



**ADDIS ABABA UNIVERSITY
SCHOOL OF INFORMATION SCIENCE
AND PUBLIC HEALTH**

Designing Knowledge Sharing Platform for Health Care Professionals in Ethiopia

By: Nebiyu Yared

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Abbreviations and Acronyms

CSS	Cascading Style Sheet
FMHACA	Food, Medicine and Healthcare Administration & Control Authority
FMOH	Ministry of Health
HSTP	Health Sector Transformation Plan
HTML	Hypertext Markup Language
ICT	Information Communication Technology
IT	Information Technology
KM	Knowledge Management
KMS	Knowledge Management System
MDG	Millennium Development Goal
MS	Microsoft
MYSQL	My Structured Query Language
NIH	National Institute of Health
OO	Object Oriented
PHP	Hypertext Preprocessor
UML	Unified Modeling Language
WHO	World Health Organization

Operational Definitions

Health Professionals: On this project health professional are any licensed experts that actively engaged into health institutions to perform health related activities.

Health Institution: On this project health institution include any health related governmental and non-governmental organizations which are registered with FMHACA to provide health related services.

Knowledge: On this project knowledge is considered as any information on how to perform health related activities, could be practical experience or formal written knowledge like guidelines. Or on locating where a specific knowledge could be found.

Knowledge Sharing: On this project knowledge sharing is a means to support the process through which one health professional's knowledge is communicated to other individuals or groups.

System: On this project system is defined as set of interrelated component working together to facilitate the sharing of one health professional knowledge to another.

Platform: The designed web based software to support the knowledge sharing activities in which health professionals and other stakeholders interact with.

Users: Are any stake holder that have the right to use the developed system Including health professionals, health Institutions, MOH, FMHACA.

Knowledgebase / Database: On this project knowledgebase or database is an organized collection of data, information or Knowledge which allows storage and retrieval.

Abstract

Background - The need for sharing health knowledge extends to professional needs like, clinical decision making, patient and practitioner's education, experience enhancement and up-to-date information of medicine in the technology era.

In Sub-Saharan region of Africa, where there is no adequate, books and reference materials especially for those professionals working in remote areas which are located away from cities, such absence of knowledge sharing widens the differences in knowledge of clinical practice that leads to variations in training and clinical experience which contributes the poor quality of services and service outcomes, among professionals in different setting which are a major causes of various catastrophes like medical errors.

In Ethiopia, there is a gap in the area of knowledge and experience sharing practices among health professional's routine practices after the completion of university training. Taking the opportunity of the advancement to information communication technology, even in remote areas, could fill this gap hence improve the quality and outcome of medical practices.

Objective- the main objective of this project is to design a user friendly and functioning knowledge sharing platform that helps health professionals to share their knowledge and experiences with each other.

Methodology- An object oriented system development methodology was used to gather requirement from FMOH, FMHACA and two selected hospitals in Addis Ababa. Total number of seventeen key informants were interviewed for requirement gathering. The gathered requirements were analyzed. Based on the requirement- interaction, behavior and structure of the proposed system were modeled using unified modeling language. The platform architecture was designed and the prototype was developed using HTML, PHP, MySQL. Finally, the prototype was evaluated using user acceptance testing.

Result- The designed system has major functionalities of registration of health professionals including their various work experience and educational achievements. Storing of accumulated knowledge, discussion on a specific topic, retrieval of stored knowledge, locating health professionals as well as health care institutions were also the major functionalities. The newly designed system is enabled with reliable, adequate performance, advanced security features and attractive as well as easy to use user friendly interface.

Conclusion: - The developed web based system can ease the effort towards disseminating and sharing medical knowledge. So that health care professional working at different locations irrespective of time and healthcare setting could have the same and comparable understanding towards the current treatment, policies, guide lines, procedural documents and various administrative directives.

Chapter One

Introduction

1.1 Background

Knowledge sharing can be described as a steadily designed and managed activity involving a group of people with similar field of interest participating in sharing their knowledge, resources, ideas, and experiences for a defined objective. This valuable asset needs to be transmitted from one to another person for improvement. Knowledge can be shared informally or formally through various means like group discussion meetings, conferences or through Publications [1]. In health sector, professionals need to share knowledge with each other for better quality service.

To cope up with the dynamically changing environment, health professionals must maintain, update and enhance their knowledge, skills and attitude. An up-to-date information is particularly important in areas especially where the disease pattern and biological nature of communicable diseases are constantly changing. Additionally, up-to-date information plays a great role in the prevention of non-communicable diseases that were thought to be eradicated but are now reemerging. Besides an organizational need for health care knowledge, need of sharing of health knowledge extends to professional needs like, clinical decision making, patient and practitioner's education and experience enhancement. Health care organizations are characterized by rapid change, challenges and increased public expectations for greater quality. Broadly there is also a need for health care knowledge for designing the national health care policy, clinical protocol, guideline formulation and clinical research. The application of information technology, to push forward the stride to quality care is an essential requirement [1].

Timely, accessible and credible health information and sharing this information with coworkers plays vital role for improving public health outcomes, whether to help people take action during an outbreak or to prevent illness. Health professionals can share their knowledge through different ways either through written or audio visual materials. With the advent of technology social networks is currently applicable and widely used. The increasing access to the Internet and mobile communication combined with strategic uses of social media can provide public health information to professionals, more quickly and directly than at any time in history [2,3]

Access to information and communication technology is growing every year in all regions of the world. About one in four people globally are using the Internet to get access to the social media [4,5]. To take the advantage of public use of technology, the World Summit of the Information Society and United Nations in its Millennium Development Goal devised a plan to create connected village, health centers and hospitals with ICT by the year 2015. With the major thinking of as an access to wards technology improves, people will increasingly show need for using the Internet to find health information [6,7].

Online social network services are considered one of the most popular network services in recent years, with billions of users spends time every day on social network sites including facebook, Twitter, YouTube, LinkedIn etc. People majorly use online social network services to share information and knowledge with their friends in real life, build online connections with new friends, follow celebrities and other network friends to get more and fresher news, and release their own information to their followers [8].

Currently the number of social network users worldwide are increasing rapidly, social networks are beginning to be adopted by healthcare professionals as a means to manage and share institutional knowledge, disseminate peer to peer knowledge and to highlight individual physicians or institutions [9]. The most interesting aspects of social networks for professional purposes are their potentialities in terms of dissemination of knowledge and the ability to reach and multiply professional contacts exponentially. Social networks like Facebook, LinkedIn, and ResearchGate gave the chance to join professional groups and pages, to share papers and results, publicize events and discuss issues [10].

A study in the area of social networking [11], shows social media are acting as a great information equalizer, which radically transforming the way people communicate around the world. Not only this but also Social media has changed the culture of communication between the employee and employers from monologue to dialogue. Until recently the predominant communication model was unidirectional. The Health institutions, the ministry of health or a journalist were communicating the public without interacting with the society. Social media with its instant and borderless nature, abolished distant electronic communication as if near face-to-face communication. Anyone with ICT access can be a content creator and communicator.

1.2 Statement of the Problem

A worldwide platform for knowledge sharing in the public health sector is enabling better and faster access, sharing and use of existing knowledge and ideas through linking. The use of information communication technology in the Health and education enhances better evidence based policy making. Knowledge and experience sharing practices among health professionals play a crucial role in the developing the clinical and practical skill of the health professionals partnerships [2].

Though, the culture of knowledge sharing is poorly practiced in Health Institution. Moreover, it is highly manifested in third world countries which have scarce material and human resources [12]. Health professionals from resource-limited countries are known for their inadequate information sharing practices [13].

In third world countries, especially Africa, most countries have health sector reform policies on safe health-care practices that can enable them to protect the need and security of the patient but in most countries it is not practical. Regardless of the health policies, those African countries are known for their inappropriate funding and unavailability of critical information support systems that includes strategies, guidelines, tools and patient safety standards. As a report by WHO, the problems most African countries are facing is related with inadequate knowledge, experience and information sharing regarding patient safety and quality of care [14].

As part of African member state Ethiopia is also facing those problems. Studies [15,16], regarding knowledge sharing culture in Ethiopia indicate; there is an inadequate and unsatisfactory knowledge, information and experience sharing practice of health professionals. This poor culture resides to several reasons in which one falls on inadequate systems to share knowledge. In the Ethiopian Context Health professionals majorly acquire and disseminate knowledge by the use of and referring to written or audio visual materials.

Today's health care system in Ethiopia, is characterized by an increased patient to health professional ratio, disconnected reporting systems within a health center, inadequate systems to share information about errors with unclear lines of authority and direction of communication among physicians, nurses, and other care providers are also worthy to be mentioned [16].

As a result, an increase in the complications, mistreatment and miss-informed decision are deteriorating the quality of care. After all, human factors are the root causes of such reduction on quality of care like medical errors. These errors are highly manifested through missing-diagnosis, wrong treatment, increased multi drug resistance and unexpected deaths. These factors contribute to the most of problems associated in the health care provider setting. The problems mainly emanate from variations in training and experience, unfamiliar settings, communication errors; these problems take the large portion. Failure to acknowledge the prevalence and seriousness of medical error because of lack of reference is also another concern [17].

One study [18], shows that almost all medical errors have been treated traditionally through accusing, embarrassing and penalty. The errors committed by professionals were thought to be a mess rather than being used as an educational input for the other physician. Moreover, most medical errors are not reported and/or hidden. Consequently, health professionals are not learning from mistakes committed in the health institutions.

Even though the use of currently available social media applications may be seen as an efficient and effective method, most of the health professionals and physicians prefer online based professional specific communities as a less-risky and higher-quality source of medical knowledge than more broadly open social media applications such as Twitter, LinkedIn, or Facebook. Besides these most physicians uses an online physician-only communities for the purpose of exchanging medical information with other physicians. Most importantly their usage is majorly manifested by application specific use [19].

Health information found on general open social media and other online sources are majorly influenced by lack of quality, credibility and reliability. Authors of medical information found on publicly open social media sites are often unknown or are identified by limited information. In addition, the information which are forwarded on this type of social medias may be left unreferenced, incomplete, or informal [20].

The posting of unprofessional content can minimize the use of general social media by health care professionals, students, and affiliated medical institutions. While evidence-based medicine de-emphasizes these kind of unreliable reports. Physicians cannot post, share or blog any legal issues on social media which can provide an important input for the healthcare professionals. Besides

these, any user on the general open social media can upload content to a site. These can make social media users to be vulnerable to both hidden and overt conflicts of interest that they may be incapable of interpreting [20].

Taking the rapid improvement of access to ICT Infrastructure and usage throughout the country as advantage, sharing knowledge and experience via state of the art technology and with controlled environment could improve the health professional's knowledge sharing practice and reduce the gaps created by poor knowledge sharing culture. Therefore, designing and implementing of an efficient knowledge sharing platform is essential. A well-established and functioning knowledge sharing platform with in health institutions, professionals, and Government bodies with no geographical and time limitation can enhance the quality of health care provision at its best.

1.3 Objective of the project

1.3.1 General objective

The general objective of this project is to design a user friendly and functioning knowledge sharing platform that helps health professionals to share their knowledge and experiences with each other.

1.3.2 Specific objectives

- To assess the existing system of knowledge sharing
- To analyze and model the requirements
- To design and develop prototype of the proposed system
- To evaluate the developed prototype

1.4 Scope of the project

The scope of this project was conceptually limited to designing knowledge sharing platform for enabling the health professionals and health care institutes to share their information, knowledge and experiences with an ease of use.

The study subjects of project were geographically limited to Addis Ababa because of financial and time constraints.

The project was limited to licensed health professionals who are authenticated by the ministry of health and the Ethiopian food, medicine and health authority control agency. The project didn't include developing the licensing system.

In addition, knowledge sharing platform system design document was documented and prototype was developed.

1.5 Significance of the Project

The proposed project can give benefit for Health Professionals as an online community that provides easy access to colleagues, professional networking and potentially access to a number of new educational and professional development resources.

For Health Care Institutions; Hospitals, Pharmacies, medical colleges etc it is a mechanism for sharing costs for a common platform that supports individual organizational activities, member communications.

For Researchers; the system can be used as a tool for disseminating information that can be utilized as an input for various practices. The proposed system can also have a great significance on health Related Government institutions which are majorly engaged in forwarding policy guidelines to health care professionals and to help them on the process of delivering better public services and to create more transparent policy proceedings.

Most importantly Citizens of the country can be benefited via getting service from a professional who are well-informed and up dated about the current advancement in the medical world.

Chapter Two

Literature Review

2.1 General Literature

2.1.1 Types of Knowledge

In the field of knowledge management, knowledge is often divided into two types, explicit and tacit knowledge [21].

Explicit Knowledge

“Explicit knowledge is referred to as the knowledge which has been articulated, codified and stored in certain mediums. The most common form of explicit knowledge is manuals, documents, procedures and stories.” Because it is possible to articulate, codify and store, explicit knowledge is also easy to share and distribute [21].

Tacit Knowledge

Tacit knowledge, on the other hand, are “the aspects of knowledge that cannot be codified, but can only be transmitted via training or gained through personal experience. Tacit knowledge has been described as “know-how” (as opposed to “know-what” [facts] and “know-why” [science]). It involves learning and skill but not in a way that can be written down. The simplest example of the nature and value of tacit knowledge is that one does not know how to ride a bike or swim due to reading a textbook, but only through personal experimentation, by observing others, and/or being guided by an instructor [21].”

2.1.2 Knowledge Management

Knowledge Management is a process used by organizations and communities to improve how business is conducted by leveraging data and information that are gathered, organized, managed, and shared [22]. As defined by WHO [23], knowledge management is a set of principles, tools and practices that enable people to create knowledge and to share, translate and apply what they know to create value and improve effectiveness.

