layer:	UC-4
RQ-10	The System must provide a structured view of the care plan of a patient information	<p>Application WSSNCP UI</p> <p>Presentation WSSNCP UI</p>	<p>Layer:</p> <p>Layer:</p>	UC-6
RQ-11	The system shall provide for the recording the implementation information	<p>Application WSSNCP UI</p>	Layer:	UC-7
RQ-12	The system shall provide for the recording evaluate expected outcome information	<p>Application WSSNCP UI</p>	Layer:	UC-8
RQ-13	The system should enable system users to generate daily, weekly, monthly, yearly report based on the collected data and information	<p>Application WSSNCP</p> <p>Presentation WSSNCP UI</p> <p>Database Layer WSSNCP</p>	<p>Layer:</p> <p>Layer:</p>	UC-9
RQ-14	<p>Data requirements of the system</p> <p>The system will be comprised of a database with search capabilities.</p> <p>The data will mainly be patient information, staff information, and daily schedules</p>	<p>Application WSSNCP UI</p> <p>Database Layer WSSNCP UI</p>	Layer:	UC-10
RQ-15	<p><b>Business rules and logic</b></p> <ul style="list-style-type: none"> <li>• Only Users allowed in system, username and password required</li> </ul>			

	<ul style="list-style-type: none"> <li>• Department staff nurses can clearly see all Nurse' schedules. Reports of progress of patient &amp; schedule are printed daily and handed to Medical Staff for reference.</li> </ul>	
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Remark: RQ = Requirement id, UI= User Interface

**Table 6:** Functional System Requirements.

### 4.1.2.3 Non-functional Requirements

The non-functional requirements describe user visible aspects of the system that are not designated to the functional behavior of the system. They span on a number of issues from user interface to security issues and the constraints of the system to improve quality of service... In a nutshell the basic non-functional requirements can be viewed as follows:

#### Availability

Since the hospital give services for 24 hours, the system should be available 24 hours/day or 7 days a week, and there should be 24 hours/day of electricity and back up source such as generator for the system to work without interruption. In addition the system should be use English language since it is difficult to translate the diagnosis and medication of illnesses [43].

#### Scalability

This project considers currently available health institutions and level of professionals in the country. But the numbers of healthcare providers as well as professionals are increasing. Therefore the system should scale up to accommodate this increasing need without a noticeable performance downgrading. Though, the architecture used allows seamless scalability, the network infrastructure should also accommodate. Along with the scalability issue, the system allows easy extensibility. It is simple to add services or integrate with other systems. In addition to using a tiered architecture, to further simplify scalability, Web based system to support nursing care planning allows other systems, to consume the common services. It expose functionalities such as getting list of messages, reports and authentication as a web service so that they can use them as part of another system [43, 44].

## **Performance**

Healthcare Professionals work in an environment where there can be a significant amount of stress and the time to perform certain tasks can be limited. To ensure the Users of the Nursing Care Planning Application System are not delayed unnecessarily it is important that strict Screen Performance times are adhered to. At the same time, the system must provide accurate, consistent and reliable data to the system users. User interface screens shall respond with speed so as to ensure fast data entry to the system. The system shall have flexible and convenient provision for data import/export with other application [43, 44].

## **User interface and Human factor**

Users are communicating with the system through the application interface which is easy to use by the health workers. This will minimize the time needed for users to adapt to use the system. There will be interfaces and menus for each function provided by the system to easily navigate from one point to the other [43, 44].

## **Organization and Human Resource**

In order to support the computerized system, the manual procedures may need to be changed partially or completely. The consequence of this may be the disappearance of some manual functions and the introduction of new ways of working. But doing this may need to conduct business process re-engineering; for instance, restructuring the organizational structures of the agencies that have been responsible for the system. It is also necessary to provide training for all the users who are working in the actual nursing care process service system [43, 44].

## **System Modification**

The system will be modifiable at any time to enhance features based on the facility needs. As needs change from time to time the original system will be made available to fill the gap between the system and the newly emerging needs. The system could be enhanced by adding new functionalities without necessarily changing the basics [43, 44].

## **Security Issues**

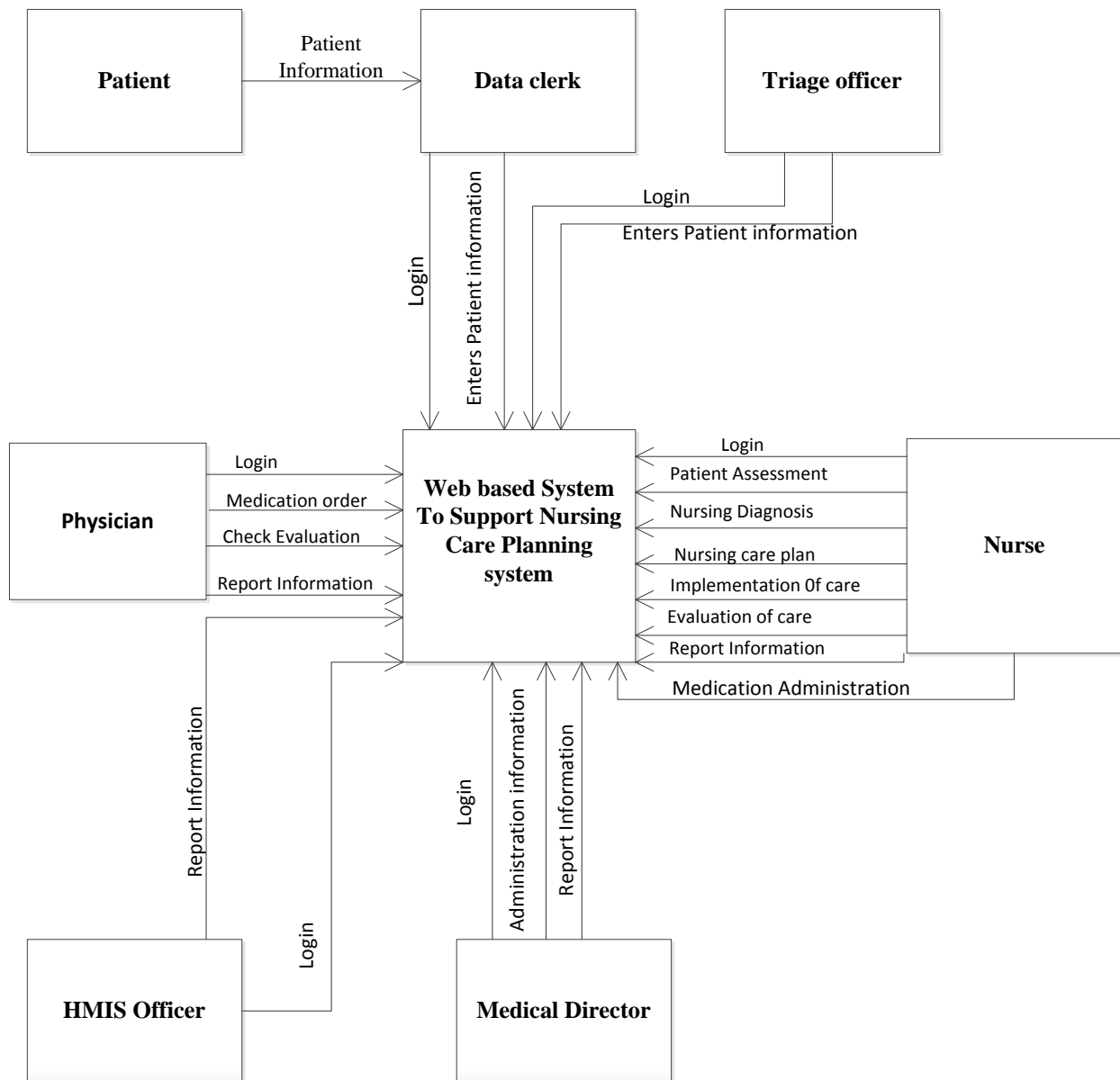
Since the system is going to handle personal information which is confidential, it should be protected from unauthorized users and intruders. No one can log into the system without a registered user name and corresponding password. Moreover, the system will use encryption techniques to avoid the tapping of the data while in transfer. This will prevent the system from being accessed by eavesdroppers [44].

### **4.1.3 Process Modeling**

A process model is a graphical way of representing how a business system should operate. It illustrates the processes or activities that are performed and how data move among them. A process model can be used to document the current system (i.e., as-is system) or the new system being developed (i.e., to-be system), whether computerized or not [45].

### **4.1.3 Contextual Diagram**

The context diagram shows the entire system in context with its environment. It shows the overall business process as just one process and also shows how a system that is being modeled is positioned in an environment with other systems and processes. They help define the boundaries of the system to be developed [45].



**Figure 2:** Contextual Diagram of the proposed system

#### 4.1.3.1. Object-Oriented Analysis (OOA)

OOA emphasizes an investigation of the problem and requirements, rather than a solution. It concerns with determining the system requirements and identifying classes and their relationships that make up an application. This phase also called requirement analysis [45].

The classes identified in this phase represented using the domain model or conceptual model class and also their attributes and relationship are expressed. Therefore the investigator develops

the domain model in this phase using one of UML artifacts (class diagram). Since, by using class diagram it is possible to represent the structure and behavior of the object [46].

### **Benefits Object Oriented Analysis**

- 1) Maintainability: simplified mapping to the real world
  - a) less analysis effort
  - b) less complexity in system design
  - c) easier verification by the user
- 2) Reusability: reuse of the artifacts that are independent of the analysis method or programming language
- 3) Productivity: direct mapping to the features implemented in Object Oriented Programming Languages

The core tasks in object oriented analysis phase in designing Wolaita Sodo Referral Hospital was defining of what to build. So the study focuses on understanding the requirements document to produce a high level specification that describes what the system is supposed to do [37].

#### **4.1.3.2. Use Case modeling**

Use Case modeling is the simplest and most effective technique for modeling system requirements from a user's perspective.

Use Cases are used to model how a system or the nursing care planning currently works in the hospital, or how the health professionals wish it to work. It is not really an object-oriented approach; it is really a form of process modeling. It is, however, an excellent way to lead into object-oriented analysis of systems.

Use cases are generally the starting point of object-oriented analysis with UML. The Use Case model consists of actors and use cases. Actors represent users and other systems that interact with the system. They are drawn as stick figures. They actually represent a type of user, not an instance of a user. Use cases represent the behavior of the system, scenarios that the system goes through in response to stimuli from an actor [47].

### 4.1.3.3. System use case modeling

An actor describes any entity that interacts with the system. In this system, the interaction of actors with the system .which runs in the Web based system or through the web interface which is deployed in the Hospital. In the proposed system, the following actors were identified. The actors are listed in Table 7.

<b>Actor Name</b>	<b>Description</b>
Data clerk	Data clerk refers to a person who gives service in the registration department or enters the patient personal information and address to the system.
Triage officer	Triage officer refers to a professional who screens patients status
Physician	Physician refers to professionals who diagnosis and treated patients and evaluate the nursing evaluation and treatment data's to the system.
Nurse	Nurse refers to professionals who have given nursing care service to the patient, View the patient detail and add a new patient history and entered nursing care process information into the system.
Medical director	The manager of the hospital will view, schedule, generate and print the report from the system.
HMIS Officer	The HMIS Officer will view, generate and print the report from the system.
System Administrator	Administrator refers to the person who administers the system and Maintain the system of User Account.

**Table7: Identified Actors**

#### **4.1.3.4. System Use case description**

To better represent the functional requirement of the system, use case model is used. It is used to model the interaction between actors and the system. A use case describes a function provided by the system that yields a visible result to the actors. In the proposed system, the following use cases are identified. Figure 4.1 shows use case diagram of the system.

#### **List of Identified use cases**

Login

Registration patient

Assessment nursing care service

Diagnosis nursing care service

Care plan nursing care service

Implementation nursing care service

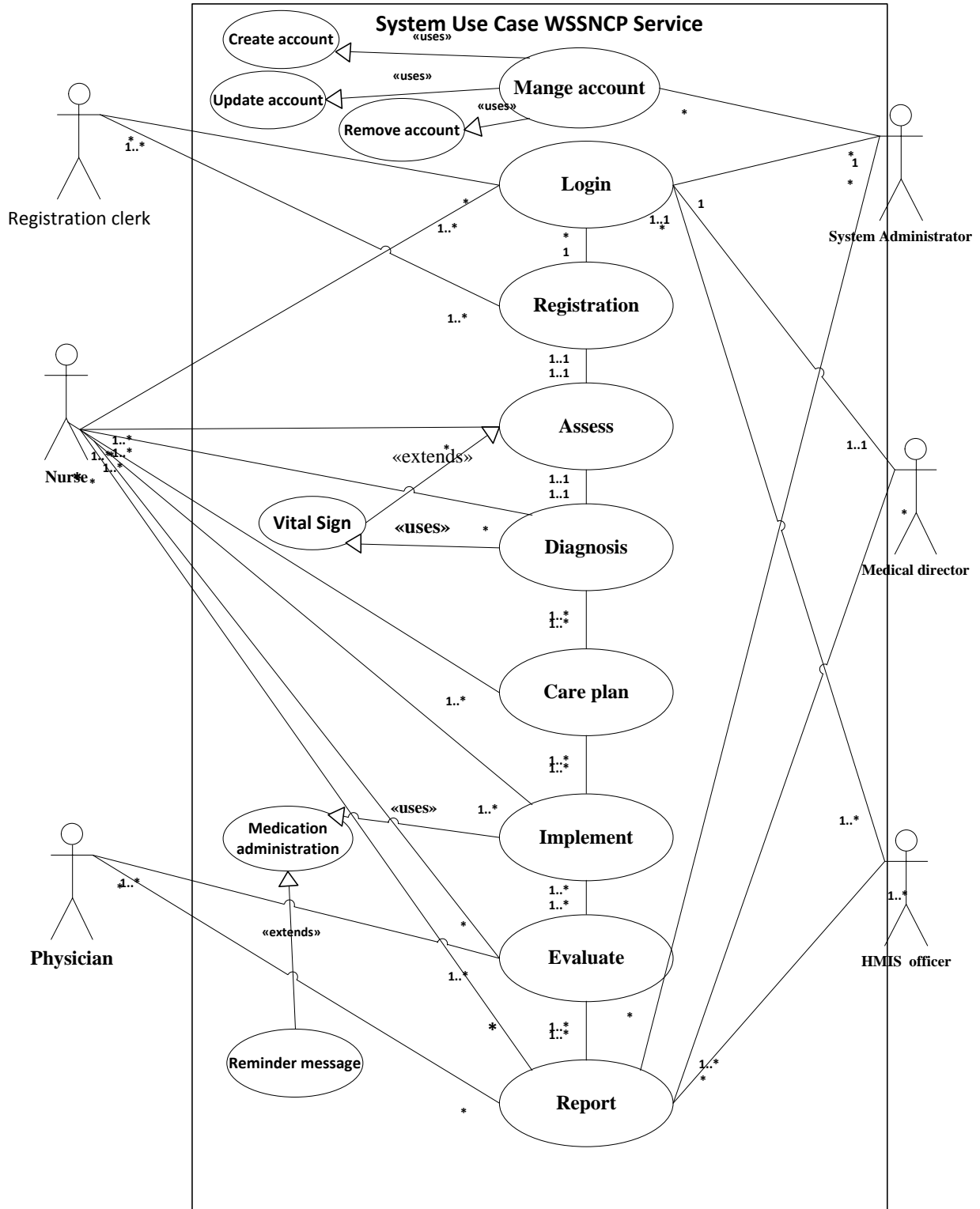
Evaluation nursing care service

Report nursing care service

Reminder message nursing care service

Vital sign nursing care service

Mange user account



**Figure 3:** System Use Case Diagram for Nursing Care Planning System (WSSNCP)

## System Use Case for Patient Registration Recording System

<b>Use case ID</b>	UC-2
<b>Use Case Title</b>	Register patient
<b>Use case Description</b>	This use case describes patient registration information system process
<b>Primary Actor</b>	Registration clerk , Nurse
<b>Trigger</b>	Registration clerk open new client registration form
<b>Pre-Conditions</b>	The Registration clerk or nurse is logged into the system.
<b>Post-Conditions</b>	The system stored registration of patient detail information in to the database
<b>process of the scenario</b>	<ol style="list-style-type: none"> <li>1. The system displays nurse menu user interface(nurse home page)</li> <li>2. The Nurse selects registration from the nurse main menu option</li> <li>3. The Nurse click on open new patient registration form</li> <li>4. The system display patient registration new form</li> <li>5. The Nurse fills the detail of patient information on the patient registration form</li> <li>6. The nurse click on submit button</li> <li>7. The system save or stored registration information on the patient database</li> <li>8. The nurse click on print button to print out patient detail history information form.</li> <li>9. Use case ends</li> </ol>
<b>Alternative courses</b>	<p>1a.If the patient is already registered on the system</p> <p>1a.1 The registration clerk enter patient card number to the system and request the system to retrieve from the user database to search the existing Patient pervious information.</p> <p>1a. 2 The system update details the required patient information in the server</p> <p>3a.If the registration clerk skip essential information unknowingly,</p> <p>3a.1The system display information to complete the skipped essential information</p> <p>3a.2 the system display different colour on the skipped place or give pop up message on the screen to hinder his/ her work b/c the user do not Continue his work.</p>

<b>Frequency of Use</b>	70-80/ Month
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**Table 8:** patient Registration use case.

### System Use Case for Assesses Recording System

<b>Use case ID</b>	UC-3
<b>Use Case Title</b>	Assesses nursing care service
<b>Use case Description</b>	This use case describes assessing patient health status information recording system process
<b>Primary Actor</b>	Nurse
<b>Trigger</b>	The Nurse receive or retrieve patient admission information The Nurse receive detail patient history information
<b>Pre-Conditions</b>	<ol style="list-style-type: none"> <li>1. The Nurse is logged into the system.</li> <li>2. The Patient admission is finished.</li> <li>3. The Patient should be transfer or consult.</li> </ol>
<b>Post-Conditions</b>	<ol style="list-style-type: none"> <li>1. The system detail assessment information was saved or stored on the database.</li> <li>2. The admission date and time was imported and saved in database server.</li> </ol>
<b>process of main courses scenario</b>	<ol style="list-style-type: none"> <li>1.The system displays nurse menu user interface(nurse home page)</li> <li>2.The Nurse selects assessment from the nurse menu option</li> <li>3.The system displays assessment recording new form</li> <li>4.The Nurse fill assessment form with required history information</li> <li>5.The Nurse click on past assessment history button to check ,validate the assessed(identified ) symptom of the patient history from the system</li> <li>6.The Nurse click on the submits button or updates filled information</li> <li>7.The system save or stored the detailed current status patient history information in to the patient database</li> <li>8.Use case ends</li> </ol>
<b>Reference “included use cases” in this section using INCLUDE Vital Sign Chart</b>	
<b>Alternative courses</b>	<ol style="list-style-type: none"> <li>4a. if the patient comes for the first time, the nurse open and fill the new patient assessment form. <ol style="list-style-type: none"> <li>4a.1 If he/she is already in in database, <ol style="list-style-type: none"> <li>4a.1.1 the system give detail patient information from the database.</li> <li>4a.1.2 the system updates the existing information on the patient data base</li> </ol> </li> </ol> </li> <li>7a. if nurse skip the necessary information , <ol style="list-style-type: none"> <li>7a.1 the system show on the place to fill or edit the data by give sign using different colour Over the title of the place or respond pop up message.</li> </ol> </li> </ol>
<b>Frequency of Use</b>	50-70/day

**Table 9:** Nursing Assessment use case.

## System Use Case for Diagnosis Recording System

<b>Use case ID</b>	UC-4
<b>Use Case Title</b>	Diagnosis nursing care service
<b>Use case Description</b>	This use case describes diagnoses patient information recording system process
<b>Primary Actor</b>	Nurse
<b>Trigger</b>	<ol style="list-style-type: none"> <li>1. The system display finished detail assessed information from the patient database server.</li> <li>2. The system displays a complete list out symptom and problems summary.</li> </ol>
<b>Pre-Conditions</b>	<ol style="list-style-type: none"> <li>1. The nurse is logged into the WSSNCP system.</li> <li>2. The patient should be admitted. (The patient admission is finished.)</li> <li>3. The patient assessment is finished.</li> <li>4. The patient is transferred or counselled.</li> <li>5. The patient is needed additional investigation.</li> </ol>
<b>Post-Conditions</b>	The system saves or stored patient diagnosis information on the database.
<b>process of main courses scenario</b>	<ol style="list-style-type: none"> <li>1. The system displays nurse main menu user interface(nurse home page)</li> <li>2. The Nurse selects diagnosis from the nurse main menu option</li> <li>3. The system displays diagnosis recording new form</li> <li>4. The system displays a complete list out symptom and identified problems.</li> <li>5. The nurse fills the diagnosis form with detailed required information [5a].</li> <li>6. The nurse click on nursing diagnosis wizard button for decision support system [6a].</li> <li>7. The system display alternative option in the look up wizard dialog box related to the symptom.</li> <li>8. The Nurse selects the types of diagnosis, the system display diagnosis look up wizard alternative option.</li> <li>9. The Nurse click on the submits button</li> <li>10. The system save or stored the diagnosis information on the patient database</li> <li>11. Use case ends</li> </ol>
<b>Reference “included use cases” in this section using INCLUDE Vital Sign Chart</b>	
<b>Alternative courses</b>	<ol style="list-style-type: none"> <li>5a. If the patient is new admitted ,             <ol style="list-style-type: none"> <li>5a.1 The Nurse adds new diagnosis form.</li> <li>5a.2 if the patient already exist on the database,                 <ol style="list-style-type: none"> <li>5a.2.1 the system adds and updates the existing information on the patient database.</li> </ol> </li> </ol> </li> <li>6a. If the patient need farther investigation or the patient show unexpected symptom ,             <ol style="list-style-type: none"> <li>6a.1 The Nurse consult to the physician</li> <li>6a.2 The Nurse click on add new message form and filled alert text message on the form then click on send button from the system.</li> </ol> </li> </ol>
<b>Frequency of Use</b>	50-70/day

**Table 10:** Nursing Diagnosis use case.

## System Use Case for Vital Sign Recording System

<b>Use case ID</b>	UC-5
<b>Use Case Title</b>	Vital sign nursing care service
<b>Use case Description</b>	This use case describes patient Vital sign information recording process
<b>Primary Actor</b>	Nurse
<b>Trigger</b>	<ol style="list-style-type: none"> <li>1. Nurse login into the system</li> <li>2. Patient is registered.</li> <li>3. The Patient admission is finished.</li> </ol>
<b>Pre-Conditions</b>	<ol style="list-style-type: none"> <li>1. The nurse is logged into the WSSNCP system.</li> <li>2. A patient admission charge is completed and delivered to nurse ward management through the system.</li> <li>3. The patient consultation, transfer, visit finished from OPD, emergency, Gynae ward, paediatric ward, medical ward, surgical ward.</li> </ol>
<b>Post-Conditions</b>	The system stored patient current vital sign status information in to the database
<b>process of the scenario</b>	<ol style="list-style-type: none"> <li>1. The system displays main menu user interface(nurse home page)</li> <li>2. The Nurse selects vital sign chart from the nurse menu option</li> <li>3. The system displays vital sign chart recording new form</li> <li>4. The Nurse fill vital sign chart form with required information [4a].</li> <li>5. Information on the patient vital sign statistics examination in to the system.</li> <li>6. The system checks &amp; validates then save (stored) the details of the patient information on the patient database server.</li> <li>7. The Nurses completed vital sign chart form click on submit button</li> <li>8. The system saves or stored the vital sign information on the patient database [8].</li> <li>9. The nurse click on print button to vital sign information</li> <li>10. The Nurse takes the print out form and attached/put on besides on the patient bed or put on the case bag.</li> <li>11. Use case ends</li> </ol>
<b>Alternative courses</b>	<p>4a.If the patient already have previous admitted information(medical information ) on the system</p> <p>4a.1 The Nurse enter patient card number to the system and request the system to retrieve pervious patient information</p> <p>4a. 2 The system update the vital sign chart result from the patient database server from the system.</p> <p>8a.If the Nurse skip essential information unknowingly,</p> <p>8a.1The system display information to complete the skipped essential information</p> <p>8a.2 The system display pop up message on the screen to fill the skipped Information from the form.</p>
<b>Frequency of Use</b>	50-60 /Month.

**Table 11:** Vital Sign use case.

## System Use Case for Care Plan Recording System

<b>Use case ID</b>	UC-6
<b>Use Case Title</b>	Care Plan nursing care service
<b>Use case Description</b>	This use case describes to Create Care Plan information recording process
<b>Primary Actor</b>	Nurse
<b>Trigger</b>	<ol style="list-style-type: none"> <li>1. Nurse login into the system</li> <li>2. The system display completed diagnosis information in the system database.</li> </ol>
<b>Pre-Conditions</b>	<ol style="list-style-type: none"> <li>1. The Nurse is logged into the system.</li> <li>2. The Patient is registered</li> <li>3. The Patient admission is finished.</li> <li>4. The Patient assessment is finished.</li> <li>5. The Patient diagnosis is finished.</li> <li>6. The Patient is transferred or counseled.</li> </ol>
<b>Post-Conditions</b>	The system stored completed nursing care plan information on the database.
<b>process of main courses scenario</b>	<ol style="list-style-type: none"> <li>1. The system displays main menu user interface(nurse home page)</li> <li>2. The Nurse selects care plan from the menu option [2a].</li> <li>3. The system displays care plan recording new form</li> <li>4. The system display completed diagnosis information in the system</li> <li>5. The nurse selects the problem then adds into the form from the system [5a].</li> <li>6. The Nurse fill care plan form with required information</li> <li>7. The Nurse click on submits button [7a].</li> <li>8. The Nurse clicks on save button or stored the care plan form into patient database server.</li> <li>9. The system save or stored the care plan information on the patient database</li> <li>10. Use case ends</li> </ol>
<b>Alternative courses</b>	<p>2a. if the patient is already exist,</p> <p style="padding-left: 40px;">2a.1 The Nurse click search or retrieve patient care plan detail information from the System Database server.</p> <p>5a. If the patient have more problem to prepare nursing care plan,</p> <p style="padding-left: 40px;">5a.1 The Nurse gives priority to select the problem for preparing the care plan.</p> <p>7a. The system update (adds) the care plan care service on the patient data base server.</p>
<b>Frequency of Use</b>	50-60/month

**Table 12:** Care Plan use case

## System Use Case for Medication Administration and Controlling Reminder Messaging Recording System

<b>Use case ID</b>	UC-8
<b>Use Case Title</b>	Send Reminder message nursing care service
<b>Use case Description</b>	This use case describes the process of sending reminder text message information recording process
<b>Primary Actor</b>	System
<b>Trigger</b>	<ol style="list-style-type: none"> <li>1. Nurse login into the WSSNCP system.</li> <li>2. The nurse gets patient medication time registration is finished in the system.</li> <li>3. The nurse receives complete medication administration through the system database.</li> </ol>
<b>Pre-Conditions</b>	The system should have control medication time, through the care service.
<b>Post-Conditions</b>	The system send automatic message to appropriate group user and the group users get mobile reminder message on mobile phone.
<b>process of main courses scenario</b>	<ol style="list-style-type: none"> <li>1. The Nurse gets patient medication time registration is finished in the system.</li> <li>2. The nurse click on the alert message wizard then select alternative time duration option display. The message wizard include (Nurse Name , Phone No, Physician name ,Phone No, Patient name , MRN, Bed No, Room No )</li> <li>3. The nurse click registered medications gives time setting button then set click on save button into the system.</li> <li>4. The system start count medication takes time duration in the day automatically [4a].</li> <li>5. Use case ends</li> </ol>
<b>Alternative Course</b>	<p>4a. if the Nurse miss to giving medication time to the patient ,</p> <p>4a.1 the system automatic send alert phone text message to login nurse.</p> <p>4a.1.1 if nurse ignore the text message , the system hold the time then send text message for the ward.</p> <p>4a.1.2 if the ward manger ignores the text message, the system sends for the matron.</p> <p>4a.1.3 if the nurse give medication to the patient on the time, but not registered into the system, the system automatically send text message to the login nurse.</p>
<b>Frequency of Use</b>	50-60/ month

**Table 13:** Medication Administration use case

## System Use Case for Implementation or Intervention Recording System

<b>Use case ID</b>	UC-7
<b>Use Case Title</b>	Implement nursing care service
<b>Use case Description</b>	This use case describes implementation plan information system process.
<b>Primary Actor</b>	Nurse
<b>Trigger</b>	The system display completed care plan information
<b>Pre-Conditions</b>	<ol style="list-style-type: none"> <li>1. The Nurse is logged into the WSSNCP system.</li> <li>2. When time is up for medication to the patient</li> <li>3. The Patient care plan is finished.</li> <li>4. The Patient is transferred or counselled.</li> </ol>
<b>Post-Conditions</b>	The information of implementation plan saved on the database and print out
<p><b>process of main courses scenario</b></p> <p><b>Reference “included use cases” in this section using INCLUDE Medication Administration</b></p>	<ol style="list-style-type: none"> <li>1. The system displays main menu user interface(nurse home page)</li> <li>2. The Nurse selects implementation from the menu option</li> <li>3. The system displays implementation recording new form</li> <li>4. The system display completed care plan information in the system</li> <li>5. The nurse select from system the alternative option care plan summary</li> <li>6. The nurse add selected care plan goal in to implementation form</li> <li>7. The Nurse fill implementation form with required information</li> <li>8. The Nurse click on the submits button</li> <li>9. The system saves or stored the implementation information on the patient database server.</li> <li>10. The Nurse click on the medication admiration chart button from the interface.</li> <li>11. The system display include look up wizard of medication administration form.</li> <li>12. The Nurse checks and validates medication time in the system to give medication to the patient.</li> <li>13. The Nurse clicks on save button from the system to store in the patient database.</li> <li>14. Use case ends</li> </ol>
<b>Alternative Course</b>	7a. If the patient already have implemented case result on the system , 7a.1 The Nurse search, open and check or validate the existing patient information from the patient database server.
<b>Frequency of Use</b>	50-60/ Month

Table 14: Nursing Care Implementation use case

## System Use Case for In Evaluation Recording System

<b>Use case ID</b>	UC-8
<b>Use Case Title</b>	Evaluate intervention nursing care service
<b>Use case Description</b>	This use case describes evaluate the intervention information record process.
<b>Primary Actor</b>	Nurse , Physician
<b>Trigger</b>	1. The system display completed implementation information.
<b>Pre-Conditions</b>	1. The Nurse is logged into the system. 2. The system display completed nursing intervention information.
<b>Post-Conditions</b>	The information of evaluation summary saved to the database.
<b>process of main courses scenario</b>	<ol style="list-style-type: none"> <li>1. The system displays main menu user interface(nurse home page)</li> <li>2. The Nurse selects evaluation from the menu option</li> <li>3. The system displays evaluation recording new form</li> <li>4. The system display completed implementation information in the system</li> <li>5. The Nurse fill existing outcome into evaluation form with required information [5a].</li> <li>6. The nurse click on submit button</li> <li>7. The system saves or stored the evaluation information on the patient database server.</li> <li>8. Use case end</li> </ol>
<b>Alternative Course</b>	<p>5a. if the patient progress health evaluation status ,</p> <p>5a.1. Unsuccessful the system iterate or recycle to start the initial phase of assessment.</p> <p>5a.2. successful the system show the remain problem to prepare care plan for others.</p>
<b>Frequency of Use</b>	50-60/ Month

**Table 15:** Nursing Care Evaluation use case

## System Use Case for Generate a Report Recording System

<b>Use case ID</b>	UC-9
<b>Use Case title</b>	Generate Report nursing care service
<b>Use case Description</b>	This use case describes report generating information process
<b>Primary Actor</b>	Nurse, Physician, Ward management, Clinical medical director. HMIS focal person
<b>Trigger</b>	<ol style="list-style-type: none"> <li>1. The system user request to generate report</li> <li>2. The user login into the system</li> </ol>
<b>Business rule</b>	The report is generated only by the user privileged on the system using login security system
<b>Pre-Conditions</b>	<ol style="list-style-type: none"> <li>1. All required data must be exists in the system data base to generate report.</li> <li>2. User has security access to the confidential data will be extracted with report</li> <li>3. Data has been gathered</li> </ol>
<b>Post-Conditions</b>	<ol style="list-style-type: none"> <li>1. Requested report is produced</li> <li>2. The generated report information saved and stored in patient database server.</li> </ol>
<b>process of main courses scenario</b>	<ol style="list-style-type: none"> <li>1. The system displays main menu user interface(nurse home page)</li> <li>2. The Nurse selects Report from the menu option</li> <li>3. The nurse select the option to generate report</li> <li>4. The system presents a list of each available report</li> <li>5. The nurse selects the report to be generated</li> <li>6. The system presents the description of that report</li> <li>7. The nurse confirms that this is correct report</li> <li>8. The system generates the selected report [8a.]</li> <li>9. The system displays the selected report on the user's screen [9a].</li> <li>10. The nurse click on the submit button</li> <li>11. The system saves or stored the generated report information on the patient database [11a].</li> <li>12. The nurse click on the print button to print the generated report</li> </ol>
<b>Alternative Course</b>	<ol style="list-style-type: none"> <li>5a. Configuration option available</li> <li>8a. The system display the option available for the report <ol style="list-style-type: none"> <li>8a.1 The nurse select one or more filtering criteria from the list</li> <li>8a.1 If the nurse confirms selection option on the system notifies the user no matching data found, <ol style="list-style-type: none"> <li>8a.1.1 The system shows a message to users that the data not available</li> </ol> </li> </ol> </li> <li>9A. if the user wants to get the report in different format then, <ol style="list-style-type: none"> <li>9a.1 Click on export the report button.</li> <li>9a.2 Select the file type of the report.</li> </ol> </li> <li>11a. If the Nurse want a soft copy report, <ol style="list-style-type: none"> <li>11a.1 The system copy the report on the storage device inserted on the system</li> </ol> </li> </ol>
<b>Frequency of Use</b>	40/Month

**Table 16:** Nursing Care Report use case

## System Use Case for Login Recording System

<b>Use case ID</b>	UC-1
<b>Use Case Title</b>	Login
<b>Use case Description</b>	This use case describes the user Login process.
<b>Primary Actor</b>	User (data clerk, triage officer, physician, Nurse, technician. Administrator)
<b>Trigger</b>	Registration clerk open new client registration form
<b>Pre-Conditions</b>	The users(Nurse, Physician, Administrator, clinical medical director) must have authorized user name and password given by Administrator
<b>Post-Conditions</b>	The user logs into the in the WSSNCP system
<b>process of main course scenario</b>	<ol style="list-style-type: none"> <li>1. The system display main user interface, when the users click in the login screen.</li> <li>2. The system displays login screen.</li> <li>3. The user enters the username, password and select user type on login screen.</li> <li>4. The system verifies account information and set access permission [4a].</li> <li>5. The user logged in to the system then system will display the main screen.</li> <li>6. Use case ends</li> </ol>
<b>Alternative courses</b>	<p>4a. If the username or password is not correct, invalid login message is displayed.</p> <p>4a.1. The user is returned to login screen and re-enters user name and password.</p> <p>4a.2. The user try the password more than five the system make freeze.</p>
<b>Frequency of Use</b>	50/ Month

**Table 17:** Login use case

## System Use Case for Mange User Account Recording System

<b>Use case ID</b>	UC-10
<b>Use Case Title</b>	Manage User Account
<b>Use case Description</b>	This use case describes the user how to create, manage or remove a user account information process.
<b>Primary Actor</b>	System Administrator
<b>Trigger</b>	Administrator login into the system
<b>Pre-Conditions</b>	The user must be authenticated and authorized.
<b>Post-Conditions</b>	User account information is managed.
<b>process of main course scenario</b>	<ol style="list-style-type: none"> <li>1. The system displays main menu user interface</li> <li>2. Open account management window.</li> <li>3. The system display present list of staff user account list.</li> <li>4. Search/ check staffs have a user account by using staff ID. [4A]</li> <li>5. If the staff didn't have an account, then the user click on create new account button.</li> <li>6. The system displays a window/ form to create new account.</li> <li>7. The user fills the required filed in the form. And click submit button.</li> <li>8. The system validates and confirms the inserted data [8a].</li> </ol> <p>The system is saved new account information in to the system.</p>
<b>Alternative courses</b>	<p>4A: If the staff has an account before:</p> <ol style="list-style-type: none"> <li>4a.1. If the user wants to update the staff's account information. <ol style="list-style-type: none"> <li>a) click on update/ edit account button</li> <li>b) The system displays a form to update the user account.</li> <li>c) The user fills the required information and click on save button.</li> <li>d) The system validates the inserted data.</li> <li>e) The updated account information is saved.</li> </ol> </li> <li>4a.2. If the user wants to delete the staff's account. <ol style="list-style-type: none"> <li>a) Select and click the staff s account.</li> <li>b) The system displays a message to confirm account deletion.</li> <li>c) The user confirms the deletion process by clicking delete button.</li> <li>d) The system deletes the account information from the database.</li> </ol> </li> </ol> <p>8A: If the password mismatch with confirm password field</p> <ol style="list-style-type: none"> <li>a) The system notifies the user entered wrong data.</li> <li>b) The system let the user to enter password and to confirm it.</li> </ol>
<b>Frequency of Use</b>	10/Month

**Table 18:** manage account use case.

#### 4.1.4 Conceptual /Domain modeling

A domain model , also known as conceptual models, domain object models and analysis object models, is the most important and classic model in OOA. It illustrates important concepts in a real world domain of the nursing care planning system. It is a visual representation or perspective of conceptual classes or real-situation objects in a nursing care planning system domain, not a software perspective and illustrated with a set of class diagrams in which no operation, method signature are defined [48].