Knowledge management is about applying the collective knowledge of the entire workforce to achieve specific organizational goals. The intention of knowledge management is not necessary to manage all knowledge, but just the knowledge they need, where they need it, when they need it the right knowledge, in the right place, at the right time and for the right individuals [21].

The current concept of knowledge management emerged in the early 1990s with various field like business administration, public policy, information systems management, library and information sciences [24]. Knowledge management is viewed as a way of providing the right information and knowledge with the potential of achieving superior competitive advantage. The discipline of knowledge management has three major components [25]; people, process and technology

- **People:** are those who create, share, and use knowledge, and who collectively comprise the organizational culture that nurtures and stimulates knowledge sharing; [26]
- **Processes:** is the methods to acquire, create, organize, share and transfer knowledge; in order to improve knowledge sharing, organizations often need to make changes to the way their internal process are structured, and sometimes even the organizational structure itself [24].
- **Technology:** is the mechanisms that store and provide access to data, information, and knowledge created by people in various locations [21].

2.1.3 Knowledge management Systems

Knowledge Management Process

Knowledge management relies on four main kinds of knowledge management processes. As shown in Figure below, these include the processes through which knowledge is discovered or captured. It also includes the processes through which this knowledge is shared and applied [27].

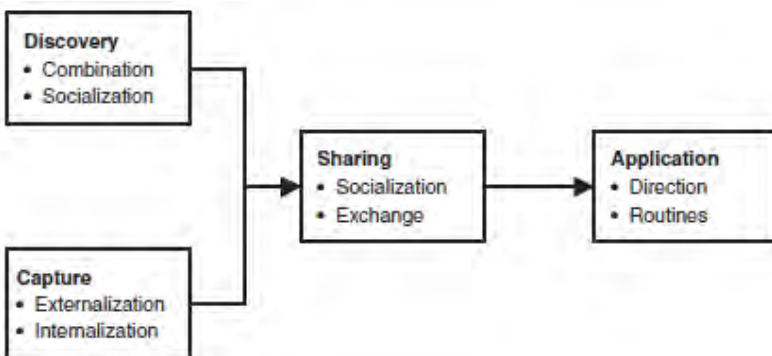


Figure 1. Becerra-Fernandez, et al. 2010, knowledge Management Process [27]

Knowledge management systems refers to any kind of IT system that stores and retrieves knowledge, improves collaboration, locates knowledge sources, mines repositories for hidden knowledge, captures and uses knowledge, or in some other way enhances the KM process [27].

Depending on the KM process most directly supported, KM systems can be classified into four kinds, Knowledge application systems, Knowledge capture systems Knowledge sharing systems and Knowledge discovery systems [27].

2.1.4 Knowledge management in healthcare

The primary and basic component of health care are information and knowledge. Being a practitioner involves using up to date medical knowledge available to practitioners when they need it and improving the knowledge is very crucial [28]. In health care, knowledge is the main resources of the organizations, as it enables the organization to achieve best medical results. The success of medical care depends on how effectively and wisely knowledge is being used to improve the health care process [29].

Health care organizations are highly tacit knowledge environment. Healthcare professionals' tacit knowledge is the most valuable source of their "experiential know-how" acquired in critical situations of patient management. The importance of tacit knowledge in health care industry is well recognized as it is certainly, about "what really works and how to make it work" rather than explicit knowledge of "how things should work" [30].

Knowledge management initiatives have emerged in the business sector, public sector, and more recently in health care. Healthcare is an information-rich industry; medical knowledge is expected to double during a professional life time [1]. And it is experiencing an exponential growth in the scientific understanding of diseases, treatment and care pathways. As a consequence, health care knowledge is in flux. New health care knowledge is being generated at rapid pace and its utilization can profoundly impact patient care and health outcomes [21].

Knowledge management in health care is aligning people, process and technologies to optimize information, collaboration, expertise, and experience in order to drive organizational performance and growth [26]. Within healthcare, knowledge management is about capturing the knowledge that is critical to the organization. Knowledge in health care includes both the experiences and understanding of practitioners (tacit knowledge) and the information available inside and outside

the organization such as, medical guidelines (explicit knowledge). Continuously improving the knowledge and making it accessible to practitioners when they need it, is critical for improving the quality of care delivered [24].

Important medical knowledge needs to be actively managed. Healthcare takes an active approach to medical knowledge management by executing a series of strategies to improve how knowledge is managed, including a branding strategy focused on mobilizing awareness and support of the knowledge management initiatives [20].

Thus, managing knowledge in this industry is an enormous task. KM holds great promise for improving health care delivery and, more critically, for dealing with information overload suffered by physicians. It can facilitate the interaction, collaboration and sharing of knowledge among physicians to improve patient care [1].

It is thus clear that healthcare can profit from many advantages that knowledge management provide, such as; improved patient care, safety and satisfaction, team-building across organizational boundaries and more informed decision making by learning from others and build on individual experiences etc. Therefore, the healthcare sector needs to embrace knowledge management strategies, processes, tools and techniques. This can support health care organizations to create greater value by delivering higher healthcare quality with optimal cost effectively [24].

2.1.5 Knowledge Sharing Systems

Support the process through which explicit or tacit knowledge is communicated to other individuals. These systems are also referred to as knowledge repositories.

Knowledge sharing systems are classified according to their attributes, and these systems could be relevant and applicable to the healthcare.

Incident report databases are used to disseminate information related to incidents. Incident reports typically describe the incident together with explanations of the incident, although they may not suggest any recommendations [22].

- **Alert systems** disseminate information about a negative experience that has occurred or is expected to occur [22].
- **Best practices databases** describe successful efforts, typically from the reengineering of business processes that could be applicable to organizational processes. Best practices

differ from lessons learned in that they capture only successful events, which may not be derived from experience [22].

- **Lessons-learned** capture and provide lessons that can benefit situations that closely resemble a previous experience in a similar situation [22].
- **Expertise-Locator Systems** are knowledge repositories that attempt to organize knowledge by identifying experts who possess specific knowledge. Expertise locator systems are also known as expert directories, expertise directories, skill directories, skills catalogues, white pages or yellow pages [22].

2.1.6 The Role of ICT in Sharing Knowledge

The rapid changes in the field of knowledge management is resulted from the dramatic progress in the field of information technology (IT). Information technology facilitates sharing as well as accelerated growth of knowledge, IT allows the movement of information at increasing speeds and efficiencies [22].

2.1.7 Functions of ICT Platforms in Knowledge Sharing

Two types of platforms can be defined in terms of their functions in knowledge sharing. The first type is called “explicit-process platform,” where sharers place the knowledge documents on the platform so that others can locate and download them in a very short period of time [31].

The platform can disseminate the shared knowledge to more employees in organizations who need the knowledge and amplify the benefit of knowledge sharing. The benefits of the explicit-process platforms also depend on the ways of transmitting documents and the spreading velocity of the knowledge. The second type of ICT platform in this study is called “tacit-process platform.” This platform is to facilitate the knowledge sharing in the tacit-process [31].

ICT allows the movement of information at increasing speeds and efficiencies, and thus facilitates sharing as well as accelerated growth of knowledge [22]. Furthermore, increasingly documents are being stored electronically. Thus knowledge objects are stored in databases that allow flexible and fast access and retrieval. Various ICT enabled functions support this access. In this case, the role of ICT is to provide access to sources of knowledge and, with the help of shared context, to increase the breadth of knowledge sharing between persons rather than storing knowledge itself [32]. ICT can also facilitate tacit knowledge sharing among organization members. ICT platform is capable

of linking, with the ideal being able to connect to anyone, anywhere [33]. ICT enable individuals to contact remotely located experts and seek detailed solutions to complicated problems. Overall, KM can be facilitated by the ICT infrastructure.

Several studies, suggest that a useful approach for tacit knowledge sharing is to develop various internet-based communities where employees and experts with specific knowledge or skills can gather together to share their knowledge through discussion. The community platform is expected to facilitate individuals in organizations raising and answering questions, or debating over more complicated issues. Through the tacit-process platform, the frequency of either individual or collective communication is increased, and the knowledge that is difficult to express in explicit forms may be better retrieved and extracted. Furthermore, the content of the communication about the non-codifiable knowledge can be electronically recorded and integrated by the platform, and then be stored in the organizational knowledge database for later sharing purposes [27,30,31,32].

2.1.8 Technologies supporting Knowledge sharing

Currently web 2.0 is showing a rapid growth for supporting knowledge sharing activities. It includes blog, wiki, podcast, social bookmark, tags, really simple syndication and social network software and has the features of social interaction and collaboration to facilitate knowledge sharing and exchange over internet platform [33]. It allows community to publish and share content by themselves and to edit content collaboratively and interactively. Through such social interaction and collective intelligence, knowledge is created and shared [34].

A blog is a user-friendly content management tool that allows users to publish their own content on the web. A blogger shares his knowledge with other bloggers who are in the community or the general public. Other bloggers write comments or share their feelings and opinions about the posted blog, or link it to other blogs. Through such blogs' linking and sharing, communities with the same interest and discussion topics are formed. Blogs overcome the geographical problems and help professionals to post and share their experience with peers connecting them in a virtual social environment [33].

A wiki is a collaborative editing tool that allows authors to co-edit a document It provides the functions/features of content management, versioning control, right management, etc. Authors

collaboratively edit a single document. They review, add comments and revise the content. Through such collective intelligence and collaboration, knowledge is created [33].

A social bookmark is a method for internet users to store, organize, search and manage webpage bookmarks. Social bookmark software allows users to input tags informally and personally to describe the webpages, and share the tagged bookmarks with others. By relating the tags of the bookmarked pages, bookmarks can be linked and clustered into different topics. It shortens searching time. Tags are the keywords or terms for describing digital media content such as social bookmarks, audio clips, video clips, blogs, wikis, websites, etc. Tags are built by a community and are used to describe its content. The tag cloud function collects and counts the number of tags used by a community, and groups and classifies them into different topics that enable a search engine to search more accurately [34].

RSS is a feed reader for content distribution, dissemination and acquisition over internet sources such as blogs, wikis, podcasts, social bookmarks or websites. When the source content is updated, the RSS feed reader automatically sends an alert signal and pushes the updated content to RSS subscribers so that RSS subscribers gather the most updated information in real time [34].

Social networking functions such as audio/video conferencing, IP telephony, desktop sharing, chat rooms, etc., for a community to communicate and interact in a virtual environment. It provides community building functions such as an electronic portfolio, resume builder, and social networking, so that people can be connected together to form online communities to exchange and share knowledge [35].

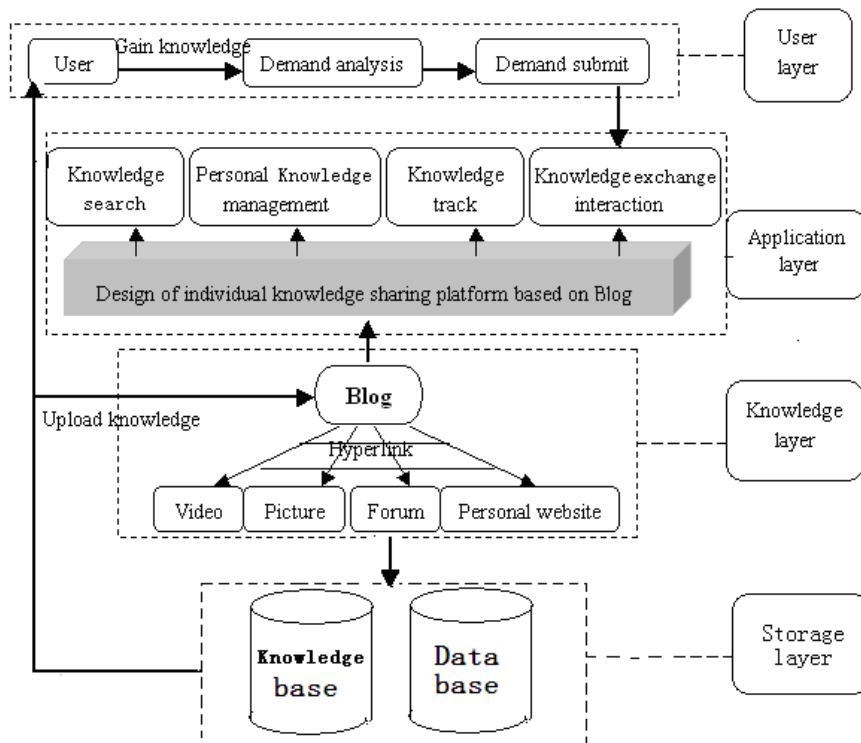


Figure 3. Zeng Qun, 2012, Nanchang University, Platform design of individual knowledge-sharing based on Blog [36]

The blog based platform proposed by the researcher could be an initial point to design an effective health care professional’s knowledge sharing system, but it needs additional functionalities to be customized as health care setting needs a controlled and secured environment and quality of the knowledge shared should be evaluated continually.

Another research paper analyzed traditional knowledge sharing processes in the context of Web 2.0 processes and presents an alignment in a common knowledge management model. on the use of Web 2.0 as a means for knowledge sharing for professional organizations, emergency response in particular. The researchers believe that an understanding and alignment of the Web 2.0 and the traditional knowledge management processes is essential to fully realize the potential of designing and developing knowledge sharing system and modeled the alignment as shown on figure below [37].