A domain model is illustrated with a set of class diagrams in which no operations (method signatures) are defined. It provides a conceptual perspective. It may show:

- Domain objects or conceptual classes
- Associations between conceptual classes
- Attributes of conceptual classes

The importance of domain model in designing WSSNCP is that it helps the study to use real world domain in creating software class and fulfills the representational gap between how the system users in nursing care planning system conceive the domain and its representation in software, the researcher develops the conceptual model for designing WSSNCP as follows in figure 4.

Concept	Attribute	Method	Description
User Account	User id First Name Last Name User Name User Password User Type	Login Add User Remove User Update User	The user account verifies user account information. Such as it validates the User Name and User Password.
Administrator	User Type Admin First Name Admin Last Name	Login Add User Remove User	The user manager handles account users. The users have to login before using the system administrator with privilege to add user to the

	User Name User Password	Update User information	system.
Invalid User Exception		Display	Pop up message Displayed for the invalid Users.
Nurse	User Id User Name User Password First Name Last Name Ward Type	Login Update User information Show Evaluation Show Report	The nurse handles every Nursing care process information.  When she / he login into the system.
Physician	User Id User Name User Password First Name Last Name User Type	Login Update User information Show Evaluation Show Report	The physician handles nursing care evaluation processed information validate or check the based on his assessment information. When He /She login into the system
HMIS	User Id User Name User Password First Name Last Name User Type	Login Update User information Show Report	
Registration	registration no registration date patient first name patient last name age gender	Set :void() Get:string()	Registration form contain registration data which is processed by Nurse or data clerk in the hospital

	phone no		
Assessment	Assessment Id Assessment date Assessment type patient registration no Patient first name Patient last name Nurse full name Ward Type	Set :void() Get:string()	Assessment form contain expected symptom or identified problem of the patient.
Diagnosis	Diagnosis no Diagnosis type Diagnosis date Identified problem Patient registration no Nurse full name	Set :void() Get:string()	Diagnosis form contain identified symptom with related nursing diagnosis result and processed by Nurse.
Care plan	Care plan no Care plan date Care plan goal Diagnosis no Diagnosis result Patient registration no Nurse full name Ward Type	Set :void() Get:string()	Care plan form contain design a goal for identified diagnosis result by giving priority for each care plan which is processed by nurse.
Implementation	Implementation no Implementation date Implementation type Care plan no Patient registration no	Set :void() Get:string()	Implementation form contains detail give intervention information based on the designed plan information which is processed by nurse.

	Nurse full name Ward Type		
Evaluation	Evaluation no Evaluation date Assessment date Assessment no Implementation no Patient registration no Nurse full name Ward Type	Set :void() Get:string() Display:evaluation ( )	Evaluation form contain detail expected outcome of the patient result
Report	Report no Report date Report type User type	Set :void() Get:string() Display:Report()	

**Table 19:** Conceptual / Domain modeling Concepts, Attribute and Methods.

Your requirements artifacts, although effective for understanding what your users want to have built, is not as effective at understanding what will be built. You need techniques to help you to flesh out the details of what needs to be built. Conceptual domain modeling, also called conceptual modeling or domain modeling, is the task of discovering the entity types that represent the things and concepts, and their relationships, pertinent to your problem space. Another way to look at it is that conceptual models are used to depict your detailed understanding of the problem space for your system [49].

Based on the identified concept and attribute in the above table 19, the researcher demonstrate the conceptual model for designing WSSNCP as following in figure 4

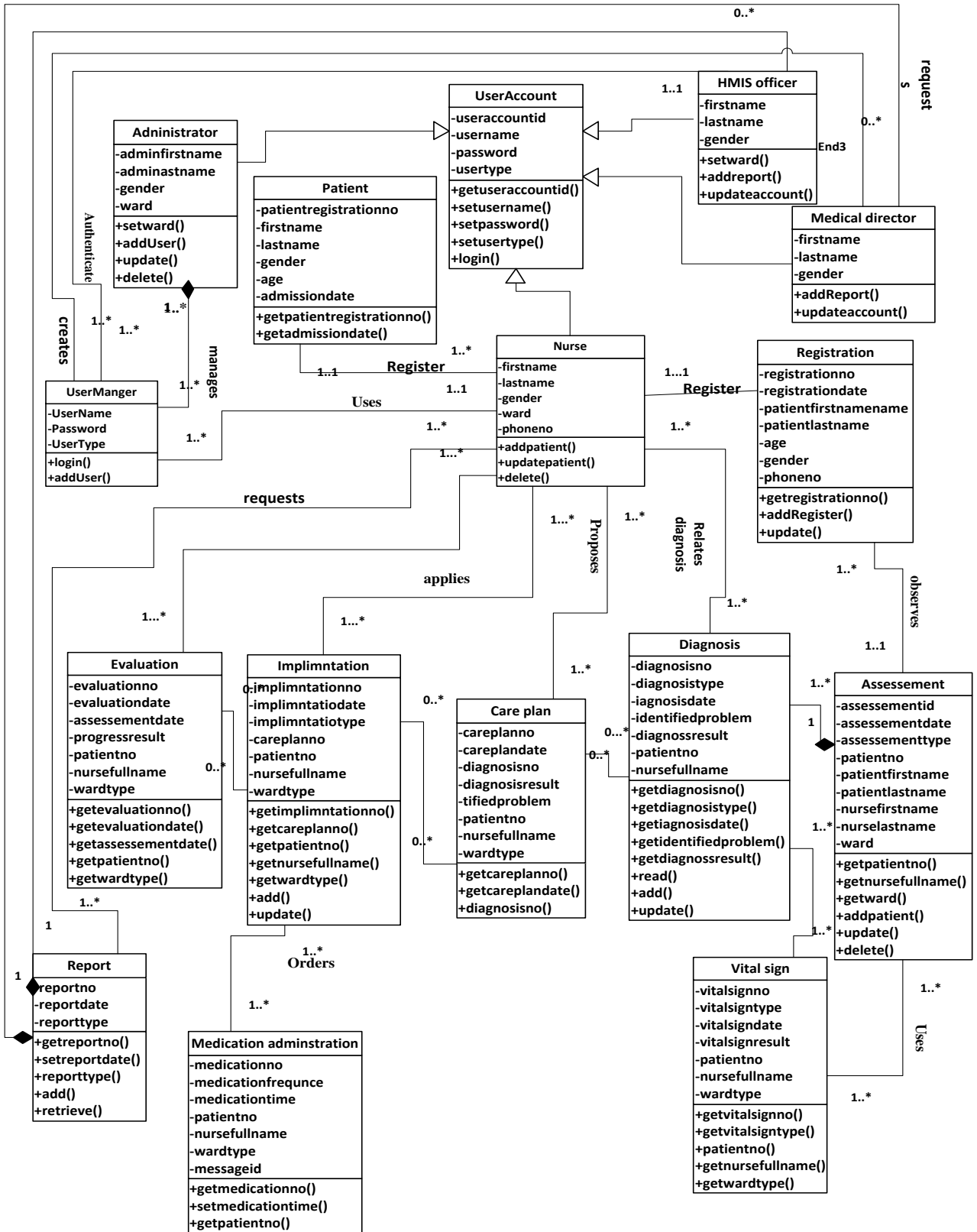


Figure 4: Domain/Analysis Conceptual model for WSSNCP

## 4.2. User Interface Designing / Prototype

A prototype is a working model that does not normally have all the required features or provide all the functionality of the final system. The main purpose of developing a prototype database system is to allow users to use the prototype to identify the features of the system that work well, or are inadequate, and if possible to suggest improvements or even new features to the database system. In this way, we can greatly clarify the users' requirements for both the users and developers of the system and evaluate the feasibility of a particular system design. Prototypes should have the major advantage of being relatively inexpensive and quick to build [50].

### 4.2.1. User-interface Flow Diagrams

UI flow diagrams are a diagram that depicts major UI elements and how users transition between them in designing system. It reflects the behavioral view of the single use case, a high-level overview of the UI for your application and also referred to as the architectural approach, because it enables me to understand the complete UI for a system. The nursing care planning system users can quickly gain an understanding of how the system is expected to work [51].

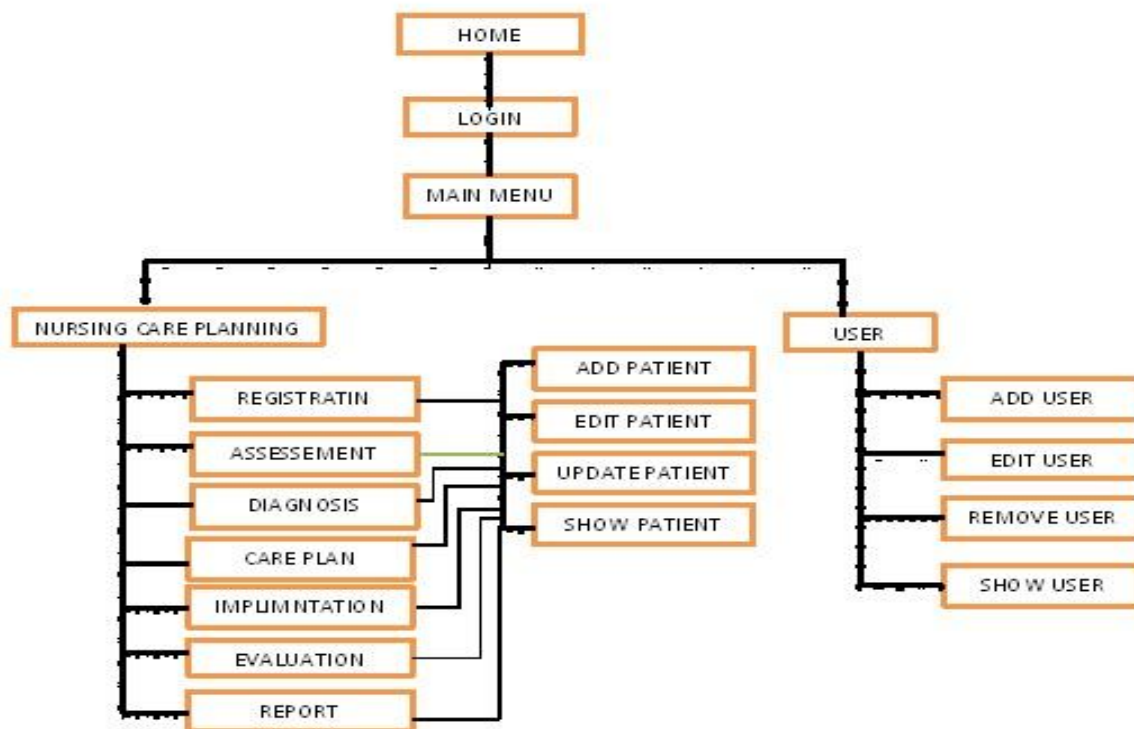
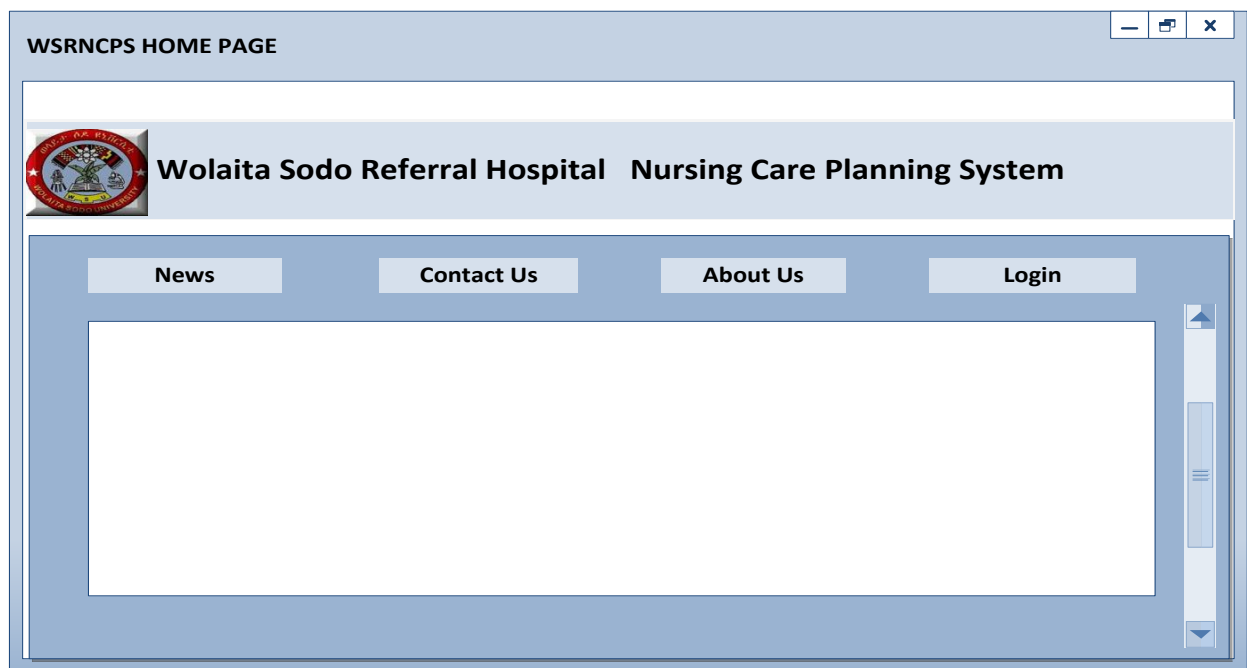


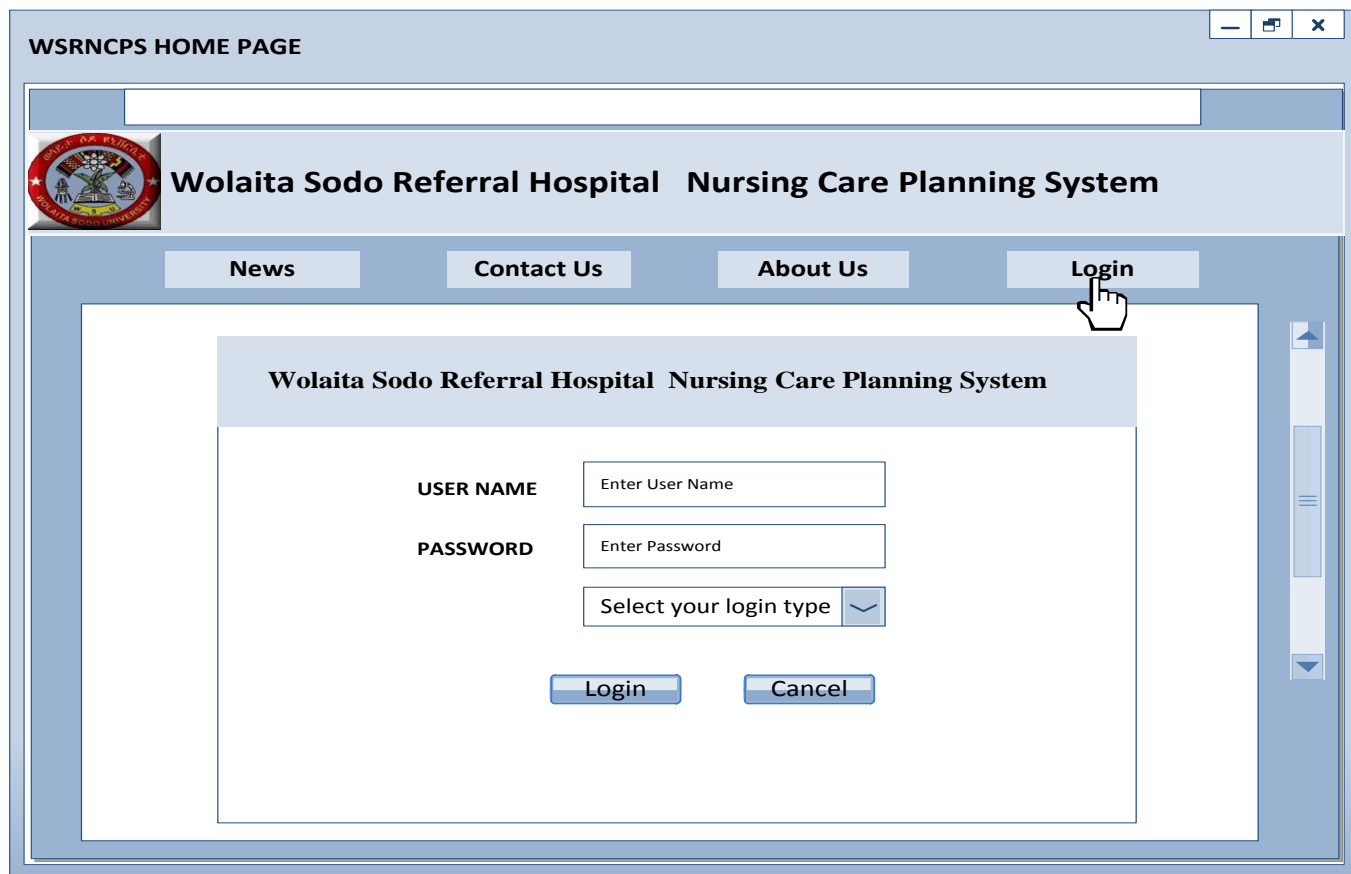
Figure 5: User interface flow diagram for WSSNCP

The home page has the following four links. When the user clicks on the about link, the system will open another page that contains description about the system. When the user clicks on the Login link, the system will display the login page to get access for the system based on the role assigned for that particular user. The user can click on cancel to go back to the home page.



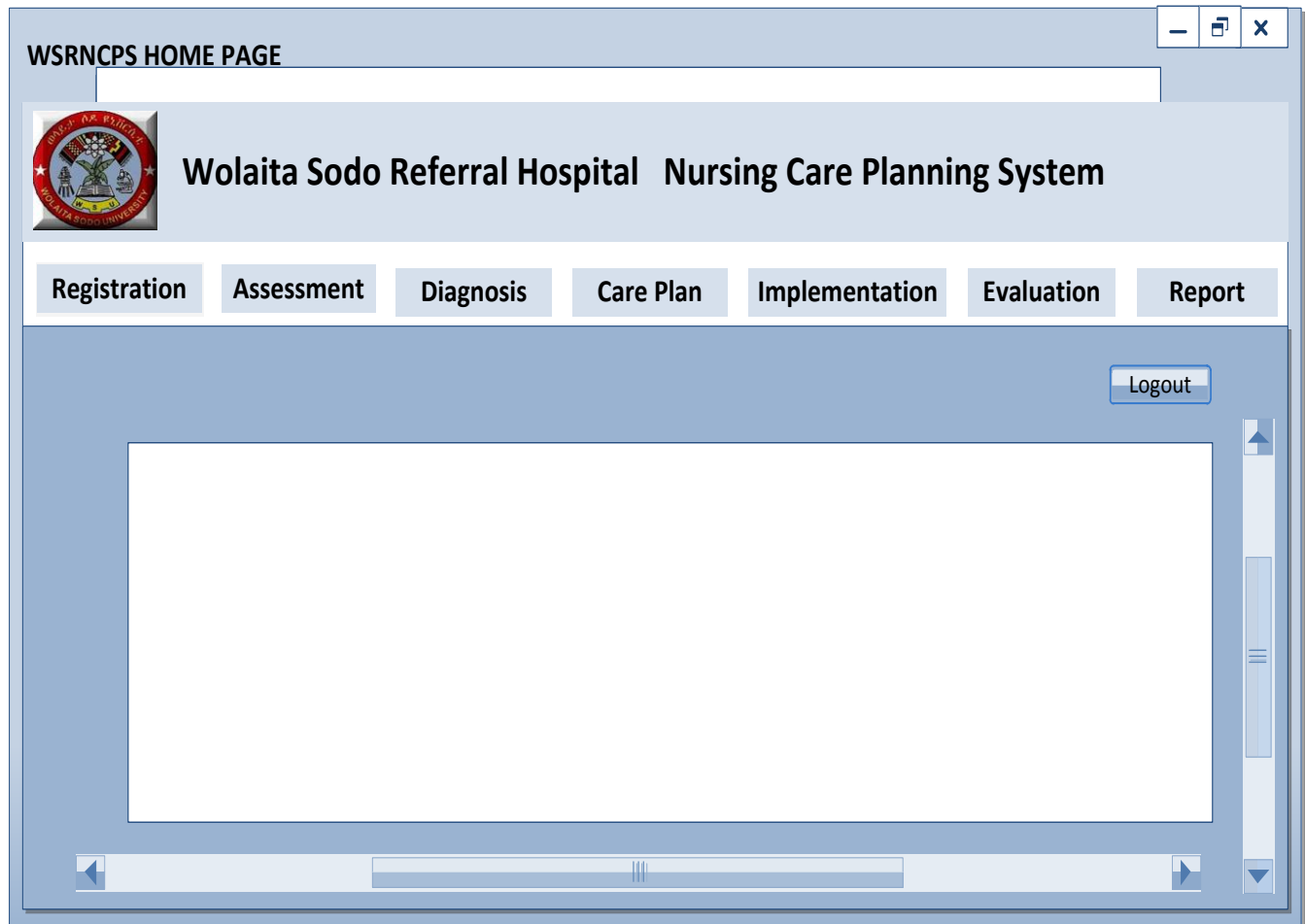
**Figure 6:** Home Page User Interface Screen

The figure 7 is show the login interface screen that accepts user name and password for authentication users.



**Figure 7:** Login User Interface Screen

The Figure 8 shows Main Menu user interface screen option form that was displayed after the health professionals had login to the system. It includes different user type option and the services that could be available in the health facility. Even though, the system designed in this study was concerned inpatient department.



**Figure 8:** Main Menu User Interface Screen

Figure 9 shows patient registration nursing care user interface screen holds data about patient's detail demographic information.

**Figure 9:** Registration User Interface Screen

The Figure 10-12 shows nursing assessment user interface; it is the first phase of the nursing care process, for gathering patient information (as relevant to the nurses). The focus of the nursing assessment is to collect information to identify patient needs and cares.

Assessment

Wolaita Sodo Referral Hospital Nursing Care Planning System

Logout

**Patient Assessment For Activity of Living**

**Patient MRN** 
**Patient Name**

**Nurse Name** 
**Nurse Phone No**

**1. Cognitive and Perceptual Level of Conscious**

Conscious     Unconscious  
 If Unconscious select stuats

Oriented  
 Comatose     Depressed  
 Forget full     Disoriented  
 Other specify     Lethargic

**3. Nutrition and Metabolism**

Special diet     Yes     No  
 Pattern of daily food     Yes     No  
 Fluids intake     Yes     No  
 Loss of Appetite     Yes     No  
 Nausea and vomiting     Yes     No  
 Weight at admission   

**2.1 Breathing Problem**     Yes     No  
 If Yes select symptom

Respiratory pattern     Cough  
 Lung sound     Oxygen supplement  
 Any respiratory tubes

**2.2 Circulation problem**     Yes     No  
 If Yes select symptom

Peripheral pulse     Jugular ventilation  
 Peripheral pulse     History of murmur  
 Chest pain     Peace maker

Other

Save    Next    Reset    Print    Cancel

Figure 10: Assessment I User Interface Screen

Assessment
— □ ×

## Wolaita Sodo Referral Hospital Nursing Care Planning System

Logout

**Patient Assessment For Activity of Living**

**Patient MRN**

**Nurse Name**

**Patient Name**

**Nurse Phone No**

**4. Elimination-Urine and faces**

Usual time of bowel movement

Any recent change in elimination  Yes  No

Any excess perspiration  Yes  No

Bowel sound  Yes  No

Abdominal tenderness  Yes  No

Stoma  Yes  No

Use of anything to manage bowels(laxative, enema, suppositories ,home remedies)

Urinary pattern      Urinary pattern frequency

incontinence      Times Per Day

retention             

nocturia

Dark Urine

**5. Psychological Care**

Altered body image  Yes  No

If No, restricted

If Yes, Anxiety and Emotional requirements

**6. Spiritual/Dying Value and belief**

Cultural practice  Yes  No

Religious practice  Yes  No

Familial traditions  Yes  No

Would like your religious leader to be contacted?

Yes  No

Comments

Save
Back
Next
Reset
Print
Cancel

**Figure 11:** Assessment II User Interface Screen

Assessment

Wolaita Sodo Referral Hospital Nursing Care Planning System

Logout

**Patient Assessment For Activity of Living**

**Patient MRN**  **Patient Name**

**Nurse Name**  **Phone No**

**7.Sleeping Sleep/rest pattern**

Adequacy of sleep  Adequate  Not Adequate

Difficulty of sleep  Yes  No

Factor affecting sleep/rest

**Summary Subjective data**

**8. Sexuality and Reproductive**

Female Menopausal  Yes  No

Menstrual pattern

Date of LMP

Use of contraceptive ?  Yes  No

**Male**

Monthly testicular Examination  Yes  No

Prostate problem  Yes  No

Penile discharge  Yes  No

**Summary objective data**

Save Next Reset Print Cancel

**Figure 12:** Assessment III User Interface Screen

Diagnosis
— □ ×

## Wolaita Sodo Referral Hospital Nursing Care Planning System

**Nursing Diagnosis**
Please complete
**Logout**

**Patient MRN**

**Nurse Name**

**Bed No**

**Ward**

**Patient Name**

**Nurse Phone No**

**Diagnosis Past History**

**Diagnosis Current History**

**Identified Patient Problem**

Date identified	Time
<input type="text" value="DD/MM/YY"/>	<input type="text" value="00:00:00"/>

**Select the Identified Problem**

- ▼
- ▼
- ▼
- ▼
- ▼
- ▼
- ▼

**Enter a Diagnosis or Select from list below**

**Diagnosis**

Select alternative diagnosis

Load with standard Nursing Diagnosis

**OK**   **Cancel**

**Save**
**Next**
**Reset**
**Print**
**Cancel**

**Figure 13:** Diagnosis User Interface Screen

**Nursing Care Plan**
— □ ×

---

## Wolaita Sodo Referral Hospital Nursing Care Planning System

---

**Nursing Care Plan**
Please complete or Affix Label
**Logout**

---

**Patient MRN**

**Nurse Name**

**Bed No**

**Patient Name**

**Nurse Phone No**

**Ward**

---

**Identified problem**

1. Problem

2. Problem

3. Problem

4. Problem

---

**Nursing Care plan patient History**

Nursing Care plan Past History

**Nursing Care plan Outcome/Goal**

**Date**

**Problem**

Display problems

**1. Goal**

-----

-----

-----

**Problem**

Display problems

**2. Goal**

-----

-----


-----

---

**Save**
**Next**
**Reset**
**Print**
**Cancel**

**Figure 14:** Care Plan User Interface Screen

Implementation/Intervention
\_ □ ×



## Wolaita Sodo Referral Hospital Nursing Care Planning System

Logout

<b>Patient MRN</b>	<input type="text" value="Enter Patient Name"/>	<b>Patient Name</b>	<input type="text" value="Enter Patient Name"/>
<b>Nurse Name</b>	<input type="text" value="Enter Nurse Name"/>	<b>Nurse Phone No</b>	<input type="text" value="Enter Phone No"/>
<b>Bed No</b>	<input type="text" value="Enter Bed No"/>	<b>Ward</b>	<input type="text" value="Enter ward"/>

**Care Plan Goal**

1. Care Plan Goal

2. Care Plan Goal

3. Care Plan Goal

**Intervention Action Patient History**

Nursing Intervention Action Past History

	Date
Intervention / Action for Care Plan	DD/MM/YY
<p><b>1. Intervention</b></p> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 5px;">Display care plan goal</div> <hr style="border-top: 1px dashed #ccc;"/> <hr style="border-top: 1px dashed #ccc;"/> <hr style="border-top: 1px dashed #ccc;"/>	<input type="text" value="DD/MM/YY"/>
<p><b>2. Intervention</b></p> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 5px;">Display care plan goal</div> <hr style="border-top: 1px dashed #ccc;"/> <hr style="border-top: 1px dashed #ccc;"/> <hr style="border-top: 1px dashed #ccc;"/>	<input type="text" value="DD/MM/YY"/>

Save
Next
Reset
Print
Cancel

**Figure 15:** Implementation User Interface Screen

Evaluation
\_ □ ×

## Wolaita Sodo Referral Hospital Nursing Care Planning System

Evaluation
Please complete or Affix Label
Logout

**Patient MRN**

**Nurse Name**

**Bed No**

**Patient Name**

**Nurse Phone No**

**Ward**

**Time of Problem Identified**

**Date Problem Identified**

**Review Date**

**Patient Progress Report/Evaluation**

**1. Patient Progress Report**

.....

.....

.....

**2. Patient Progress Report**

.....

.....

.....

**3. Patient Progress Report**

.....

.....

.....

**Identified Problem**

Save
Next
Reset
Print
Cancel

**Figure 16:** Evaluation user interface Screen

Report

Wolaita Sodo Referral Hospital Nursing Care Planning System

Report Please complete or Affix Label Logout

Nurse Name  Ward

Types of Report  Nurse Phone No

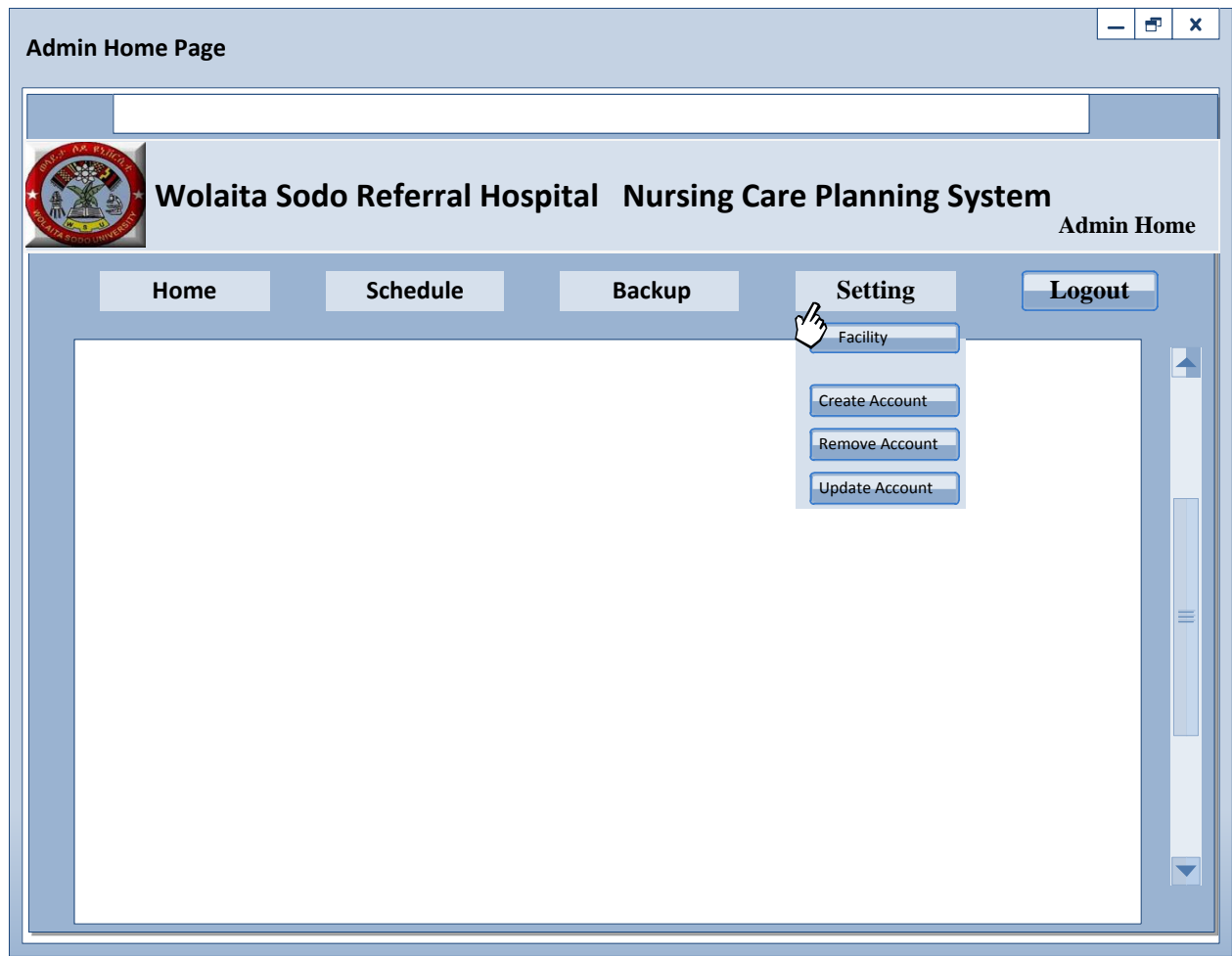
Starting Date  To Finished Date

Total Admitted Patient Number Total Discharge Patient Number Total Patient Death Number Total patient Referral Number

Report

Save Next Reset Print Cancel

Figure 17: Report user interface Screen



**Figure 18:** Administrator Home page Screen

## 4.3 System Design

### 4.3.1. Object Oriented Design

OOD is a phase which concerned with defining software objects their responsibilities and collaborations in nursing care planning system to fulfill the requirement independent of implementation details. There are a set of diagrams that are used to describe the design for software objects of nursing care planning system in object oriented design phases. This includes system architecture diagram and subsystem, software design class diagrams, sequence diagram also known as object interaction and diagrams entity relation diagram so forth [38].

This study used UML artifacts, sequence diagrams, along with class diagrams to design the system being designed, WSSNCP. Another task in this phase is designing UI which is based on nursing care planning and standard forms and other as described in UI flow diagramming section. The output of the design stage should specify clearly how the system should be constructed to satisfy the specified requirements [45].

### **4.3.2. System Architecture**

The architecture chosen for the system is three tier. The first layer runs on the client side, the second layer at the middle layer and the third layer will be the database system. The system will run using web technology. This architecture provides greater application scalability, high flexibility, high efficiency, lower maintenance, and reusability of components. Since each tier runs on a separate machine, it improves systems performance.

The system uses dynamic web technology, i.e., adding and retrieving data to and from the data store whenever requested is possible. It requires a client side program which is accessed by the Nurses, by the Physician, by HMIS officer and also an interface that communicate with the external system. It needs server side functions that implement the functional requirements and the database system that stores data.