Table 1. Ansgar Scherp et al. ,2013 Traditional KM processes aligned with Web 2.0 processes and its applications [37]

Knowledge Management	Knowledge Creation	Knowledge Transfer	Knowledge Storage/ Retrieval	Knowledge Application
Web 2.0				
Knowledge Syndication		Blogs, Podcasts, News Feeds		
Collaborative Knowledge Creation	Wikis	Wikis	Wikis	
Collaborative Knowledge Exchange		Discussion Forums		Discussion Forums
Knowledge and Meta-Knowledge Sharing		Sharing and Tagging of Content	Sharing and Tagging of Content	
Social Networking (SN)	SN Applications	SN Application	SN Applications	
Knowledge Orchestration	Mashups	Mashups		Mashups

The common model developed by the researcher clearly shows where each Web 2.0 process can be applied, and thus the different characteristics of the Web 2.0 and organizational processes can be taken into account. Finally, the researchers examine the application of Web 2.0-based knowledge management systems for emergency response and present the initial work on developing a tool to support knowledge management in emergency response. This technique is embedded in the context of the WeKnowIt research project that aims at examining how Web 2.0 techniques such as user generated content, question and answering and social networking can be applied in the emergency response domain [37].

There are various types of knowledge sharing platforms in the world like “SharePractice”, “Doximity” which allows to connect with doctors from all kinds of fields. These platforms allow to share and access images of patient ailments within the network and pave the way in order to discuss them. The currently known systems like “Doctors Hangout”, “Nurse Zone”, “Doc 2 Doc”, etc are examples. Even though adopting the following systems to our country is possible it will be difficult to blend with the knowledge sharing culture of health professionals in Ethiopia [38].

Besides, the techniques and tools, considering human and other factors that affect knowledge sharing practices could be an important input in designing an effective knowledge sharing system. The following are researches made in different countries on factors affecting knowledge sharing culture or practice:

According to a descriptive survey conducted in Malaysia on knowledge sharing practice, which studied 400 researchers and officers from 6 research institutes within the National Institute of Health (NIH). Emphasis on creating a knowledge sharing environment in an organization requires change in corporate culture and knowledge sharing culture needs to be seen as a positive force towards creating an innovative organization. The study revealed lack of teamwork, lack of communication channels, lack of encouragement as a hindering factors to knowledge sharing. Besides lack of skill and knowledge, lack of trust to peers are identified to be a major factor for an impediment for practicing the culture of knowledge sharing. Besides the lack of trust towards management is another hindrance factor to be considered. On the other hand, respondents in the study did not perceived lack of policies and guidelines would hinder knowledge sharing practice [39].

On another study in the area of Knowledge management process to support evidence based practice in healthcare. They identified lack of collaborative environment and lack of common platform to share experience, or to gain new insights to be the major contributing factors for the poor culture of knowledge sharing. The study also stated, for the creation of new tacit knowledge the interaction of practitioners with each other is required. This poor culture of knowledge sharing is highly exhibited among nurses, assistant nurses and physicians. Especially within physicians, this poor culture of knowledge sharing is aggravated by lack of recognition, poor working condition and lack of support from managers [40].

An updated model to enhance knowledge sharing among stakeholders in Jordanian Hospitals Using Social Network. The researchers developed conceptual model to reduce the barriers faced by stakeholders in the Jordanian hospitals. The model also had a frame work that can enhance knowledge sharing behavior and motivate them to share their knowledge with their coworkers. The study included randomly selected doctors, nurses and pharmacists in government, military and private hospitals. In this study the researcher categorized factors hindering knowledge sharing in individual, organizational and technological settings. The individual barriers that hinder stakeholders from sharing their knowledge include: a lack of time, past mistakes, experiences, lack of interaction, education, ownership and cultural differences. On the other hand, organizational barriers that influences the knowledge sharing are: lack of leadership, shortage of formal and informal spaces to share, existing corporate culture, deficiency of company and physical work

environment. And the technological barriers that impact the knowledge sharing among stakeholders are: Unrealistic expectations of employees, lack of computability, mismatch, reluctance to use IT systems, lack of training and lack of communication [41].

On the other hand, knowledge sharing opportunity, communication channel, motivation, resource allocation and high educational level were found to be independent predictor of knowledge sharing. On a study, on knowledge sharing among professionals in Felege Hiwot Hospital, Bahirdar. The study concluded the management should give a great attention to knowledge sharing, necessary infrastructure and incentive mechanism to motivate staffs [42].

Individuals, Technological and organizational factors also play a great role in the knowledge sharing practice among healthcare professionals. According to a study conducted on public hospitals in Mekelle, Ethiopia. The above mentioned three factors were identified. Based on the findings of this study supportive managers, communications, professional's motivation and financial issues were found as significant predictors that affect healthcare professionals' knowledge sharing practice in the hospitals under study [43].

On another study conducted in Addis Ababa health bureau, on assessment of knowledge sharing practice of healthcare professionals in hospitals. The study showed that job satisfaction, very high level of motivation, extrinsic motivation, communication channel and presence of knowledge sharing opportunities were independent predictor that affect the culture of knowledge sharing [44].

The factors mentioned in the above studies share some common characteristics of barriers to effective knowledge sharing practice and should be reduced and appropriate measures should be taken to increase the usage of the designed system.

Chapter Three

Methodology

3.1 Study area and Period

This study was conducted in Addis Ababa from January 2016 to May 2016 GC.

3.1.1 Study design

Design science methodology was employed and an Object Oriented design approach was used to design as well as to develop the prototype of knowledge sharing platform. Object oriented design or object oriented programming is an advance in the software engineering field which has an iterative and incremental nature. The OO methodology was chosen in order to reduce software development time, and resources required to support existing programs and applications, increase program code reusability.

3.2 Source population

The project used health care professionals which are licensed by Food, Medicine and Healthcare Administration & Control Authority (FMHACA) in Ethiopia. Additionally, health information technology directorate, Maternal and Child Health directorate and Medical Services division of the Ethiopian ministry of health and information technology division of the Ethiopian Food, Medicine and Healthcare Administration and Control Authority were also included in the study. These aforementioned bodies are chosen, because they are the major stakeholders who are directly concerned with the sharing and preparing of different policies and practice guidelines related to the health sector. The health professionals in the study are both from the private and governmental health care settings. Those selected for the study health professionals that were working on different governmental health care organization were assigned by the Ethiopian ministry of health to the different health centers after graduation.

3.3 Sampling

Inclusion criteria

The study included licensed health professionals and who were working as a department head in health facilities in Addis Ababa. In addition, the study included the focal personals from the previously mentioned different ministerial organizations.

Table 2. Sample Selection of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

Key Informants	No. of Respondents	
FMoH health information technology directorate	1	
FMoH Medical Services Division	1	
FMoH Maternal and child Health directorate	1	
FMHACA information technology division	1	
Health Professionals	St. Paul	Kadisco
Senior specialists	0	1
General practitioners	2	2
Anesthetists	2	2
Nurses	1	1
Laboratory Technologists	1	1
Pharmacists	1	1
Radiologists	1	1
Total Respondents	17	

The study employed a type of purposive sampling procedure called maximum variation (heterogeneous) sampling to select individual participants for the study. These participants are chosen from the different departments in the hospitals that are included in the study. The maximum variation sampling procedure in these study applied can provide a wide range of perspectives about the custom of knowledge sharing custom in the chosen settings. This method also can enable the researcher to collect the various attributes, behaviors, experiences, incidents, qualities and situations about the subject of the study. Thus, this all together can help to obtain greater and varying insight in to a phenomenon by looking at it from different angels. In the study the samples for the health professionals were selected from one governmental hospital St' Paul millennium

medical college and one private hospital Kadisco general hospital based on the principal investigators choice because of the investigators previous work experience at those selected health care settings.

3.4 Methods of Data collection

Key Informant Interview

A face to face interview was conducted with key informants from the two organizations on how each one of them share, obtain and the way on how they acquire different information and knowledge. Each and every respondent's answers for the respective interviews were recorded. These recorded inputs were used as an input for the requirements of the system to be developed.

Observation and Document Analysis

Existing different written materials, were reviewed to obtain an understanding into the existing knowledge sharing and obtaining custom within the different health care organizations. Different practices and experience sharing mechanisms within the health professionals, with the Ethiopian ministry of health and FMHACA were assessed without violating the confidentiality and right of the health professionals.

Questionnaire

A Questionnaire based on Likert scale was adopted from Richard H. user interface evaluation report [45] and developed with 13 major criteria which were used to evaluate the user interfaces of knowledge sharing prototype of the system with four scales; Fully Agree, Agree, Disagree and Fully Disagree with grades of 4, 3, 2, 1 respectively.

3.5 Data processing and Analysis

Before any of the gathered data were used to the development of requirement the data were checked and summarized for its coherence to the policies and guidelines that are drafted by the Ethiopian ministry of health and FMHACA.

3.5.1 Design and Analysis Techniques

On analysis phase, information gathered through interview and observation; in which the current ways of knowledge sharing with the problem identified on the methods of sharing were briefly discussed. Knowledge areas that are currently a burning issues were selected depending on the interview from the ministry of health to be initial point of the knowledge sharing platform.

From the problems identified the functional requirement which mainly address what has to be performed by the system which include identifying the stake holders, basic businesses process as well as functionalities, and Non-functional requirements to define the overall qualities or attributes of the resulting system were identified.

As mentioned above, in order to design and develop the prototype of a web based health professional's knowledge sharing platform an object oriented design and development methodology was used. The designing included the use of the different unified modeling language.

Use case diagram was used to clearly understand and extract the key stakeholders of the system with their respective tasks. Each use cases where described using the standard use case narration format to show each process flow [46].

Class diagram was used to design the structure of a system by showing the system's classes, their attributes, and the relationships among objects [46].

Sequence diagram was used to model the logic of usage actions for each functionalities process flow [46].

System Architecture Diagram was used structure the solution that meets all the technical and operational requirements, while optimizing common quality attribute such as performance, security, and manageability, and overall success of the system [46].

User interface for each functionalities was designed to show how the users actually interact with the system [45].

3.5.2 *Analysis and Design tools*

After having all the required data and information, different designing and programming tools has been used.

Client Side: for designing user interface

- **HTML5:** was chosen for its nature of flexibility, supported on all browsers, user-friendly, consistent and efficiency and it is free.
- **CSS3:** was used to define styles the design, layout and variations in display for different devices and screen sizes. which Helps avoid duplication, Makes maintenance easier.
- **JavaScript:** was used for client side validation purpose
- **Ajax:** is a set of web development techniques using many web technologies on the client-side to create asynchronous Web applications.

Server Side:

- **PHP 5.5** is used as a connector to the database. This a layer plays the basic role in the functioning of the system, in which the different business rules work to provide the different services and functionalities that are provided by the system.

Back End: Data storage and manipulation

- **MySQL 5.6** database server was because it provides the ultimate in scalability, supporting the capacity to handle deeply embedded applications. And it is highly compatible with PHP.

Other Tools

- **Adobe Dreamweaver cc 2015** was used for the designing of the prototype.
- **Microsoft Visio 2013** to design the UML diagrams.
- **MSWord 2013:** -was used as documentation preparation tool and for other text operation.

3.6 Dissemination of Results

The study final report will be disseminated to Addis Ababa University, the Ethiopian ministry of health and the Ethiopian Food, Medicine and Healthcare Administration & Control Authority.

3.7 Ethical Consideration

Ethical clearance was provided from Addis Ababa University School of Public Health to conduct this study. In addition, official letter was provided to the different health institutions involved in the gathering of the requirements.

During the study precaution was made so as the proposed study findings should benefit and cause no harm to the participants. Privacy and confidentiality were maintained at all times, all findings portrayed in a confidential manner and no personal or identifiable information were recorded or printed in the study. No name was recorded during the interviewing process. Ethical issues may arise at any point during any study regardless of the rigorous planning. Therefore, it is important that possible ethical issues were identified, prevented, and reviewed as best as possible prior to, during and after the study.

Chapter Four

Discussion

Analysis and Design of the System

4.1 Analysis

4.1.1 Introduction

Requirement collection and analysis is part of the basic and essential step preceding the design of the system in the software development life cycle. A deep look into the previously existing system in use is essential for predicting and drafting the basic functionalities for the system that is to be built. The designing of the system is dependent on the types of requirements identified and addressed. They are crucial in identifying who needs which information in what way. This chapter focuses on identifying the requirements, modeling the business process and the design of the new system.

4.1.2 The Existing knowledge sharing mechanism

Medical sector is a knowledge and information intensive area which requires an updated information and knowledge regarding treatments, patient safety and service provision. The sharing of the medical information and knowledge involves different interested parties which participate in the provision of treatment, policy drafting and planning. Ensuring the Patients safety and security is the core ideology to which the concerned bodies work for. These scenario puts health care professionals to the focus. In order to meet the safety and security goals these health professionals has to be equipped by the required practical and theoretical knowledge and information.

With the expansion of medical education by the government universities and private sector medical institutions hundreds and thousands of health care professionals graduate every year. The graduated health care professionals are assigned by the ministry of health to the different health institutions and hospitals in the country. During their daily professional work, health care

professionals are required to perform different tasks which need practical and theoretical understanding.

In order to obtain these professional knowledge input, they may be required to consult different senior specialists or they will be obliged to refer to different written or audio visual materials. Besides performing these tasks, they are required to be accountable and responsible to different policy and guidelines that are forwarded by different government bodies. These connections require transactions and sharing of various information to and from the health care professionals and the concerned government bodies. Currently these knowledge and information happens in an unorganized manner, even though it happens, it is a manual paper and personal communication based mechanism.

According to the response given by the Ethiopian ministry of health division of Health information technology directorate; the ministry has almost no means of direct means of communication with the health care professionals, after they are graduated from the medical school. Not only these but also the ministry is currently facing serious issues in locating the health care professionals and in assessing their performance. Currently the ministry cannot evaluate or assess the performance of the health care professionals at their own work place unless their performance information is given to them by the hospital they work in.