#### **4.3.2.1. Proposed Web based 3-tier Architecture for Nursing Care Planning System**

In order to meet its design goals and be widely available for the existing Health Facility, the system is designed based on the architecture of web applications. It is known that Web applications can be made to be available throughout in Ethiopia. Moreover, Web applications can also be available during working hours [52].

They also support a number of users at a time depending on the capacity of the hardware, web server, and speed of the communication link. The other design goal is security. Currently, web applications can have secure exchange of Information with proper attention on security. The detail of the security requirement of the nursing care planning system is discussed in above section of non-functional requirement analysis. Therefore, as we have discussed for the software

design of the nursing care planning system is based on web architecture. The design is three-tiered architecture. That is the front-end, middle and back-end tiers. The front-end tier is the client side running on web browsers. The middle tier contains the web server and/or application server. The backend tier is the database server, which has the feature of distributed database. Figure 1 below shows the web architecture we use for the nursing care planning system.

The three components are described in detail as follows.

### **I. Front-end tier / Web browser /**

As with any other web application, this tier is normally implemented by web browsers, which are available on every computer. The necessary web protocols like http and https are already available on most computers. From this tier, authorized users can access the system using the web protocols.

However, since nursing care planning system is sensitive, we give enough attention to the security issues that can arise in the proposed architecture i.e. web based applications. One important issue is that the nursing care planning system is available only to authorized users and to the level that they are authorized.

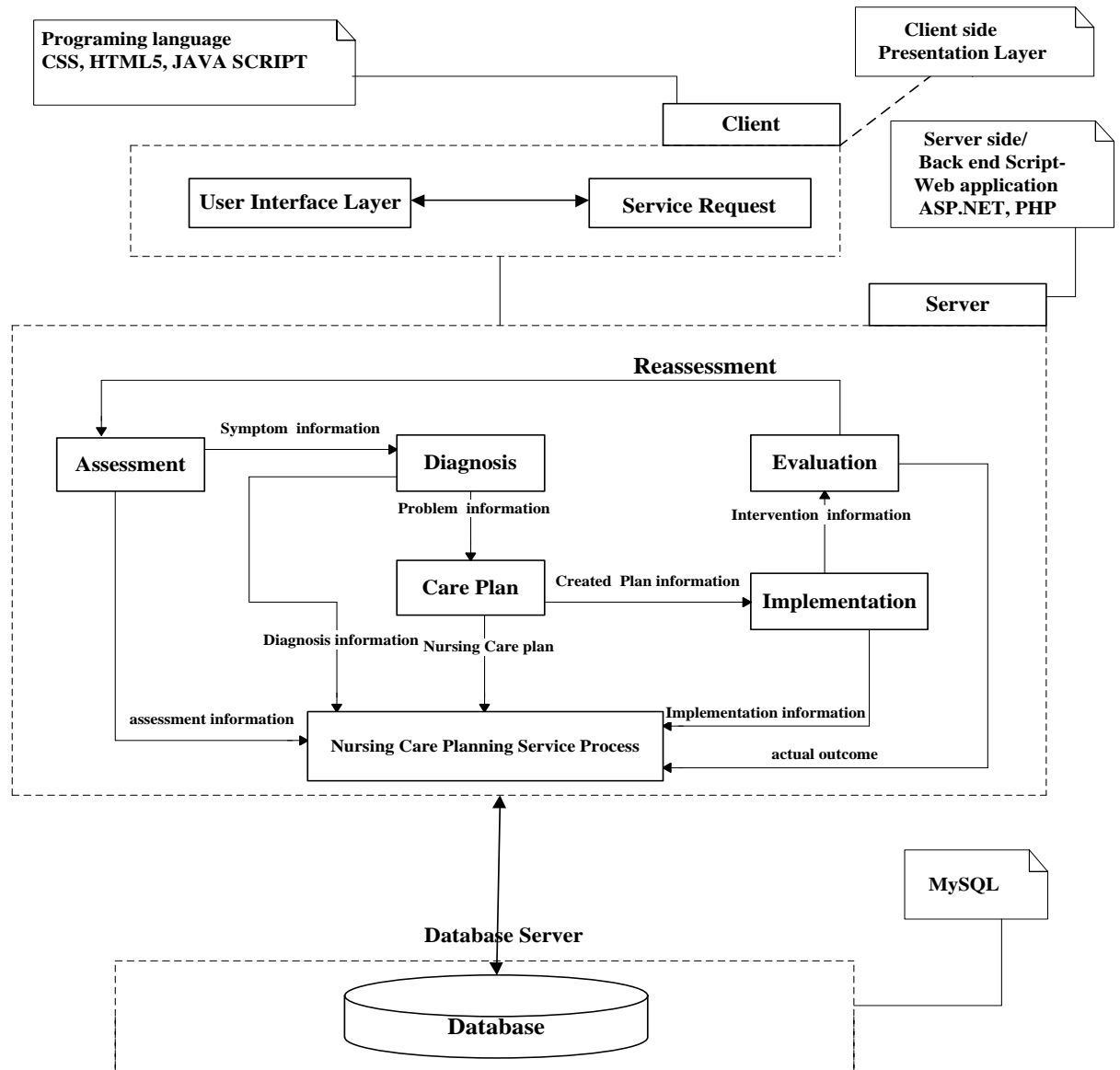
This can be achieved by using secure communication and authentication. For this, we propose the use of Certificates and Secure Socket Layer connection that encrypts information exchange between the front-end tier (web browsers) and the middle tier (web server).

### **II. Middle tier / Web Server or Web Application Server /**

It is in this tier that the business logic of the nursing care planning system is placed. The servers hold all the application code and it is organized in three-tier architecture. The presentation tier communicates with business and data access tier of the application and database tier and writes back to it during an update. The middle-tier contains most of the application logic and translates clients' requests into database queries and other actions and translates query results to client devices. The applications supported by this middle-tier are data access and update to support nursing care planning system application which consists of the assessment, nursing diagnosis, nursing care plan, implementation, and evaluation in the care service process system.

### III. Back-end tier / Database Server /

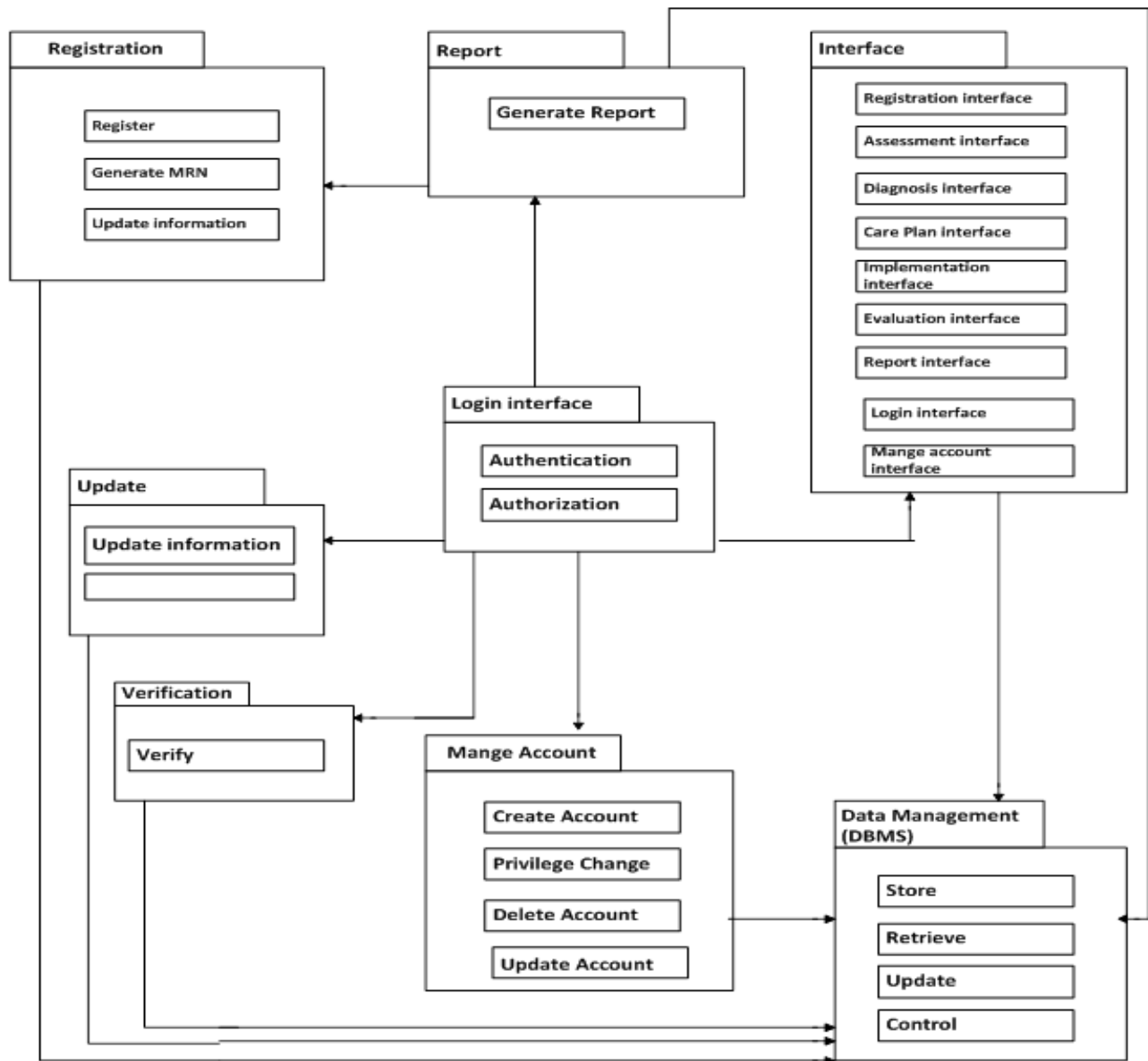
The back-end tier is the database server where the patient information, care service information, system users' information will be stored. The database is a distributed database where a number of databases at different location collaborate to store and provide patient information.



**Figure 19:** Proposed Web based System to Support Nursing Care Planning three tire System Architecture.

### 4.3.2.2. System Object Model

The System Object Model Section allows for a description of the subsystems. In order to make system design and development easy, the system is decomposed into smaller parts called subsystems. In this stage, classes with similar functionality are grouped into a single subsystem. During system decomposition, achieving strong coherence within the subsystem and loose coupling between subsystems were taken into consideration. The major subsystems identified are shown in Figure 20.



**Figure 20:** Description of the Subsystem Interface

### 4.3.2.3. Subsystems Description

#### Interface Subsystem

1. **Registration interface:** enables the users to register vital events.
2. **Update interface:** enables the users to update personal information
3. **Report Interface:** enables the system to show the report generated by the system.
4. **Login interface:** enables the system to be accessed by system users. The system users in order to interact with the system must first interact with the login interface.
5. **Manage Account interface:** enables the administrators of the system to interact with the system in order to administrate it.
6. **Verification interface:** enables the users to verify birth certificates.

#### Registration subsystem

This subsystem is responsible for adding or registering all valid information about events regarding a particular individual, when the patient needs the service. The following are the functionalities inside the registration subsystem:

- Generate Medical identification number
- Add new patient
- Generate Detail patient information and patient service card.

#### Update subsystem

Any information about the owner of the essential events that need to be updated is accomplished by this subsystem.

#### Login subsystem

This subsystem is responsible for giving authentication and authorization capabilities for users.

Authentication: This service enables the system to verify the validity of user who tries to access the system by giving a user name and password.

Authorization: this service enables the system to give different kinds of privileges to different users of the system.

#### Manage Account subsystem

This subsystem allows the administrator to “Create” new user account, “Change” user privilege and “Delete” user account.

### **Verification subsystem**

This subsystem allows user of the system from external institutions to verify and validate someone's birth and age information based on the events identification number.

### **Data Management Subsystem**

This subsystem is responsible to make a connection with other subsystems and also for storing, retrieving and updating all information about vital events and any other information needed by the system.

### **4.3.3. Sequence diagram**

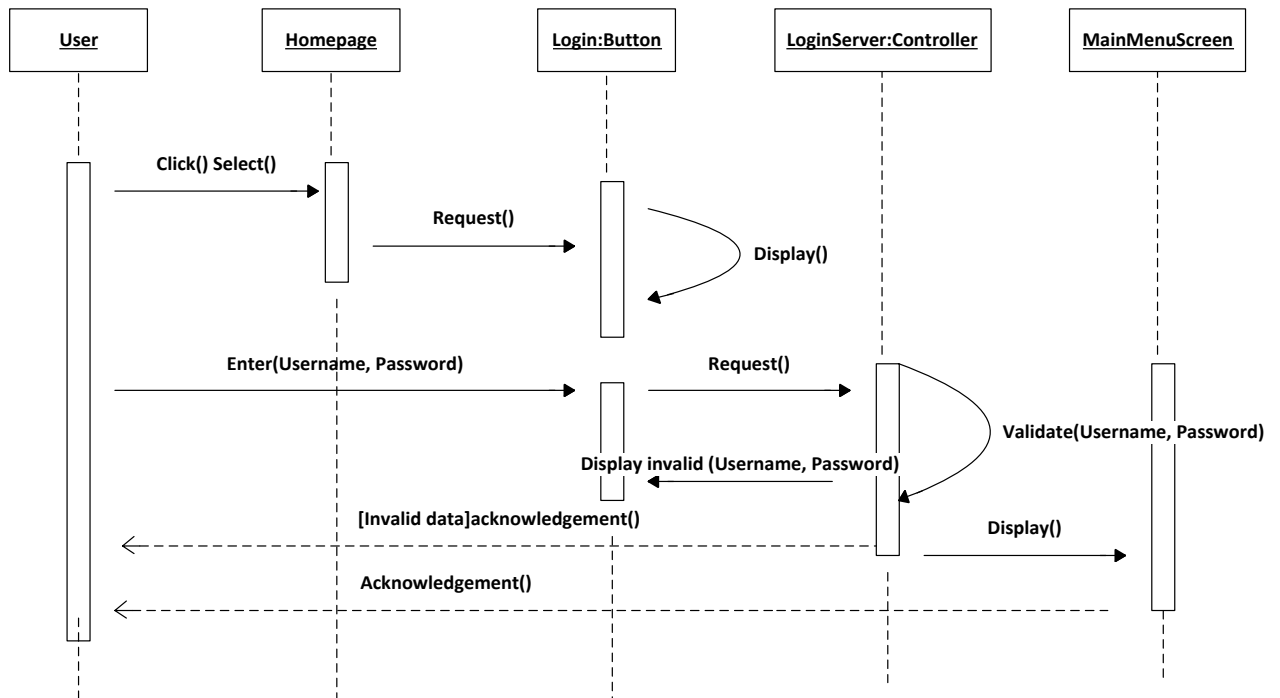
Sequence diagram is used to describe patterns of communication among set of objects which are participated in the use case. Communication between objects is represented by message passing between the objects. Objects are represented as columns with the vertical line to represent the life time of the object. According to [37, 38, 48], sequence diagrams are used to:

1. Validate, describe and show the way that how our system is used.
2. Explore our design because they provide a way for us to visually step through invocation of the operations defined by our classes.
3. Detect bottlenecks within an object-oriented design. By looking at what messages are being sent to an object, and by looking at roughly how long it takes to run the invoked method, we quickly get an understanding of where we need to change our design to distribute the load within your system.
4. Identify new responsibilities for classes and objects, and, sometimes, even new classes. Its implication is that it helps us to update our class model appropriately.
5. Show the interactions between objects in the sequential order that those interactions occur.

The sequence diagrams for the identified use cases are shown below from Figure 19 -28.

### 4.3.3.1 Login into the System

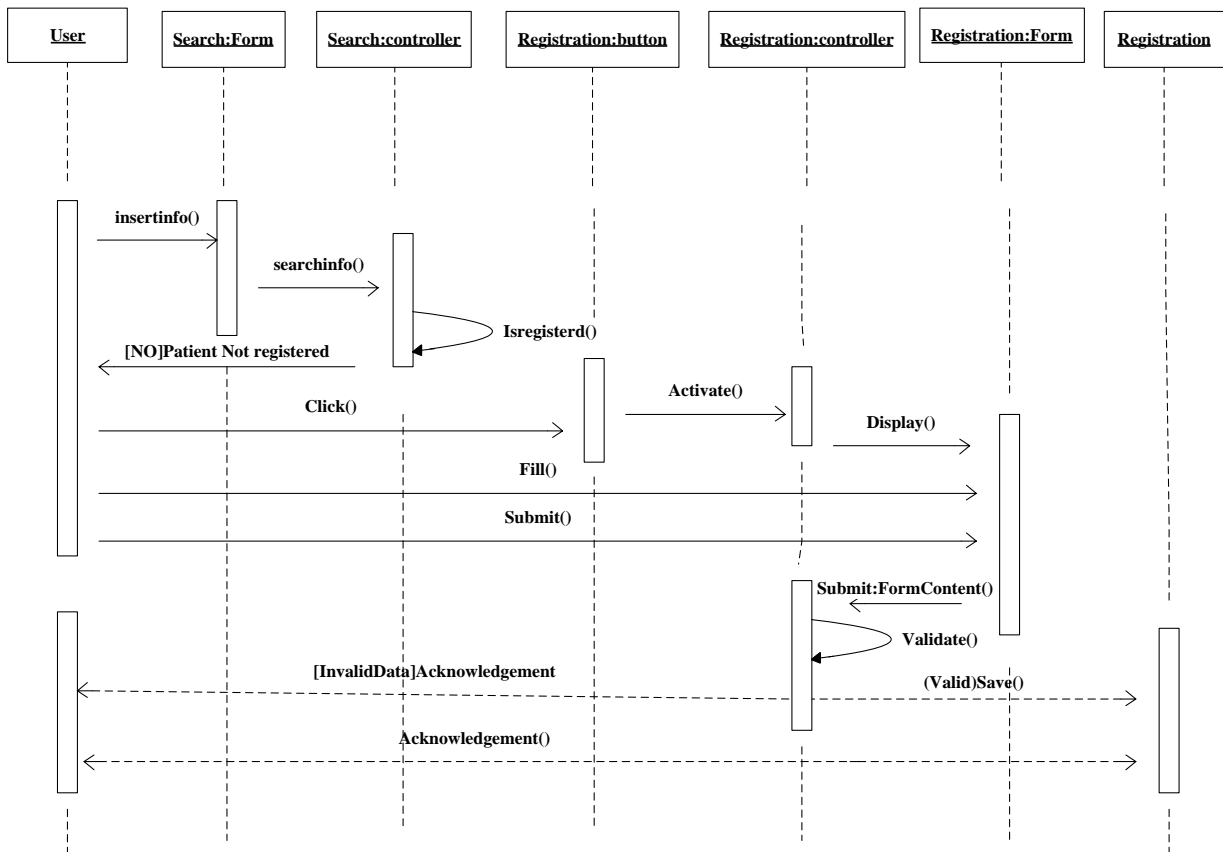
This use case is runs in the server side. It enables the nurse login into the system based on the given privilege. The use case is first initiated via a boundary object, login Button and the login based on the given information to access from the system. The sequence diagram is shown in Figure. This sequence diagram is used to formalize the behavior of the system and to visualize the communication among objects of the system. It is the one that shows the dynamic model for this work. The sequence diagram for most use cases is shown in the upcoming diagrams. The label below the figures describes to which use case the sequence diagram belong too.