Additionally, according to the response given by the medical service division of the ministry, currently they forward treatment guidelines and different practice information via paper printed book format. Whenever the professional want to use them he/she have to search through the pages which will consume time and lengthens the treatment time required. Most importantly the medical service division is currently facing problems in the distribution and providing clarification of some issues which need elaborated explanation regarding an informational and practice guideline support. Also providing an up-to-date information about the advancing medical technological information and treatment updates up to the rural areas without geographical and time limitations is also another problem.

Despite of the knowledge and information sharing problems the ministry is facing, the ministry tried to deploy an offline digital library so the physician can obtain information and different practical knowledge's without going far from the local health care settings. Although it was a good

move, but according to the response given by the ministry of health ICT directorate the deployed digital library is not in use in most of the areas where it was deployed. As a major constraint they mentioned the issue of accessibility, search incapability, poor design and content search incapability are causing and contributed to the poor usability of the digital library by the physicians. Currently the ministry is performing reevaluation and is constructing an additional functionality to the electronic based digital library.

From the information given by the Ethiopian ministry of health, they have a plan to create a connection between health professionals that creates an environment of sharing and exchange of ideas regarding communicable and non-communicable diseases. Not only have the aforementioned areas, in addition they are planning to include different practical experiences and detailed explanations regarding the treatment with the prevention of various epidemic and reportable diseases. Moreover, the department of emergency disease outbreak management which are involved in handling the emergency disease outbreak in the organizations need a fast and reliable information from the source of outbreak in time, that could enable them to take measures against the outbreak. Besides a formal training or workshop given during the occurrence of the outbreaks, there is no mechanism that the physicians who work at distant places have the access to know and be exposed to those areas of knowledge.

As per the response given by the different health care professionals working in different hospitals and clinical settings. These health care professionals raised three issues as a major hindrance factors they are facing towards improving their clinical and practical excellence that is influenced by the culture of the knowledge and information sharing in their institutions. These are, a few formal and organized means of obtaining or acquiring different practice and theoretical information and knowledge in their local setting with ease, few sources for the retrieval of an updated practical or theoretical medical information and knowledge. These is highly manifested by the unavailability of the proper content and search capability. Thirdly there are a few means of sharing their practical knowledge with either physicians or senior specialist without having interruptions in their work.

The Ethiopian Food, Medicine, Health Care Administration and Control Agency by the power given by the Ethiopian ministry of health can accept and provides decisions related to medical errors committed by the health care professionals. The agency also has a power to provide health

professional's professional license. But according to the response given by the FMHACA supervision officers the agency currently has the body which is delegated to accept medical errors from users and to act upon them, but they only accept these complaints on a face to face based information provision mechanism. As most of Ethiopian citizens and large number of health care settings are located on the country side the number of complaints that reach the agency are few which is highly influenced by the absence in a direct means of communication with the agency. Besides the aforementioned difficulty related to the notification mechanism, the platform to which the errors can be saved so they can be used as an educational and decision instruments for other health care professional practice and the agency is absent.

Licensing the health care professionals who work in the health care sector setting also involves locating those professionals. This is essential in the control and supervision of the quality of the services given, besides it is crucial in reaching everybody. But currently after providing the professional license the agency has no means of locating them which creates a barrier to forwarding the various policy and guidelines to each individual. Moreover, it makes a difficulty to know which health care professional provides a particular service where and at what setting.

Currently the focus of the government policies including the fifth health sector transformation plan (HSTP) gives priority on some selected knowledge areas. In addition, these concerned bodies have a major vision of empowering their working environment and their staffs with core understanding of the knowledge and information sharing culture, this can easily be seen in the HSTP which have moto of INFORMATION EVOLUTION as a theme. These different health care organizations on this study majorly focused their effort to some selected knowledge areas. with regard to this, The Web Based Health Professionals Knowledge Sharing Platform majorly emphasizes on a selected Knowledge Areas. These knowledge areas include health professionals best practice, major incidents report, expertise with health center locator, medical errors, maternal and child health.

4.2 Functional requirements

Functional requirements are requirements which are crucial in identifying which stakeholder in the system needs which types of information in what format. These requirements mainly address what has to be performed by the system. It involves identifying the basic businesses, performances/ functionalities that a system should provide to users and a tasks that must be done by the system. The different functional requirements that are required to be performed by the system to be built are listed below in the table. The lists are obtained by the careful face to face interview and observation of the different process and functionalities that are found in the existing system.

Table 3. List of functional requirements for knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

Req ID	Use case Id	Requirement
RQ-1	UC-1	The system shall enable the identification of different users and their roles
RQ-2	UC-2	The system shall support the creation of group of system users.
RQ-3	UC-8	The system should have a feature to manage group of system users.
RQ-4	UC-3	The system should locate experts based on the information from their license registration
RQ-5	UC-7	The system should locate health care settings
RQ-6	UC-4, UC-5	The system should allow notification and comment of medical errors
RQ-7	UC-4, UC-5	The system should enable storing of practical experience
RQ-8	UC-7	The system should enable retrieval of information regarding practical experience
RQ-9	UC-6	The system shall enable registration of health professionals including various work experience and educational achievements
RQ-10	UC-1, UC-6	The system shall enable the registered user to view and update their own personal information with restricted access privilege
RQ-11	UC-4	The system shall enable the registered user to view others profile information on selected basis.
RQ-12	UC-3	The system shall enable generation of activation code and send via registered phone number or E-mail taken during license registration.
RQ-13	UC-5, UC-6	The system shall enable sharing which involves comment, post etc. editing of various information.

4.3 Non Functional requirements

Non-functional requirements define the overall qualities or attributes of the resulting system. These nonfunctional requirements comprise of functional behavior of the system and additionally on the property or quality that the product must have, such as an appearance, or a speed or accuracy property. Thus focus majorly on the visible quality aspects of the system and the overall attributes of the system, including portability, availability, scalability, reliability, efficiency, testability, understandability, interface, security.

- **Usability:** The system should be easy is to use, the health professionals as well as other users of the systems should easily understand.
- **Reliability:** The system should be reliable to the extent to which it works as and when needed.
- **Correctness:** The system should do the proper things properly, for example calculating for Years of experience, Age or search for user query
- **Appearance:** The user interfaces should look pleasant or even attractive, often promoting confidence in its use.
- **Availability:** The system should be available 24/7 able to be used when needed.
- **Security:** The system should be accessible and usable only in authorized ways by authorized users.
- **Data Access:** limited to the system administrator
- **Physical Security:** The database computer should be kept in a safe house. Guarding the server with human or lock it in safe place.
- **Privacy:** The system should protect personal information and undesired access to personal space.
- **Scalability:** The system should able to be used by varying numbers of users, or with varying amounts of data.
- **Performance:** The system should respond to the request within a reasonable period of time. The system should support concurrent access, in which multiple users can access it simultaneously. The system should be capable of processing queries quickly. Beside the software, hardware is also a great factor in its efficiency.

4.4 Proposed System

Based on the above functional and nonfunctional requirement, the newly proposed system which allows the involvement of the various users and their interactions, majorly concerned on the sharing of selected areas of knowledge provides various functions and usability to the user. Each user whether the health institution or the health professional that is licensed by the FMHACA with its own specific professional and demographic data can be part of the system. This allows the user to share different knowledge's, information regarding the different professional or health institution specific news and update.

With a search capability that is enabled in the system the various knowledge areas that the system includes and the various users that are registered in the system can easily be identified and the various general and specific information regarding them can be retrieved.

Most of the medical errors which are committed in the health institutions besides being used as a Medco-Legal evidence they can also be used as a means of acquiring new knowledge. In order to use them as a source of knowledge the errors have to be shared and the necessary professional's comment should be given by the concerned medical professional. The new system enables these mechanisms by enabling the health professionals to view the various complaints that are submitted by the public and the health professional that are working in the various health centers.

The audiovisual and written materials to be shared on the system can convey various information with ease thus they can capture the attention of the most sensitive sense organs of human body (eye and ear). The new system is enabled with sharing of written, audio and video materials that have different formats. Besides, sharing after they are used for a specific time limit the data will be saved onto the database; thus they can be retrieved for later use. These materials, which are knowledge specific, are saved onto a specific category of knowledge area which makes it to be easily identified and found during searching in time of need. In addition to sharing of the various knowledge's the system enables commenting i.e. reflecting different views toward that specific post.

The system also enables the registered users to manage their own information based on their need to handle various organizational or person specific profiles changes in the institution.

Besides the profile management functionality, the different experts and health institutions which are registered in the system can easily be located from the system. In addition to the profile management each user's activity in the system is managed by the administrator of the system.

The system administrator in addition to managing the users can create a new page when a new knowledge area emerges as a major area to be focused on by the different users of the system. Prior to accessing the system, the FMHACA which has the power to validate and issue the physician and health institution license must authenticate and provide the access to use the system.

4.5 Object-oriented modeling

There are different modeling languages for modeling in object oriented design and analysis, though unified modeling language UML, which has become a standard modeling language for object-oriented modeling has been chosen for this system.

The system modeling for Knowledge sharing system has majorly the interaction, behavioral and structural part. The interaction part consists of use case and sequence diagram while the structural part has class diagram while the behavioral modeling part has use case narration modeling to represent the system [46].

4.5.1 Use case modeling

Use cases are and simple and good way of representing and explaining the system users/actors and the major use cases/scenarios. Another value of use cases is that they emphasize the user goals and perspective; this diagram can clearly show the users the system, what their typical scenarios of use are, and what their goals are. UML modeling provides interaction view; which is a more user-centric emphasis rather than focusing on the detailed functionalities of the system. The system has five major actors in which each of them have their respective identified tasks [46].

Table 4. List of Actors and their Description of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

Actors	Description
administrator	Is a person responsible in controlling knowledge sharing system and create or update status of system users
Health Professionals	A health professional is a person licensed with FMHACA and engaged in health related activities.
Health Institutions	Are different institutions that are licensed by FMHACA could be (Hospitals, clinics, health posts, etc.)
MOH	Is the system owner.
FMHACA	Are responsible to validate the license of health professionals or Institutes

The recognized use cases of the system are the following: -

Table 5. List for use cases of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

No	Use Case	Description
1	login	Used to allow Actors of the system to get in to page with appropriate privilege.
2	create Account	Used to let health professionals and health centers register themselves to the system.
3	Validate License	Used to check whether the registered health professionals or health institutions is registered and have license in FMHACA.
4	Add New Post	Allow Health professionals, Health centers to add an Information, knowledge, experience to knowledge base in order to share with each another.
5	Add comment	Allow Health professionals to share their insight or knowledge on the topics posted by other Health Professionals.
6	Manage Profile	Allows Health professionals or health institutions to update their status to allow others to search and view
7	Search	Search for user query from the knowledge base and return the related posts.
8	Manage User	Allow administrator to add new users of the system other than health professionals and institutions update or change status.
9	Create Page	Allow MOH administrator to create new and which are currently burning issues or Knowledge areas as a page

4.5.2 Use case Diagram

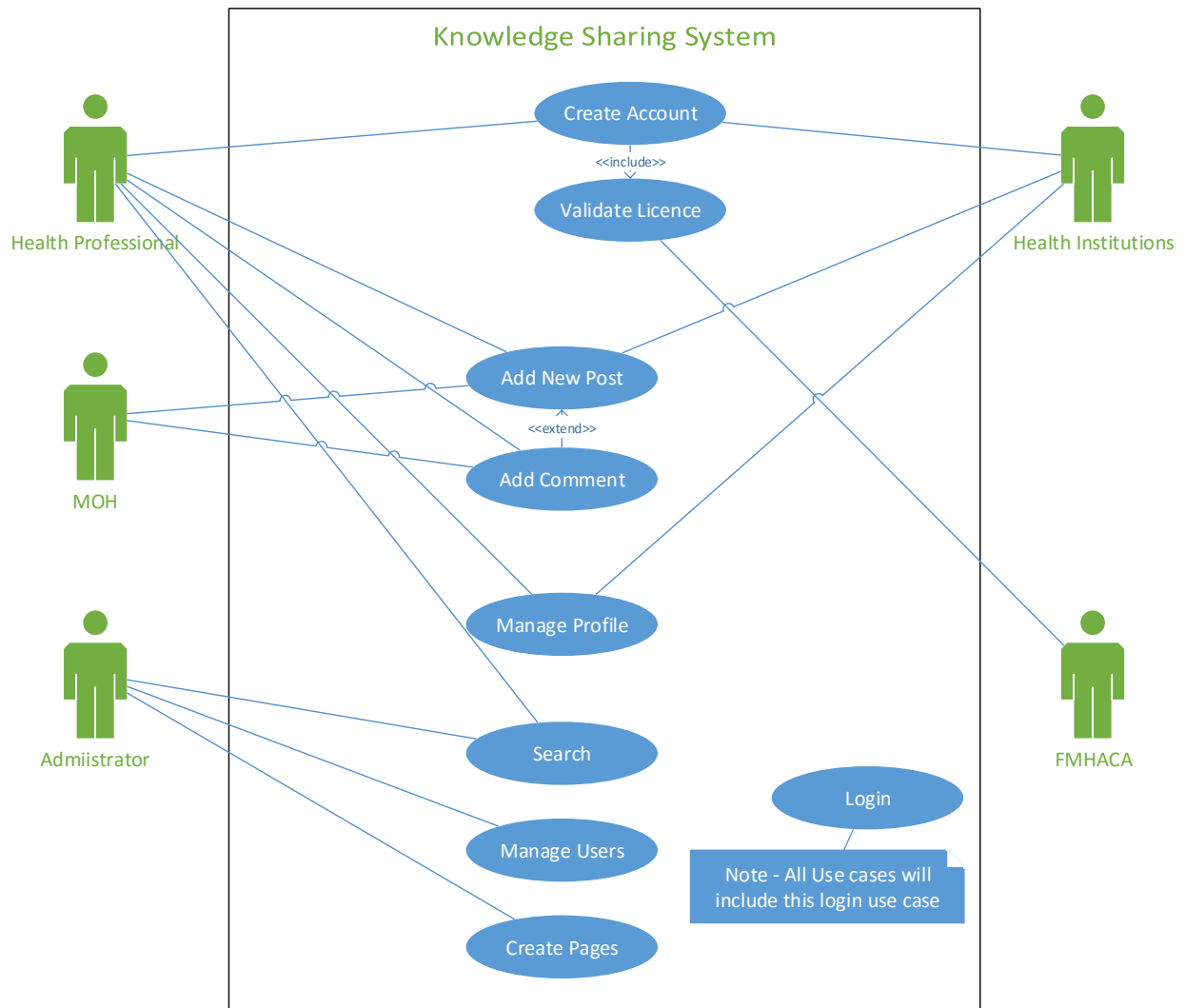


Figure 4. Use case Diagram of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

4.5.3 Use case Documentation

Use case narratives are the next and most important modeling standard, which describes each use case in detail as a path traversed through the system to meet a requirement. For the later technical steps, use case narrations play the role of where to start. So, the more precise and complete a use case narration is, the more accurate will be the later designs like class diagrams and sequence diagram [46].

Use case narration is a textual representation of the course of events encountered when an actor is interacting with the system. The description of each use case are listed below

Table 6. Description for use case login of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

Use Case ID	UC-1
Use Case Name	Login
Use case Description	Used to allow Actors of the system to get in to page with appropriate privilege.
Primary Actor(s)	Administrator, MOH, Health Professionals, Institutions, FMHACA
Pre-condition	The user must have username and password
Post-condition	User Logged in Successfully
Basic Scenario	<ol style="list-style-type: none"> 1. Users wants to login 2. The system responds by presenting the home page along with the login form. 3. The user enters username and password in the login form. 4. The system validates the user. 5. The system displays access page for the privileged user 6. The use case ends
Alternative Scenario	<p>Alternate A. Login attempt Failed</p> <p>A5. The system identifies the username or password is incorrect and informs the user to enter the account again.</p> <p>A6. The use case continuous at step 3 of the main flow of Events.</p> <p>A7. If the user tries three times continuously the system Locks the user</p>

Table 7. Description for use case create Account of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

Use Case ID	UC-2
Use Case Name	Create Account
Use case Description	Allow health professionals and health institutes register themselves to the system.
Primary Actor(s)	Health professionals, Health Institutions
Pre-condition	The User must be an active licensed health professional or registered Health institutes.
Post-condition	The account is created and ready for Activation
Basic Scenario	<ol style="list-style-type: none"> 1. Health professional or institution wants to sign up to use the system 2. The system responds by presenting the home page along with the registration form (health professionals or health institutions registration form). 3. The user enters appropriate information and submit. 4. The system checks the information provided. 5. The system registers the user to database 6. The system displays Success message and prompts the user to wait until the account is activated. 7. The system activates UC-3 validate the user license. 8. The use case ends
Alternative Scenario	<p>Alternate A. Information provided is incorrect</p> <p>A5. The system identifies the username or license already exists</p> <p>A6. The system prompts the user exist or license exist</p> <p>A7. The use case continuous at step 3 of the main flow of Events.</p>

Table 8. Description for use case Validate License of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

Use Case ID	UC-3
Use Case Name	Validate License
Use case Description	Used to check whether the registered health professionals or health institutions have license in FMHACA.
Primary Actor(s)	FMHACA
Pre-condition	<ol style="list-style-type: none"> 1. Health professionals or institutions must create an accounts using registration form 2. User must login to the system with FMHACA privilege
Post-condition	An activation code will be sent to user
Basic Scenario	<ol style="list-style-type: none"> 1. An administrator in FMHACA receives a notification when he logs in to the system. 2. The administrator view the account created 3. The administrator cross checks the license with the health professional information manually 4. The administrator changes the status to activate, enter the mobile number and email which is registered on the document, and submit. 5. The system generates activation code 6. The system sends Activation code to users email and mobile. 7. The use case ends
Alternative Scenario	<p>Alternate A. the License is incorrect</p> <p>A5. The use case ends</p>

Table 9. Description for use case add New Post of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

Use Case ID	UC-4
Use Case Name	Add New Post
Use case Description	Allow Health professionals, Health centers to add an Information, knowledge, experience to knowledge base.
Primary Actor(s)	Health Professionals, Health Institutions
Pre-condition	user must have an activated account and logged in to the system
Post-condition	A discussion topic or knowledge to be shared is posted on selected page
Basic Scenario	<ol style="list-style-type: none"> 1. Health professionals wants to ask question or share their knowledge 2. health professionals select appropriate page extends UC-5 3. Health professionals enter a topic or a question on text field or browse a document and attach to share and submit. 4. The system checks the field is not empty 5. The system saves the information to the knowledge base. 6. The system displays the posted content to the appropriate page along with who posted it with link to profile, what time. 7. The use case ends
Alternative Scenario	<p>Alternate A. text field is empty and no file is attached</p> <p>A5. The system prompts a message “field is empty”</p> <p>A6. The use case continues at step 3</p>

Table 10. Description for use case add Comment of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

Use Case ID	UC-5
Use Case Name	Add New Comment
Use case Description	Allow Health professionals to share their insight or knowledge on the topics posted by other Health Professionals.
Primary Actor(s)	Health Professionals
Pre-condition	1. User must login to the system. 2. User should view posted content (UC-4)
Post-condition	An Insight for a topic, an experience, or an answer is posted under (UC-4).
Basic Scenario	<ol style="list-style-type: none"> 1. Health professionals views a post. 2. Health professionals enter their insight into text field or browse a document and attach to share and submit. 3. The system checks the field is not empty 4. The system saves the information to the knowledge base. 5. The system displays the posted comment under the topic posted along with who commented it with link to profile, what time. 6. The use case ends
Alternative Scenario	<p>Alternate A. text field is empty and no file is attached</p> <p>A4. The system prompts a message “field is empty”</p> <p>A5. The use case continues at step 3</p>

Table 11. Description for use case Manage Profile of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

Use Case ID	UC-6
Use Case Name	Manage Profile
Use case Description	Allows Health professionals or health institutions to update their status to allow others to search and view
Primary Actor(s)	Health Professionals
Pre-condition	<ol style="list-style-type: none"> 1. User must login to the system with MOH privilege 2. User should have activated account (UC-2)
Post-condition	Updated Status others can view
Basic Scenario	<ol style="list-style-type: none"> 1. Health professionals wants to update their profile 2. Health professionals select manage profile page 3. The system displays manage profile page. 4. Health professionals can select profile picture, add educational background, Specialties, experiences etc 5. The system checks the information provided. 6. The system displays the updated profile. 7. The use case ends
Alternative Scenario	<p>Alternate A. information provided is not correct.</p> <p>A6. The system prompts to check the field with problem</p> <p>A7. The use case continues at step 4.</p>

Table 12. Description for use case search of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

Use Case ID	UC-7
Use Case Name	Search
Use case Description	Search for user query from the knowledge base and return the related posts.
Primary Actor(s)	Health Professionals
Pre-condition	User should log in (UC-1) view appropriate page (UC-5)
Post-condition	System displays the query related Posts
Basic Scenario	<ol style="list-style-type: none"> 1. Health professionals wants Information on a specific topic 2. Health professionals select appropriate page on knowledge area 3. The system displays search text field 4. Health professionals enters search query and submit 5. The system filters the query 6. The system searches the knowledge base 7. The system give weight to result. 8. The system displays all search result with more weighted on the top. 9. The use case ends
Alternative Scenario	<p>Alternate A. No result found</p> <p>A9. The system prompts No result found and suggest to enter different query.</p> <p>A7. The use case continues at step 3.</p>

Table 13. Description of use case manage users of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

Use Case ID	UC-8
Use Case Name	Manage Users
Use case Description	Allow administrator to add new users of the system other than health professionals and institutions update or change status.
Primary Actor(s)	MOH Administrator
Pre-condition	User should log in (UC-1) view appropriate page (UC-5)
Post-condition	User status Updated
Basic Scenario	<ol style="list-style-type: none"> 1. Administrator select manage user page. 2. The system displays input field to create new user at the top and the list of already existed user accounted along with their status. 3. If Administrator wants to create new account should enter in to appropriate fields and submit 4. The system checks the Information provided. 5. The system saves to the database. 6. The system displays the newly created account in the account list. 7. The use case ends
Alternative Scenario	<p>Alternate A. The username exists or information provided is incorrect</p> <p>A5. The system prompts the problem with the field.</p> <p>A6. The use case continues at step 3.</p> <p>Alternate B. The Administrator wants to update status of already existing user.</p> <p>B4. The administrator searches the wanted user</p> <p>B5. The system displays the user.</p> <p>B6. The Administrator change the status and submit</p> <p>B7. The system Updates the database.</p> <p>B8. The use case ends.</p>

Table 14. Description for use case create page of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

Use Case ID	UC-9
Use Case Name	Create Page
Use case Description	Allow Administrator to create new and which are currently burning issues or Knowledge areas as a page
Primary Actor(s)	Administrator
Pre-condition	Administrator must log in to the system.
Post-condition	A new knowledge area is created and ready for health professionals to post on.
Basic Scenario	<ol style="list-style-type: none"> 1. Administrator wants to add a new knowledge area as a page and open create page user interface. 2. The system responds by presenting the create page along with the registration form 3. The user enters page name and submit. 4. The system checks the information provided. 5. The system registers the page to database 6. The system displays Success message. 7. The use case ends
Alternative Scenario	<p>Alternate A. Information provided is incorrect</p> <p>A5. The system identifies the provided information is false</p> <p>A6. The system prompts the user to correct the field</p> <p>A7. The use case continuous at step 2 of the main flow of Events.</p>

4.5.4 Class diagram

Class diagram is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, and the relationships among objects [46].

Different classes of the knowledge sharing system were identified based on the requirement gathered from the interview, observation and document analysis made, some attributes of the class were added based on the researcher's experience. The classes were normalized to avoid redundancy and maintain the efficiency of the proposed system.

The following table shows the identified classes with their description and map of requirement id which leads the class to be selected.

Table 15. List of identified classes with requirement mapping, January to May 2016

Class Name	Description	Req ID
HealthProfessionals	A class that helps to hold information about the health professionals' objects.	RQ-2, RQ-3
HealthCenters	A class that helps to hold information about the health institutions objects.	RQ-4
Posts	A class that holds all the posts or knowledge shared by health professionals.	RQ-12
Comments	A class that holds all the comments by health professionals on specific knowledge shared.	RQ-5, 12
Pages	A class that holds all the knowledge areas created by administrator.	RQ-6
professions	A class that holds all the allowed professions of health professionals on the system.	RQ-8, 9, 10
Experiences	A class that holds experiences of health professionals.	RQ-8, 9, 10

EducationalStatus	A class that holds educational background of health professionals.	RQ-8, 9, 10
Institutions	A class that stores all health professionals working or previously worked institution.	RQ-8, 9, 10
JobTitles	A class that stores all health professionals Job titles.	RQ-8, 9, 10
Assigned Speciality	A class that stores a health professionals' specialties.	RQ-8, 9, 10
Specialities	A class that stores all health professionals' specialties objects.	RQ-8, 9, 10
HealthProfessionalsAddress	A class that stores a health professionals' Address.	RQ-3
HealthCentersAddress	A class that stores a health centers Address.	RQ-4
UserAccounts	A class that stores a login information for health professional, health centers, administrators, MOH, and FMHACA	RQ-1,2,11

The below diagram on fig. 5 shows all the class with their attributes including visibility and datatype of the attributes, methods with their return type. The diagram also shows the relationship between the class with their multiplicity, it basically shows the structure of the health professionals knowledge sharing system.