**Figure 21:** Home Page Sequence Diagram

### 4.3.3.2 Patient Registration Nursing Care Service Sequence Diagram

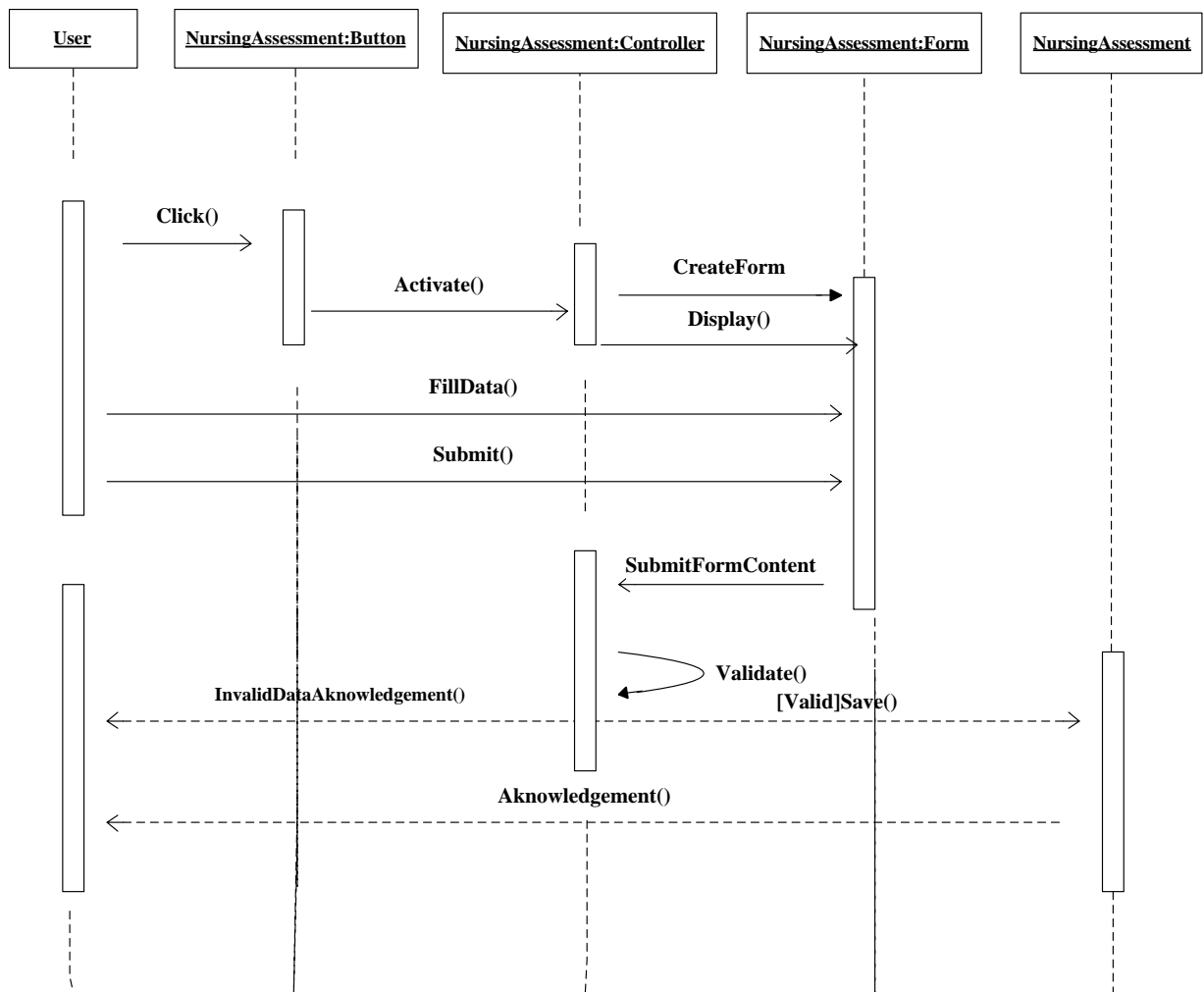
This use case is runs in the server side. It enables the nurse to make registration based on the patient response to collected detail information and create, update the information. The use case is first initiated via a boundary object, registration Button and the patient registration based on the given information with support by the system. The sequence diagram is shown in Figure 22.



**Figure 22:** Patient Registration Sequence Diagram

### 4.3.3.4 Assessment Nursing Care Service Sequence Diagram

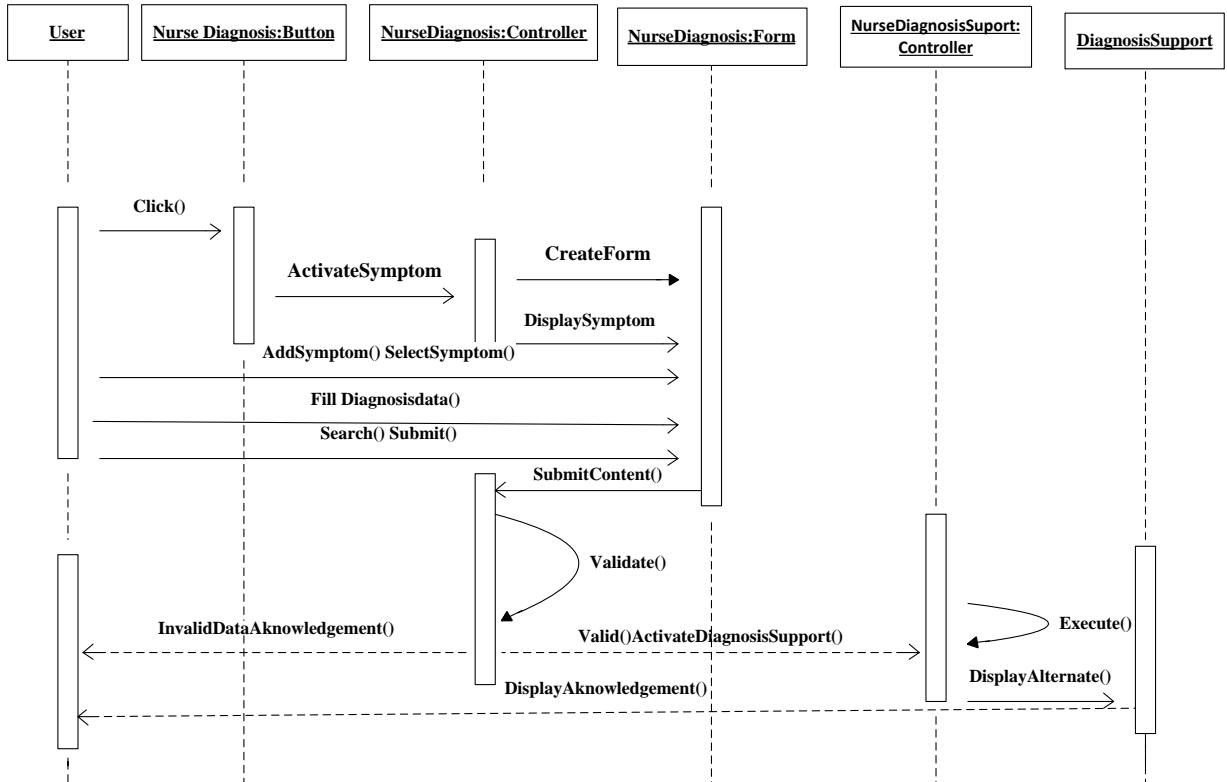
This use case is runs in the server side. It enables the nurse to make nursing assessment based on the collected data. The use case is first initiated via a boundary object, nursing assessment Button and the nursing assessment based on the given information with support by the system. The sequence diagram is shown in Figure 23.



**Figure 23:** Nursing Assessment Sequence Diagram

#### 4.3.3.5 Diagnosis Nursing Care Service Sequence Diagram

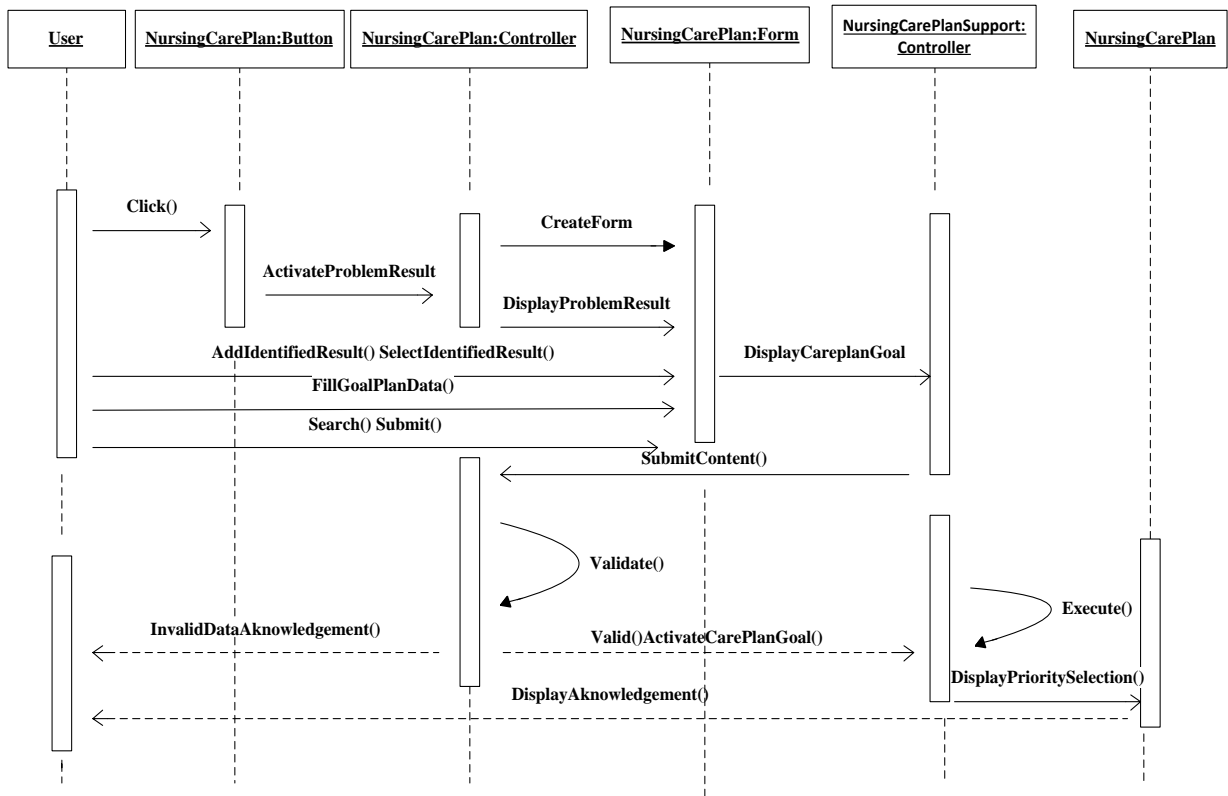
This use case is runs in the server side. It enables the nurse to make nursing Diagnosis based on the collected data. The use case is first initiated via a boundary object, nursing Diagnosis Button and the nursing Diagnosis based on the given information with support by the system. The sequence diagram is shown in Figure 24.



**Figure 24:** Nursing Diagnosis Sequence Diagram

#### 4.3.3.6 Nursing Care Plan Nursing Care Service Sequence Diagram

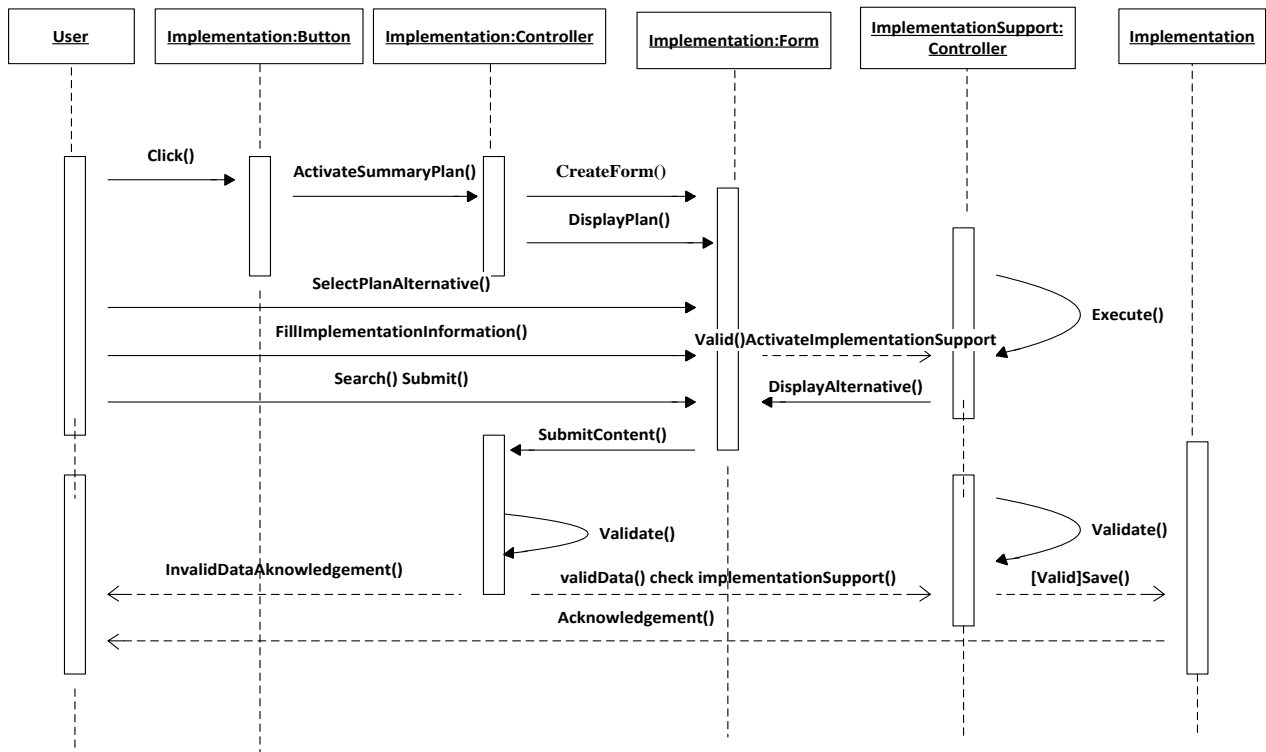
This use case is runs in the server side. It enables the nurse to make nursing care plan based on the collected data. The use case is first initiated via a boundary object, nursing care plan Button and the nursing care plan based on the given information with support by the system. The sequence diagram is shown in Figure 25.



**Figure 25:** Nursing Care Plan Sequence Diagram

#### 4.3.3.7 Implementation Nursing Care Service Sequence Diagram

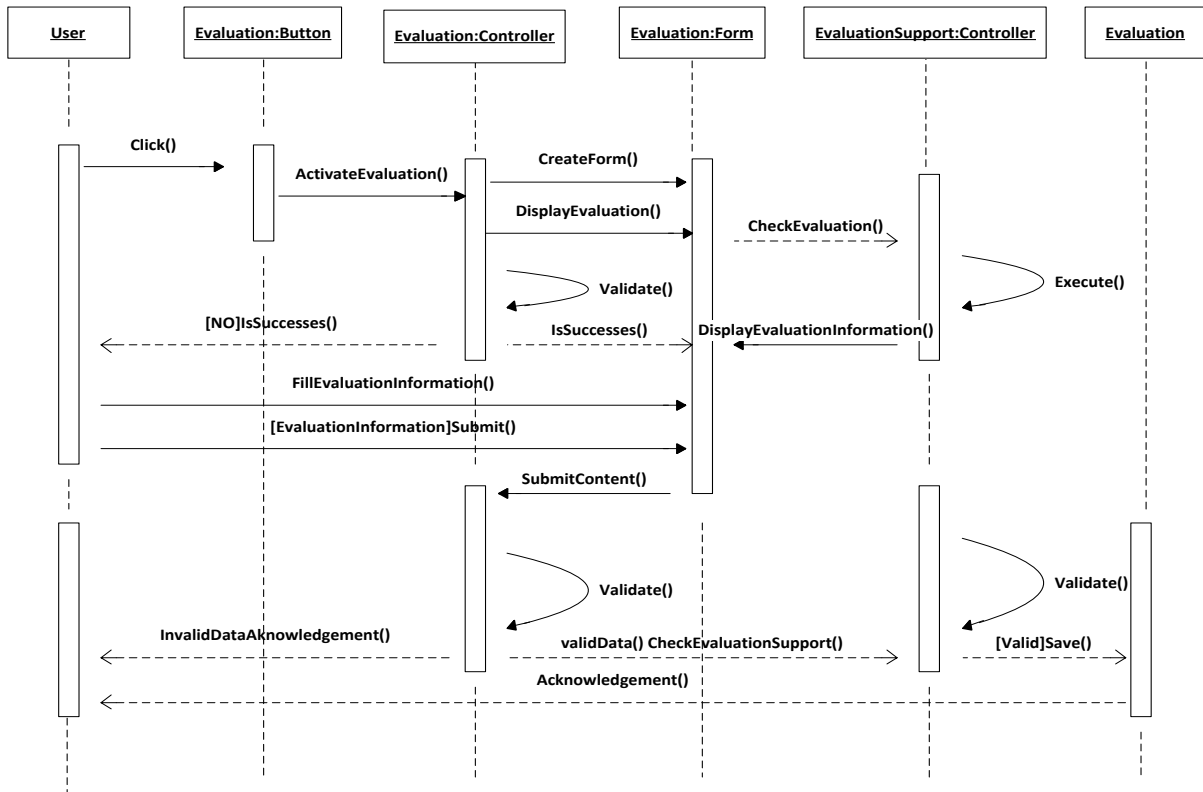
This use case is runs in the server side. It enables the nurse to make nursing implementation based on the collected data. The use case is first initiated via a boundary object, implementation Button and the implementation based on the given information with support by the system. The sequence diagram is shown in Figure 26.