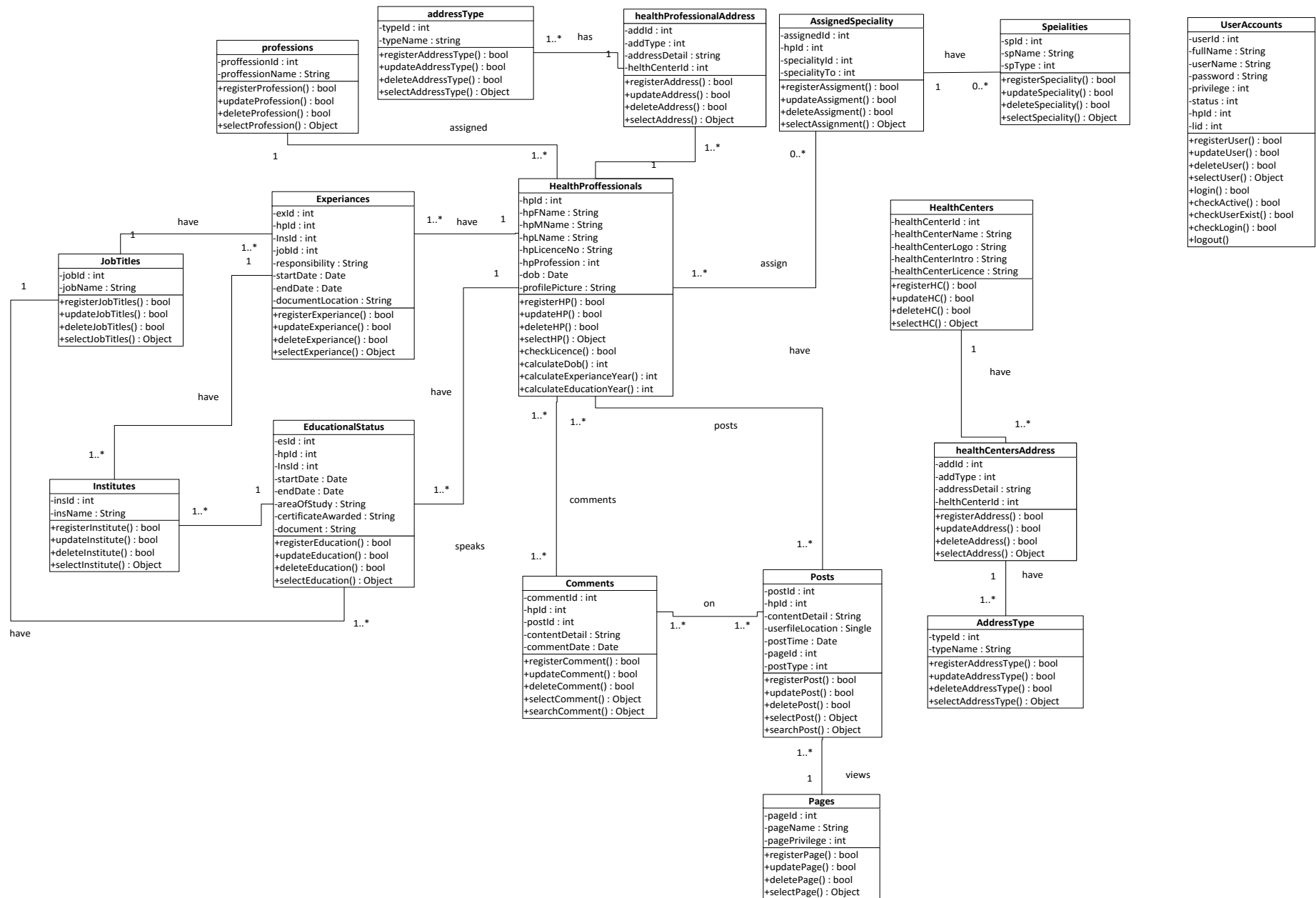


Figure 5. Class Diagram of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

4.5.5 Sequence Diagram

Sequence diagrams are used to model the logic of usage actions. A usage scenario is exactly what its name indicates – the description of a potential way that the system is used. The logic of a usage scenario may be part of a use case, perhaps an alternate course. It may also be one entire pass through a use case, such as the logic described by the basic course of action or a portion of the basic course of action plus one or more alternate scenarios. It may also be a pass through the logic contained in several use cases [46]. The following sequence diagrams shows the usage of each use cases on the health professionals knowledge sharing platform.

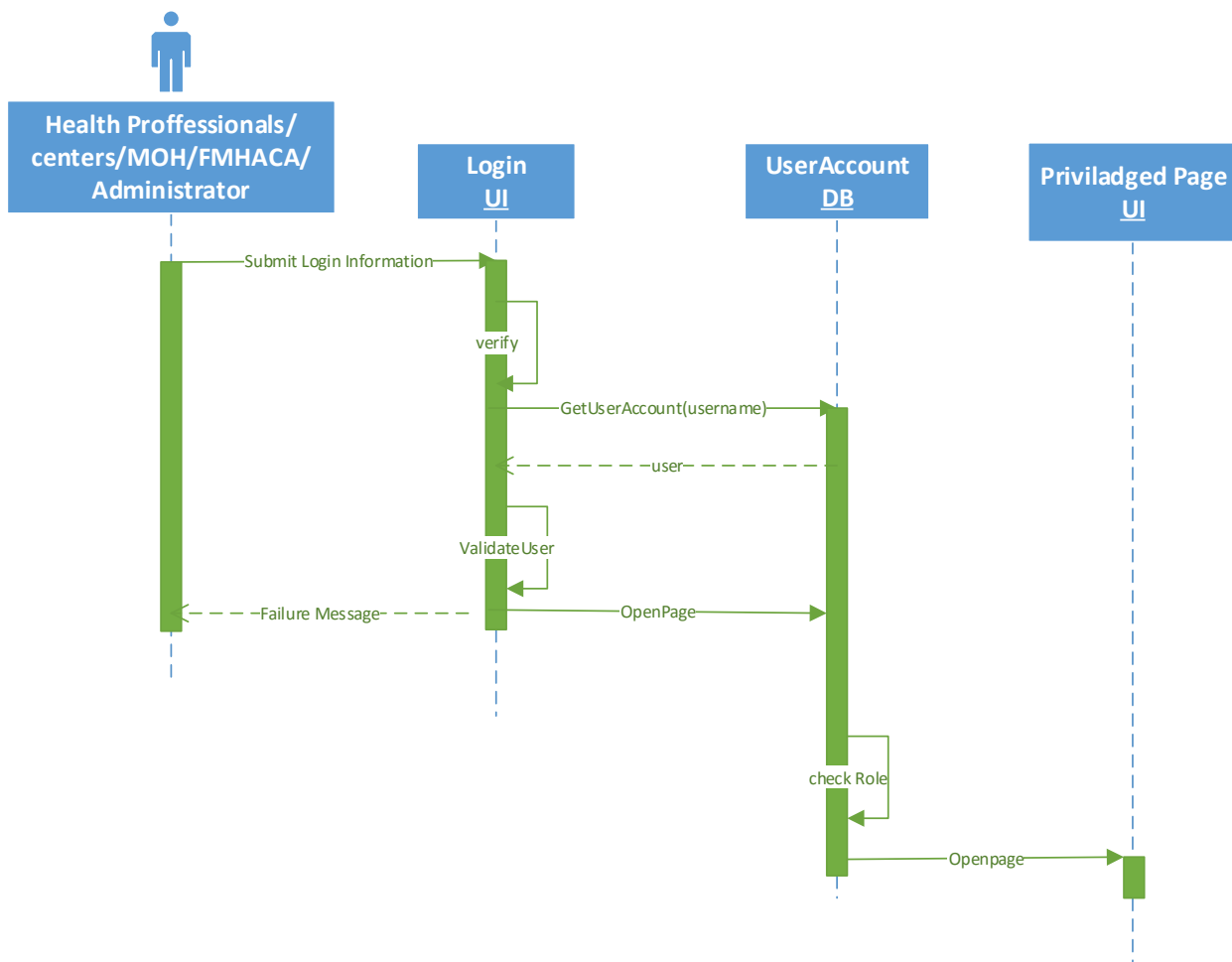


Figure 6. Login Sequence Diagram of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

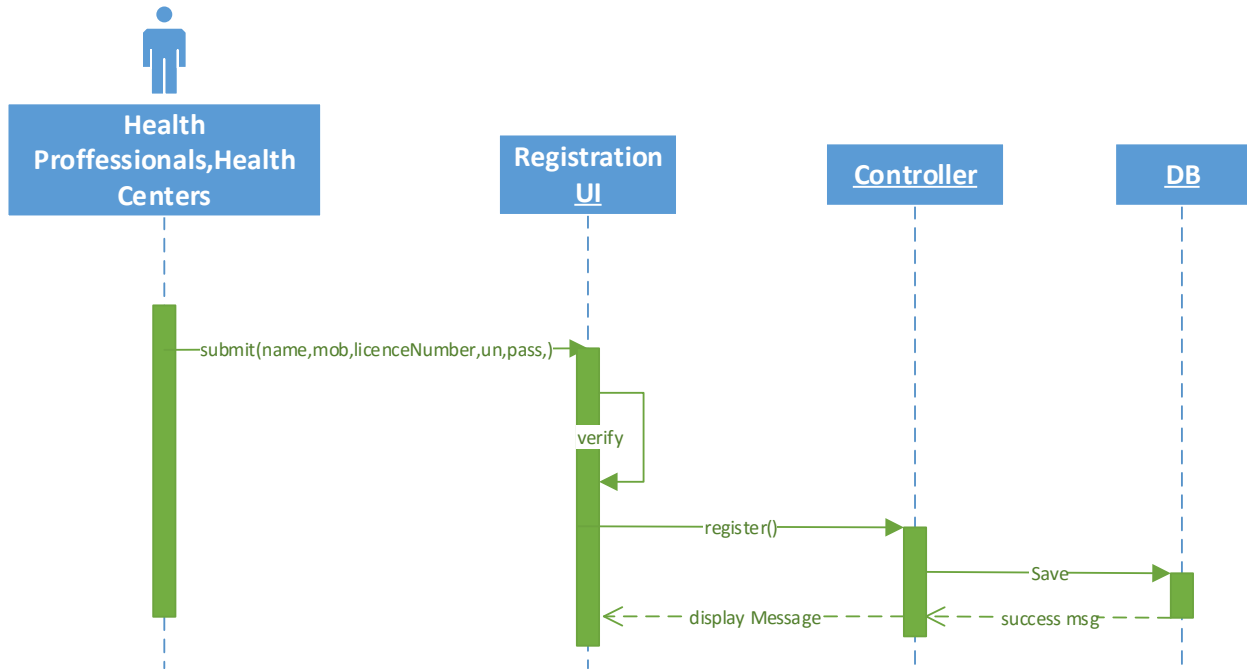


Figure 7. Registration Sequence Diagram of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

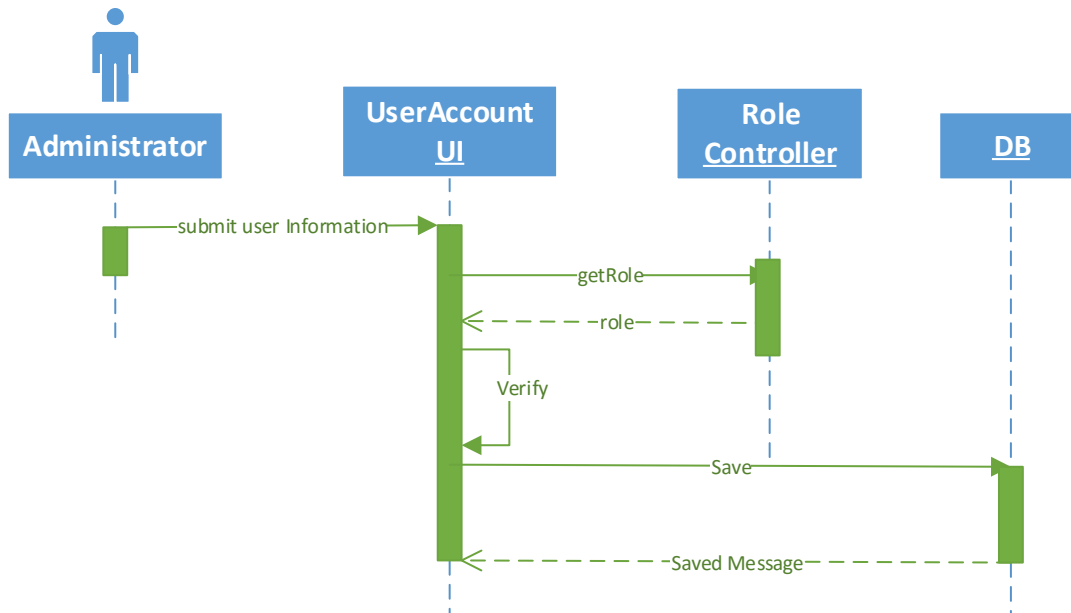


Figure 8. Manage User sequence diagram of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

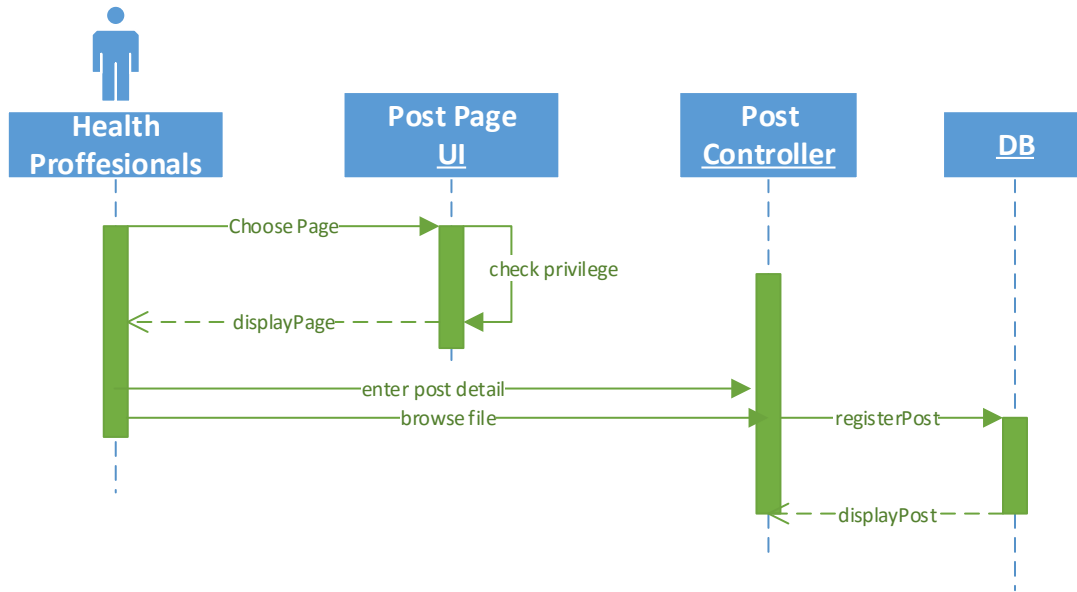


Figure 9. Post sequence diagram of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

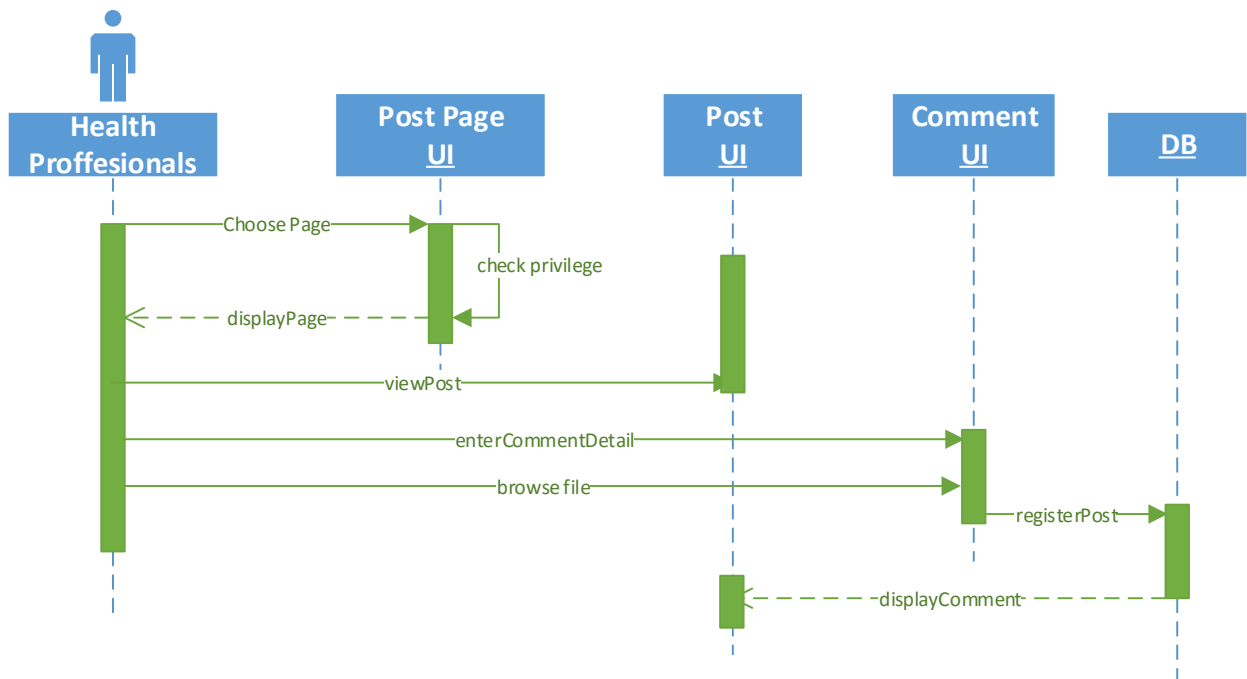


Figure 10. Comment sequence diagram of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

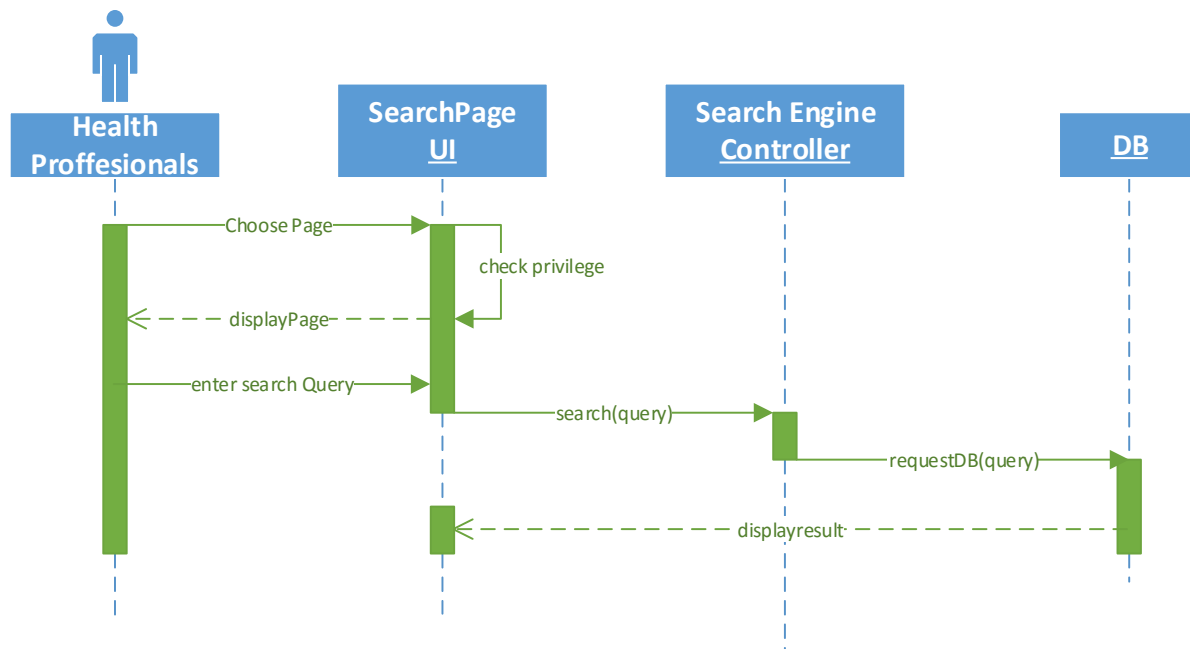


Figure 11. Search sequence diagram of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

4.5.6 Proposed software Architecture

Modern application design involves partitioning an application into multiple tiers; the user interface, a middle tier of business objects and the data access tier, it may be helpful to identify the types of processing that we can expect an application to do [46].

The user interface (presentation tier) interact with user, Interact with external application or services. The developed knowledge sharing system has multiple forms or user interfaces mentioned on section 4.5.5, which interacts with the users of the system. The user interfaces were designed using HTML, CSS and JavaScript.

On business processing (Business tier) calculation or other processing, enforcement of business rules, Business related data validations are processed. Here all the main functionalities of the knowledge sharing core functionalities which were mentioned on section 4.2 are processed. PHP was used to develop the business process and will be deployed on web server.

Data processing (Data services tier) data manipulation, enforcement of relational data rules is handled on this tier. MySQL was used as a database all the business transactions are saved into the database and can be accessed through this tier.



Figure 12. Knowledge sharing software architecture of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

4.5.7 User Interface

The design of this system involves different working models (prototype) of the interfaces that the system uses. The user interfaces are designed in way that is easier and can be adoptable with ease to the user. Additionally, starting from the selection of the color to the selection of the various length and width matrix of the web page is done in consultation with the different users of the system [45].

Home Page

Home Page includes a link to sign up and login, top 5 active medical experts, Search for health institutes or Experts, Latest news from health institutions. A link for the public to report medical errors

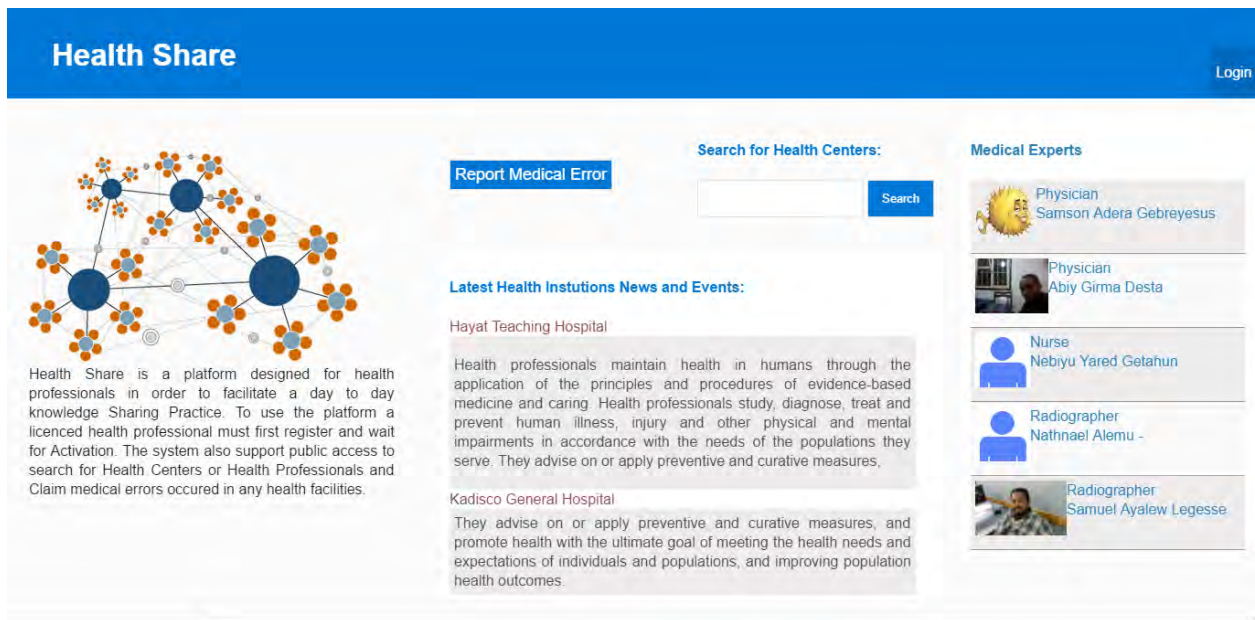


Figure 13. Home Page user Interface of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

Login and health Professional Registration Page

At the top right of the home page there is a link for login. When user click it slides and displays a username and password field with login button. Under the login registration screen is also available with radio button to choose from Health professionals or Health Institutions. Health professional's registration form have 8 required fields which are full name of health professional, profession, License number, Mobile Number or email address which will be used as a username and password.

Health Share

0911636290 [Login] Login

Register Health: Professional Institution

Search for Health Centers: Medical Experts

Report Medical Error

Search

First Name [] IS

Middle Name []

Last Name []

Select Profession []

Licence Number []

Mobile No/Email [] Please fill out this field.

New Password []

Re enter Password []

SignUp

Health Share is a platform designed for health professionals in order to facilitate a day to day knowledge Sharing Practice. To use the platform a licenced health professional must first register and wait for Activation. The system also support public access to search for Health Centers or Health Professionals and Claim medical errors occurred in any health facilities.

Latest Health Instutions News and Events:

Hayat Teaching Hospital

Health professionals maintain health in humans through the application of the principles and procedures of evidence-base medicine and caring. Health professionals study, diagnose, treat and prevent human illness, injury and other physical and ment impairments in accordance with the needs of the populations the serve. They advise on or apply preventive and curative measures,

Kadisco General Hospital

They advise on or apply preventive and curative measures, and promote health with the ultimate goal of meeting the health needs and expectations of individuals and populations, and improving population health outcomes.

Figure 14. Login Page User Interface of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

Health Professional Institution Page

Health Institution registration form have 5 required fields which are Name of health institution, License Number, Mobile Number or email address which will be used as a username and password.

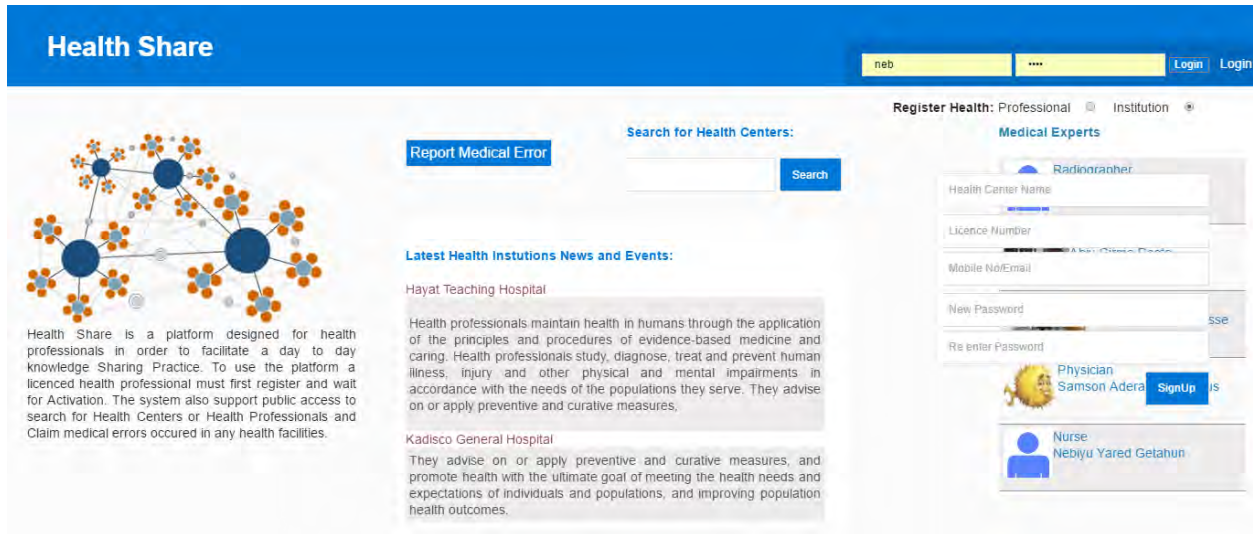


Figure 15. Health Institution Registration User Interface of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

Knowledge sharing Page

Each posts have list of available pages on the left, Search field next to the header, links to Logged in user posts, Profile, Change password. Each Pages have a post field, button to browse file to attach, submit to post the Information, the posted message will be displayed the field. Under each post there is a comment field and submit button each comment will be displayed under the comment field.