**Figure 26:** Nursing Implementation / intervention Sequence Diagram

#### 4.3.3.8 Evaluation Nursing Care Service Sequence Diagram

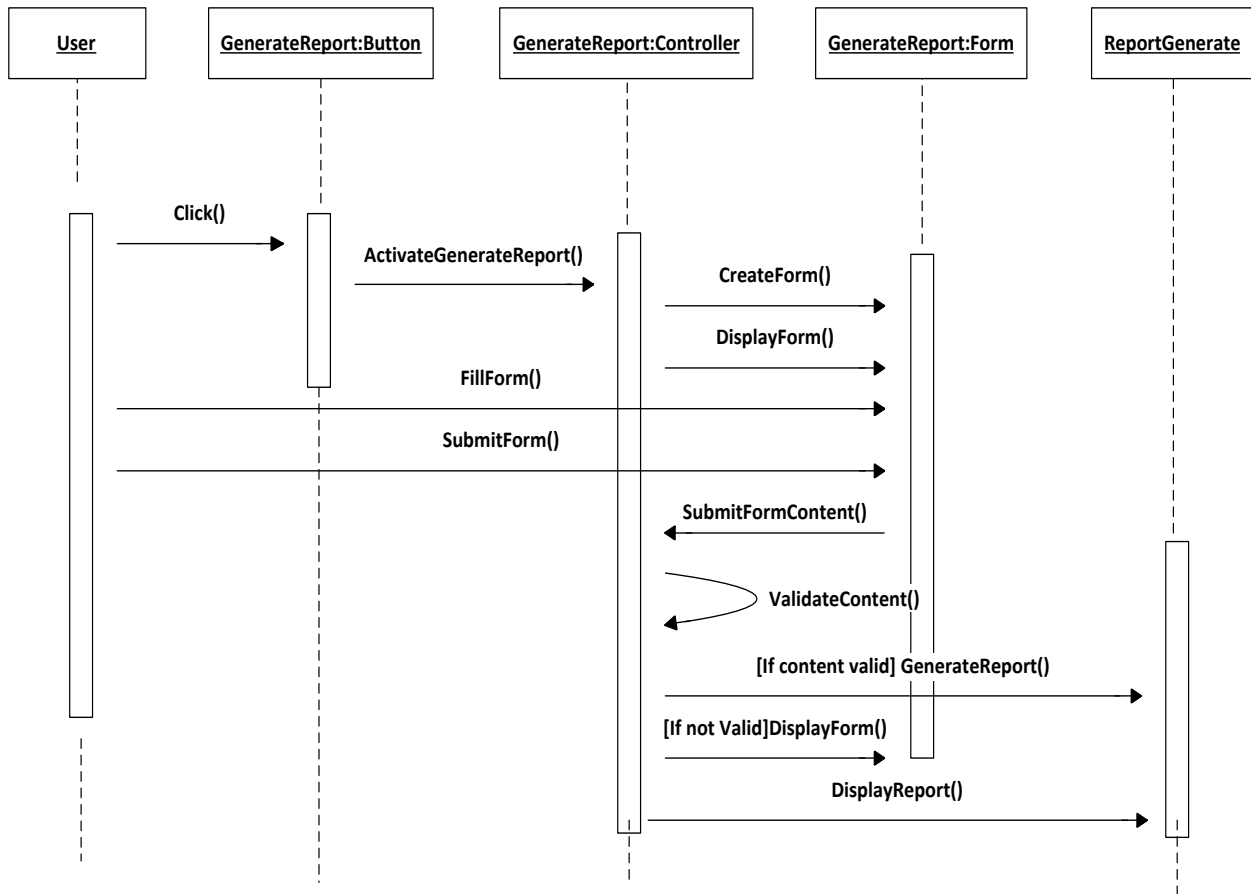
This use case is runs in the server side. It enables the Nurse to nursing evaluation based on the collected data. The use case is first initiated via a boundary object, Evaluation Button and the Evaluate based on the given information with support by the system. The sequence diagram is shown in Figure 27.



**Figure 27:** Nursing Evaluation Sequence Diagram

#### 4.3.3.9 Generate Report Nursing Care Service Sequence Diagram

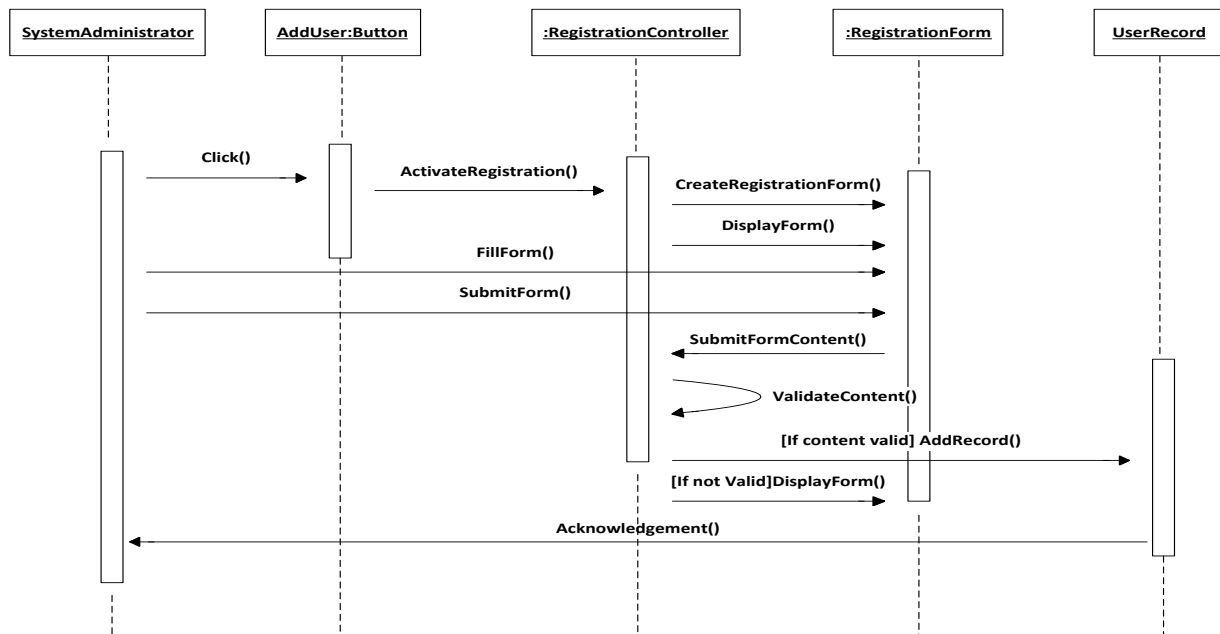
This use case is runs in the server side. It enables the system administrator to generate report based on the collected data. The use case is first initiated via a boundary object, Generate Report Button and the generate report based on the given information. The sequence diagram is shown in Figure 28.



**Figure 28:** Nursing Report Sequence Diagram

#### 4.3.3.10 Register User/ Create Account

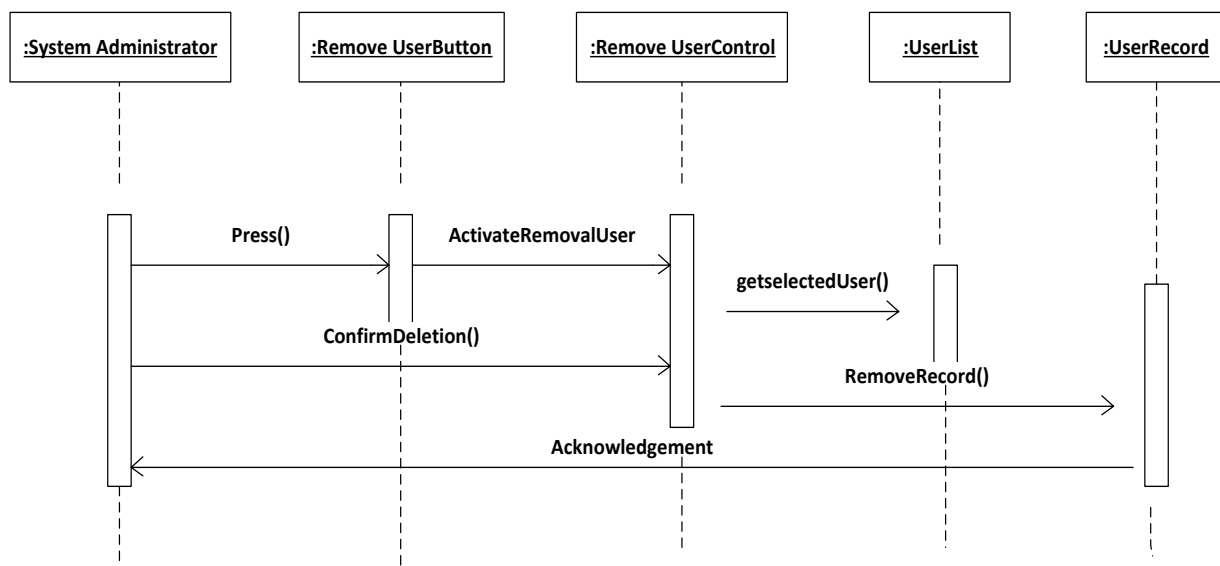
Register new user use case is used to register new system users. It runs in the server side of the system. When new user needs to be registered, the system administrator initiates this use case and fills the registration form. If the user information is valid, registration will complete successfully. The sequence diagram of the use case is shown in Figure 29.



**Figure 29:** Register/Create Account Sequence Diagram User

#### 4.3.3.11 Remove User Account

Remove user use case enable system administrator to remove registered user from the system. The sequence diagram is shown in figure 30.



**Figure 30:** Remove User Account Sequence Diagram

#### **4.3.4. Object Oriented Design Class Diagram**

A dynamic view of collaboration objects in WSSNCP shown in sequence diagram earlier, a static view of the class definitions is usefully shows with a class diagram. The design class diagram shows attribute and methods of the each class, the design class diagram show software classes. In this way, OOP designs and languages can support a lower representational gap between the software components [50, 52]. In design class diagramming a class with its attributes and methods is clearly represented. The researcher develops the model for design class diagram as follows in figure 31; it shows a design class diagram for designing WSSNCP.





## 4.5. User interface evaluation

The goal of the system user interface was to determine the usability of a web-based system to support nursing care plan. The evaluation often refers as the question of how well users can understand the system functionality [54].

Heuristic evaluation is one of the most commonly used discount evaluation methods due to its low cost. It is an inspection method that can prospectively uncover problems with a user interface, indicate the severity of the problems, and make suggestions for fixing the problems [54, 52].

Heuristic evaluations that are performed by two or more usability experts can identify more than 50 percent of the usability problems with an interface. The method requires that a small set of 3 to 5 experts evaluate a user interface based on their knowledge of human cognition and interface design rules of thumb or heuristics. Once the experts identify the heuristics violated within an interface, experts rate the problems in terms of severity on a scale from 1, indicating a cosmetic problem (fix can wait), to 4, indicating a catastrophic problem (immediate fix) [54, 52].

Usability user interface evaluation is the extent to which users can use a computer system to achieve specified goals effectively and efficiently while promoting feelings of satisfaction in a given context of use [54, 52].

The result of user interface evaluation is demonstrated as follows. The values for all attributes in table 4.13 are fixed as: Strongly agree = 5, Agree = 4, undecided = 3, Disagree = 2 and Disagree = 1.

No	Criteria of evaluation	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
1	Characters on the computer screen easy to read				30%	70%
2	Highlighting on the screen helpful				20%	80%
3	Screen layouts were helpful			10%	10%	80%

4	Sequence of screens clear.				30%	70%	
5	Overall reactions to the system wonderful			10%	30%	60%	
6	I thought the screen use of terminology throughout system consistency.				20%	80%	
7	Terminology relates well to the work you are doing				10%	90%	
8	Messages which appear on screen			10%	20%	70%	
9	Computer keeps you informed about what it is doing			10%	10%	80%	
10	Error messages				30%	70%	
				<b>Average Result</b>	<b>4%</b>	<b>21%</b>	<b>75%</b>
					<b>Total agree value</b>	<b>96%</b>	

**Table 20:** user interface evaluation

## 4.6. Discussion of Result

As compared to the manual system, the new automated system design can be integrated all the phases of nursing care service process activities of the inpatient department of the hospital. The new designed system provides information for decision in nursing care planning process. This web based system for nursing applications should include all applications that nurses' can utilize to solve a patients' problem. By doing so, a standard patient care was established.

Using standard care plans have their own benefits in the way to decreases the time needed to create a new care plan for each patient instead of subjective and objective expressions to describe patient situations. Patient care plans designed in electronic form can be recorded and updated in a short time, this have its own contribution towards risk minimization in data loss. Correct identification and application of this web based system in inpatient management are important as the right assessment, diagnosis, care plan, implementation, and evaluation of patient related history.

The web based system will support the professionals in different stages; assessment, recording information and flexible construction decision support nursing care planning process. The nursing care plans data employing and saving in electronic system are easy and precaution for any technical malfunction leading out to save a data loss. The nursing care planning process should be printed out in paper form and documented in patients' folder.

The health professionals evaluated the analysis and design document along with the investigator and showed their agreement with their professional wise descriptiveness of the document, the evaluators generally agreed about the system contributions to the study area.

## Chapter 5

### 5. Conclusion and Recommendations

#### 5.1. Conclusion

Existing nursing care planning system in the health facility is kept manually using different paper based formats. Based on the responses of participants, paper based recording management system has different problems like duplication of records, data quality and completeness, illegibility of records, difficulty for easy access, leading to lack of timely, reliable and relevant information and difficult to deliver comprehensive and timely health information to users. This project contributes to better understanding of using nursing care planning service process and solve the current problems.

Identified essential requirements from the study area are assessment, diagnosis, care plan, intervention, evaluation and medications. In addition, respondents' revealed that even if national guidelines were present but due to different problems like lack of resource, inconvenient working environment and workload cannot address the above parameters. So, in this study the national standards and guideline were used as an input in order to determine the requirements for the new system.

Following the required analysis, system use cases were used to describe the basic functions of system boundary and illustrate detailed description of the activities. In this project, system requirements are identified by consulting the users. Some of functional requirements are the system keep track of patient's medical history and basic information while non-functional one are the system available seven days in a week, scale up to accommodate this increasing need without a noticeable performance downgrading and protected from an unauthorized users and intruders.

The design model transcribes the analysis model in such a way going to be implemented. A designing web based nursing care planning system was used object oriented approach to design the three tire system architecture models (adopted). The implantation of the model contributes to

the effective and efficient nursing care service planning process and improves communication between different health professionals by accessing networked system through the web-based system.

Finally user interface prototype design shows part of the system which the user interact to the system. It includes different components like screen displays that provide navigation through the system, forms that capture data and reports that the system produces. User evaluation also proves that the system meets users interface factors such as screen terminology, system capabilities, user behavioral factors, such as attitudes, intention to use; completeness, timely available, and format of layout and perceived usefulness and delivered to the health workers of the study health facility. Therefore, regarding implementation of the system in the hospital and further researchers to extend the developed prototype are suggested in the recommendation section of the research project.

Through all this, the study addresses the researcher problems and made a significant contribution to nursing care planning information system in Wolaita Sodo Outona Referral Hospital which improves the current nursing care service system.

## **5.1. Recommendations**

This study made to designing a web-based system to support nursing care planning in order to improve the current paper based nursing care planning process. Based on the finding the following recommendations should be taken in consideration by Woliata Sodo Outona Referral Hospital managing bodies and other stakeholders to solve existing nursing care planning process associated problem.

### **A. Health Facilities**

- ❖ The hospital should provide a better infrastructure (Network, electric power) to deploy the system.
- ❖ The hospital should provide hardware and software in order to install the system

## **B. Federal Ministry of Health**

- ❖ The Federal Ministry of Health and regional Health, Woliata Sodo Outona Referral Hospital should work on the system implementation of nursing care planning process.
- ❖ The Federal Ministry of Health and implementations hospital and other stockholders should work on the capacity building on health professionals.

## **C. Students / Researchers**

- ❖ Researchers or students should continue the project to complete all the rest part of system implementation, by using this project as an input for next phase of software development process.

## Reference

1. Constitution of the World Health Organization. United Nations. October 2006.
2. Athina Lazakidou. Web-Based Applications in Healthcare and Biomedicine. USA: Oklahoma State University; 2010.
3. Ralph V. Carlone. Automated Medical Records hold promise to improve patient care report to the chairman. US: committee on governmental affairs; 1991.
4. Federal Democratic Republic of Ethiopia Ministry of Health. Health Sector Development Programme IV Final Draft. Addis Ababa: Ethiopia; 2010.
5. Federal Democratic Republic of Ethiopia Ministry of Health. Health Sector Development Programme IV Final Draft Addis Ababa. Addis Ababa: Ethiopia; 2010/15.
6. Health Policy of the transitional Government. Addis Ababa: Ethiopia; September 1993.
7. INFORM Unit. Information for health management: the MSH approach. Management science for Health. Boston: MA US; 2005.
8. Hiwot Araya. Developing Patient Record System for health centers in Habru woreda West Wolo, (MSc thesis), Addis Ababa: Addis Ababa University. Ethiopia; 2012.
9. Rajalakshmi Murugan, Mulugeta Aseratie, Mulugeta Molla. Assessment of Factors Affecting Implementation of Nursing Process Among Nurses in Selected Governmental Hospitals. Addis Ababa: Ethiopia; 2014
10. Hiwot Araya. Developing Patient Record System for health centers in Habru woreda West Wolo, (MSc thesis), Addis Ababa: Addis Ababa University. Ethiopia; 2012.
11. MulugetaAsratie. Assessment on factors affecting implementation of nursing process among nurses in selected governmental hospitals (MSc thesis), Addis Ababa, Addis Ababa University. Ethiopia; June 2011.
12. Feng, l.,lu, h. integrating database and web technologies . International, journal of World Wide Web; 1998.
13. Nantika Prinyapol. A dynamic platform for workflow management system. A ward management perspective. University of Wollongong; 2010.
14. Guenther, J. T. Mapping the literature of nursing informatics. J Medical Library Association; 2006.

15. Asieh Darvish, Fatemeh Bahramnezhad, Sara Keyhanian, Mojdeh Navidhamidi. The Role of Nursing Informatics on Promoting Quality of Health Care and the Need for Appropriate EducationL. Canadian: Canadian Center of Science and Education, Global Journal of Health Science; Vol. 6, No; 2014.
16. Staggers, N., Gassert, C. A., Curran, C., A. Delphi study to determine informatics competencies for nurses at four levels of practice. Nursing research; 2002. Available from [<http://dx.doi.org>]
17. Okwor Emeka, Daniel. Design and implementation of an electronic patient management system. Caritas University; 2012.
18. Elske Ammenwerth , Ulrike Kutscha , Ansgar Kutscha ,Cornelia Mahler , Ronald Eichsta'dter , Reinhold Haux. Nursing process documentation systems in clinical routine—prerequisites and experiences. Ireland: Elsevier Science Ireland Ltd; 2001.
19. Maria Malliarou, Sofia Zyga. Advantage of health information system in health service, XOPHTIA – CHOREGIA Scientific Forum in Sport Management International Journal. SMIJ – VOL. 5, Number 2, Greece: Technological Institution of Larisa; 2009.
20. Ting-Ting Lee PhD, RN. Nurses' concerns about using information systems: analysis of comments on a computerized nursing care plan system. Taiwan: Blackwell Publishing Ltd, Journal of Clinical Nursing; 2005.
21. Ting-Ting Lee PhD, RN. Nurses' perceptions of their documentation experiences in a computerized nursing care planning system. Taiwan: Blackwell Publishing Ltd; 2006.
22. Okwor Emeka Daniel. Design and Implementation of an Electronic Patient Management System. (A Case Study of Shonahan Hospital, Nsukka Enugu), Amorji-Nike, Emene Enugu State: Caritas University; September, 2012.
23. James Studnicki,Donald J. Berndt,John W. Fisher, using information systems for public health administration. Jones and Bartlett Publishers;2010.
24. Op't Land M, Proper E, Waage M, Cloo J, Steghuis C. Enterprise Architecture: Springer; 2008.

25. D2-8. The requirement engineering process, Remote Accessibility to Diabetes Management and Therapy in Operational Healthcare Networks, (Version 3.0);2012
26. Saranya Devi Ganesan. An Architecture Framework for Web Applications (MSc thesis). India: Ohio State University; 2013.
27. Rohan Ohol. Web Based Nursing Home Information System Needs, Benefits, and Success In Providing Efficient Care At Long Term Care Facilities. USA: University of Missouri-Columbia (MSc thesis); 2010.
28. Shirin Sharif. Characterization of a longitudinal care plan model for managing chronic diseases: a care plan ontology to computerize paper- based care plans. Halifax. Nova Scotia: Dalhousie University; March 2012.
29. Yuan Hong. Preserving Privacy in Web-based e-Health Systems, Montreal, QC. Canada: Concordia University; 2012.
30. Subhomoy D. Dass. A Web-Based Automated Classification System for Nursing Language Based on Nursing Theory. Boca Raton. Florida: Florida Atlantic University, (MSc thesis); December 2011.
31. Ani Dumar Dubey. Diabetes Disease Management System. Columbia: Massachusetts institutes of technology; (MSc thesis) 2004.
32. Kwuy Im Jung, Byung Suk Lee. Development of the ICNP Based Cancer Nursing Information System. Korea: aGospel Hospital, Kosin University; 2010.
33. Tom Edgar. An Expert Inference Engine for Generation of Nursing Diagnoses. Florida: University of North Florida, j.t.bowen@unf.edu.; May, 1991
34. Hyeoun-Ae Para, InSook Cho, NamSoo Byeun. Design modeling a terminology-based electronic nursing record system, an object-oriented approach. South Korea: Elsevier Ireland Ltd; July 2006.
35. Vivian Zia. A Computerized Nursing Workload Management System in a Pediatric ICU. Montréal: McGill University; April, 1997.

36. Mohammad A. Rob. Dilemma between the Structured and Object-Oriented Approaches to Systems Analysis and Design. Houston: Texas; 2008.
37. Barbara Haley Wixom, Alan Dennis. Systems Analysis and Design with UML Version 2.0. An Object-Oriented Approach. Indiana University, University of Virginia. John Wiley & Sons, Inc.; 2005.
38. Craig Larman. Applying UML and Pattern: an introduction to object oriented analysis and design, third edition. United States of America: Addison Wesley Professional; October 20, 2004.
39. Douglas Baldwin, Greg W.Scragg. The object primer, agile model-driven development with uml 2.0. UK: Cambridge University press; 2004.
40. Tolessa Alemu. Designing an Integrated Licensing and Inspection Information System: The Case of Oromia Regional Health Bureau. Ethiopia: Addis Ababa University; October, 2014
41. Trading Technologies, Version 7.X, Hardware and Software Requirements and Optimizations. Trading Technologies International. Inc.; 2014.
42. DEBT management and financial analysis system, Version 4, Hardware, Software and Training Requirements for DMFAS 6; October 2013.
43. Kevin Daimi, Luming Li, Xiaodan Lu, Nazar El-Nazeer. Requirements Engineering for Home Health Care Software Systems, Detroit: University of Detroit Mercy, @udmercy.edu; 2012.
44. Gert Zülch & Sascha Stowasser. Usability Evaluation of User Interfaces with the Computer aided Evaluation Tool PROKUS, Germany, Kaiserstra: Universität Karlsruhe (TH); 2007.
45. Addison-Wesley. somerville, software engineering: United States of America, Pearson; 2011.
46. Roberta M. Roth. System analysis and design 5th, Virginia: University of Virginia. John Wiley & Sons, Inc.; 2012.

47. Information on system analysis and design tools UML project, England: New York. Popkin Software and Systems, Inc.; 2001.
48. David Avison, Guy Fitzgerald. Information system development methodology tools and technique. London Boston: Brunel University. McGraw-Hill Companies; 2005.
49. Scott W. Ambler. The Object Primer, Third Edition, London: Cambridge University Press; 2004.
50. Thomas Connolly, Carolyn Begg,.A Practical Approach to Design, Implementation, and Management, England: London University of Strathclyde. Pearson Education Limited; 2005. [available from [www.booksites.net/connbegg](http://www.booksites.net/connbegg)]
51. Douglas Baldwin, Greg W.Scragg. The object primer, agile model-driven development with UML 2.0. UK: Cambridge University press; 2004.
52. Chin, J.P., Diehl, V.A., Norman, K.L. Development of an Instrument Measuring User Satisfaction of the Human-Computer Interface, University of Maryland; 1986-1998 [available from <http://garyperlman.com/quest/>]
53. Byung S. Lee. Journal of Object-Oriented Programming, University of St. Thomas; March 1996.
54. Constance M. Johnson, Ph.D., EHR Usability Toolkit: A Background Report on Usability and Electronic Health Records. USA: Agency for Healthcare Research and Quality; 2011 [available from [www.ahrq.gov](http://www.ahrq.gov)]

## ANNEXES

### ANNEX 1\_INTERVIEW

#### ADDIS ABEBA UNIVERSITY

#### SCHOOL OF INFORMATION SCIENCE AND SCHOOL OF PUBLIC HEALTH

#### MSC IN HEALTH INFORMATICS PROGRAMM

My Name is Siraj Sebhatu .I am post graduate student of health informatics program and my project research objective Design of a Web based System to Support Nursing Care Planning for Wolaita Sodo Outona Referral Hospital.

**Confidentiality and Verbal Consent Form:-**This interview is design based on the information acquired will help to inform decision on how to design, implementation and achieving the institution mission. From a research conducted in Wolaita Sodo Outona Referral Hospital to Design Web Based System to Support Nursing Care Planning for Wolaita Sodo Outona Referral Hospital of SNNP Regional State of Ethiopia. You are kindly requested to provide genuine answers to the interview. The information you provide is confidential and is used only for the purpose of this study. If you have any interview question, don't hesitate to ask the project investigator. Your cooperation and participation until the compilation of the interview is very necessary for the successful compilation of the assessment. We therefore ask your genuine willingness. However, you have the right to turn down if you are not voluntary to participate so that fills 'NO' in the box below.

If you are voluntary or not mark 'x' on your opinion YES  NO

THANK YOU IN ADVANCE FOR YOUR COOPERATION

## **Guide Line of Interview used for Design Web Based Nursing Care Planning process information elicitation and to identifying requirement of the system and to analyze the system**

### **Data and Process**

1. What types of information is processed in the current system?
2. What data are included in each types of information processed?
3. How are patient data collected and stored?
4. What are the problems on the existing forms?
5. How do you retrieve patient information in the current system?
6. How do you get patient history
7. How do you record data during the assessment of the patient in the current system?
8. That information is included in the assessment record?
9. How is nursing care process started?
10. What are the current problems on the data processing?
11. What types of error happen most in nursing care record process?

### **Report/ Communication**

12. How is the collected data used or analyzed in the current system?
13. How does patient information flow among the professionals?
14. Who needs what information and when?
15. How frequently do you review / prepare the report in the current system?
16. For who does the report submitted?
17. How do you prepare report currently?
18. What does the information communication infrastructures look like in the organization

### **People**

19. How is patient information accessing privilege provided for the professionals?
20. Who is responsible for patient record error and how?
21. Who make the reports?
22. Did the nurses have computer skill?

## Management (Procedure)

23. Where are the leverage points and critical processing points where a change in procedure could significantly improve efficiency and service?
24. Do you have guide line to help your assessment?
25. What are patient information recording procedures include?
26. How is a problem on patient information recording process handled?
27. Do have any system/mechanism to trace the problem?

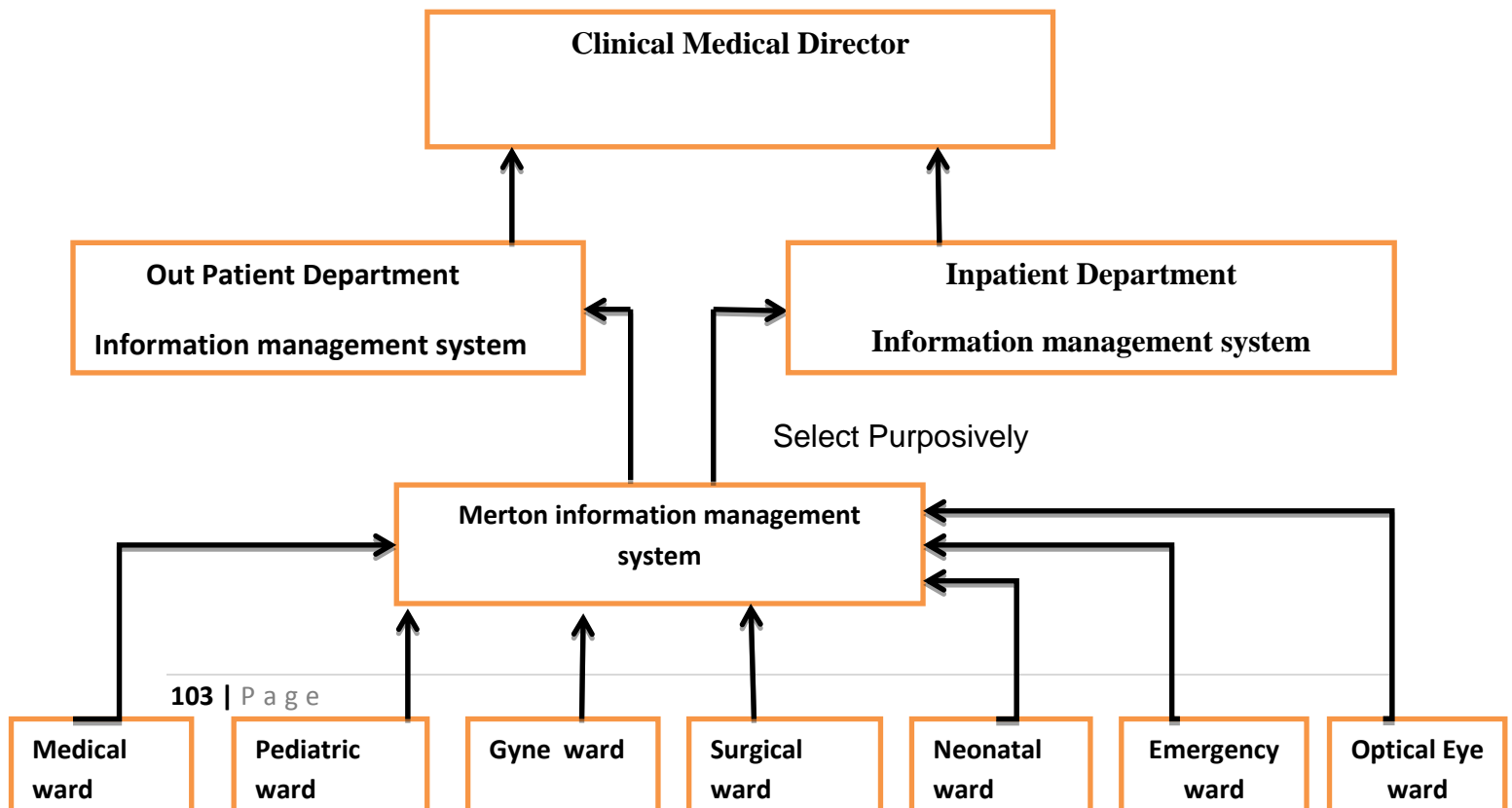
## Software

28. Is there any planned approach or computer system to improve the current system?
29. Do you have any software used to prepare reports? Which software?
30. Do you have computer network for sharing of the information such as reports?

## Hardware

31. Do you have a computer? How many?
32. For what purpose do you use it?

## Annex II: A schematic representation of sampling Procedure



## **Business process of the nursing care planning**

### **I. Business process of registration:**

- ✓ The patient presents in the registration department.
- ✓ If the patient is new the data clerk asks the patients full information from the patient.
- ✓ The data clerk registers full patient information
- ✓ The data clerk gives identification number.
- ✓ The patient makes payment.
- ✓ The data clerk sends the patient to the triage officer.
- ✓ The triage officer screens the patient.
- ✓ After screening, the patient will be sent to the selected case team.

### **II. Business process of nursing assessment**

- ✓ The patient brings admission card
- ✓ The ward nurse confirms admission order
- ✓ The ward nurse confirms availability of bed
- ✓ The ward nurse takes history and performs nurse assessment.
- ✓ The nurse registers the history of present illness on the assessment form.
- ✓ The nurse record present vital sign result.
- ✓ The nurse interview the patient to collect the present situation
- ✓ The nurse record on the form his /her assessment result

### **III. Business process of nursing diagnosis**

- ✓ The nurse make nursing diagnosis using assessment result
- ✓ The nurse identifies the symptom based on nursing diagnosis.
- ✓ The nurse give problem number for each identified problem.

### **IV. Business process of nursing care plan**

- ✓ The nurse record and list out the problem number on the nursing care plan form

- ✓ The nurse designs a plan for each problem.
- ✓ The nurse make intervention solution for each designed care plan

**V. Business process of nursing evaluation**

- ✓ The nurse check the patient condition based on the vital sign expected outcome.
- ✓ If the patient does not show improvement, the nurses reassess the patient.

**VI. Business process of nursing report**

- ✓ The nurse makes report for every shift time, the daily condition of the patient, the weekly, month, admitted and discharged patient.

**Annex IV: Survey 2: User Satisfaction**

Please circle the numbers which most appropriately reflect your impressions about using this user interface system.

1. Characters on the computer screen easy to read.

1   2   3   4   5

Strongly Disagree                  Strongly Agree

2. Highlighting on the screen helpful

1   2   3   4   5

Strongly Disagree                  Strongly Agree

3. Screen layouts were helpful

1   2   3   4   5

Strongly Disagree                  Strongly Agree

4. Sequence of screens clear.

1   2   3   4   5

Strongly Disagree                  Strongly Agree

5. Overall reactions to the system wonderful

1   2   3   4   5

Strongly Disagree                  Strongly Agree

6. I thought the screen use of terminology throughout system consistency

- 1 2 3 4 5  
Strongly Disagree      Strongly Agree
7. Terminology relates well to the work you are doing
- 1 2 3 4 5  
Strongly Disagree      Strongly Agree
8. Display Messages which appear on screen consistent
- 1 2 3 4 5  
Strongly Disagree      Strongly Agree
9. Computer keeps you informed about what it is doing
- 1 2 3 4 5  
Strongly Disagree      Strongly Agree
10. Display the Error messages helpful.
- 1 2 3 4 5  
Strongly Disagree      Strongly Agree

## DECLARATION

I, the undersigned, declare that this research project is my original work and has not been presented for a degree in any other university, and that all source of materials used for the thesis have been duly acknowledged.

---

**Siraj Sebhatu**

This research project has been submitted for examination with my approval as university advisor.

**Signature**

**Date**

Alemayehu Mekonnen (MD, MPH),

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\_\_\_\_\_

Ato Getachew Jemaneh

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May 2015, Addis Ababa, Ethiopia.