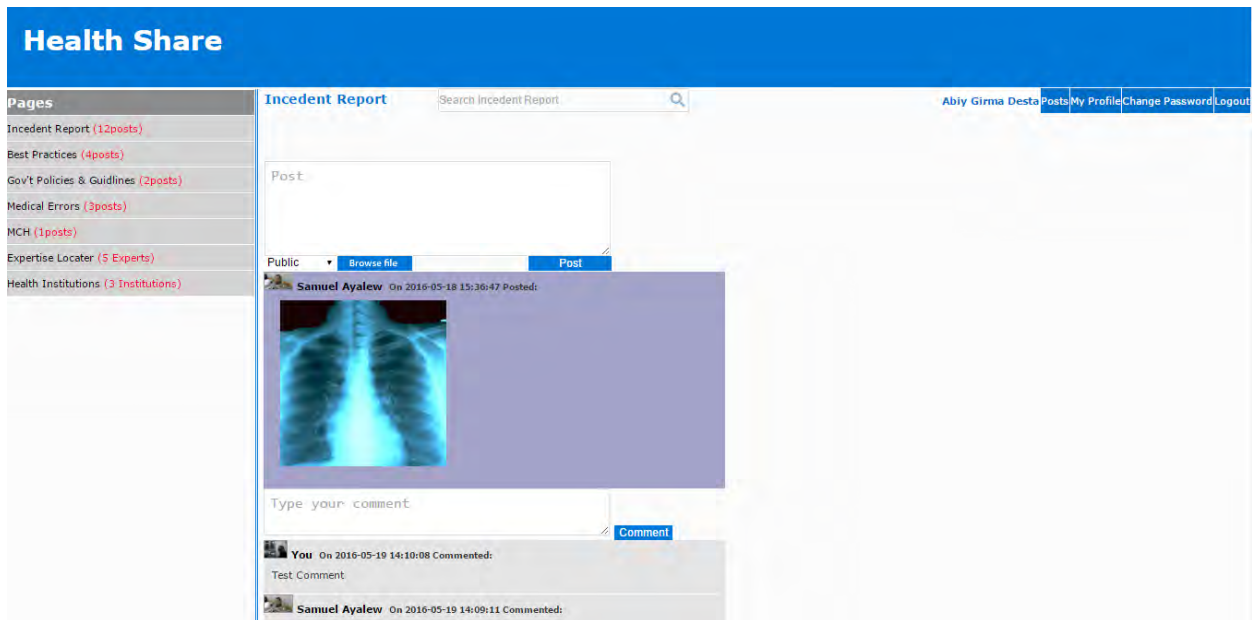


Figure 16. Post Pages User Interface of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

Expert Locator page

Expert Locator page differs from other post page in which it is used to search and locate health professionals so it has a criteria selection: By profession, by specialty and search field, when user selects criteria the results will be displayed under search results with links.

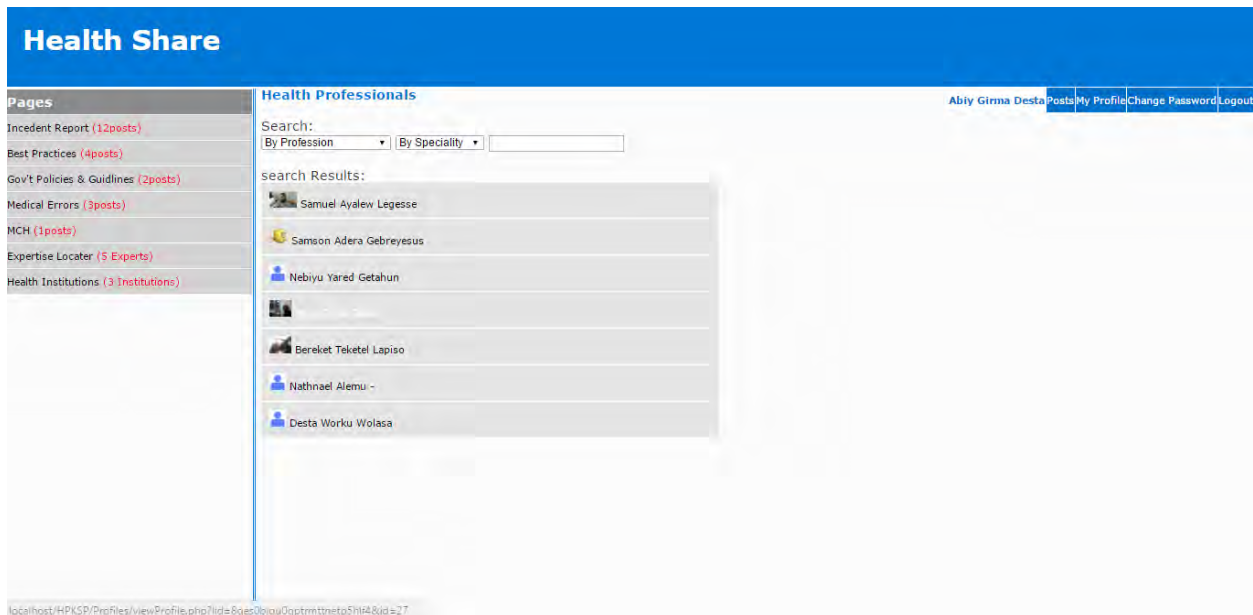


Figure 17. Expertise Locator User Interface of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

Health Institutions Search page

Health Institutions page is the same as expertise locator screen but it is used to search and locate health Institutions, it has a criteria selection: by specialty and search field, when user selects criteria the results will be displayed under search results with links.

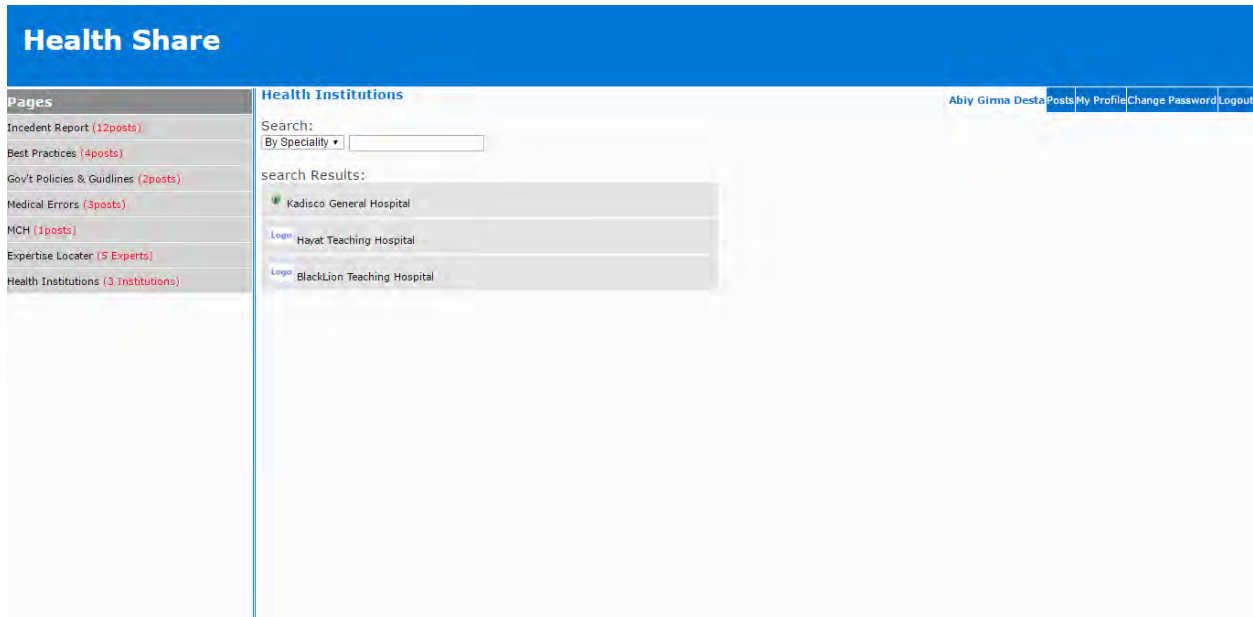


Figure 18. Search Health Centers User Interface of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016


Manage Profile Page

This screen allows a logged in health professional to update their profile. It has multiple fields and functions.

- It Allows to add profile picture
- Date of Birth- with date field
- Multiple Specialties- with select, it has the ability to add new specialty as well
- Educational Background- Institution can be selected or new institutions could be added if not available in the selection, Date fields, Area of study, Document attachment.
- Work Experience- It has Institution, Position, Responsibility fields. Accepts multiple values as well
- Language- New language could be added or Selected from the list and multiple values can be added.
- Address- Allows to select address type along with address value. New address type could also be added.

Health Share

Samuel Ayalew Logged In | Profile | Change Password | Logout

Click to Change Picture: 

Date Of Birth: 1984-05-09

Specialty:

Educational Background

Institution	Start Date	End Date	Area of Study	Degree	Document	
<input type="text"/>	<input type="text" value="mm/dd/yyyy"/>	<input type="text" value="mm/dd/yyyy"/>	<input type="text"/>	<input type="text" value="Certificate"/>	<input type="button" value="Choose File"/> <input type="text" value="No file chosen"/>	<input type="button" value="Add"/>
Oxford University	2000-05-03	2003-05-01	Internal Medicine	Bachelor's Degree	0	<input type="button" value="Remove"/>
Addis Ababa University	2016-02-01	2016-03-10	Public Health	Master's Degree		<input type="button" value="Remove"/>

Experience

Institute	Position	Responsibility	Start Date	End Date	Document	
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="mm/dd/yyyy"/>	<input type="text" value="mm/dd/yyyy"/>	<input type="button" value="Choose File"/> <input type="text" value="No file chosen"/>	<input type="button" value="Add"/>
Kadisco Hospital	General Practitioner	Something	2003-05-03	2010-05-17	0	<input type="button" value="Remove"/>
Black Lion Hospital	General Practitioner	gogo	2010-05-18	2016-03-09		<input type="button" value="Remove"/>

Language Spoken

Language	
<input type="text" value="Amharic"/>	<input type="button" value="Add"/>
English	<input type="button" value="Remove"/>
French	<input type="button" value="Remove"/>
Amharic	<input type="button" value="Remove"/>

Address

Address Type	Address	
<input type="text"/>	<input type="text"/>	<input type="button" value="Add"/>
Mobile	0911636290	<input type="button" value="Remove"/>
Office Tel	0114162148	<input type="button" value="Remove"/>
Email	Samuel@gmail.com	<input type="button" value="Remove"/>

Figure 19. Profile Update User Interface of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

Change password Page

Change Password allow users to update their password with the new one It have three fields to enter the old password, the new password and to confirm the new password and submit button.

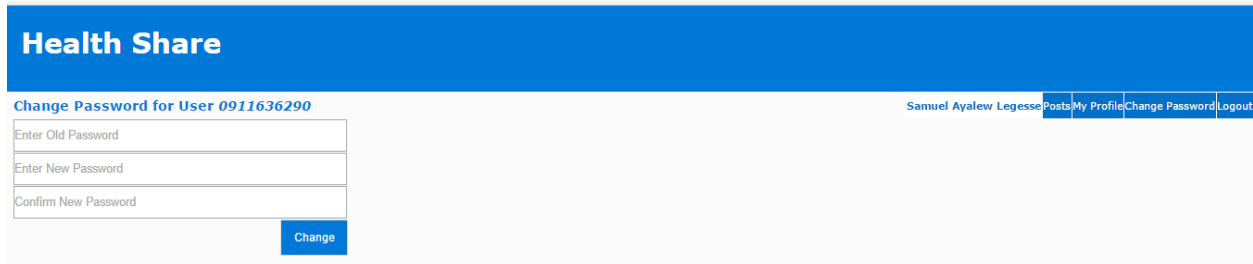
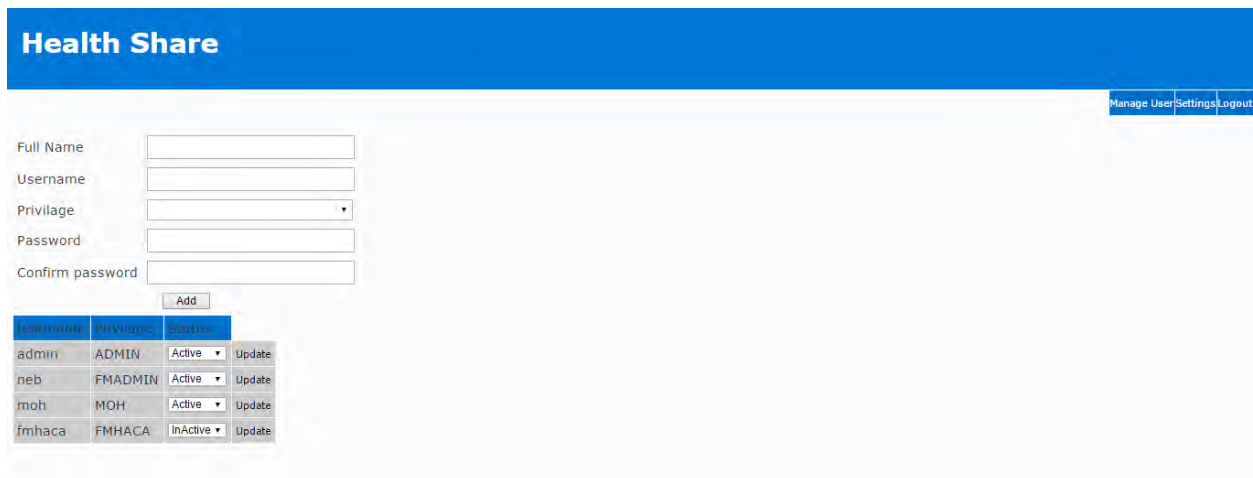


Figure 20. Change password User Interface of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

Manage Accounts Page

Administrator use this screen to create new user other than health professionals and health centers. It has five fields, Full Name, username, select privilege, password and confirm password. And a submit button. The created accounts will be listed below and their status could be updated.



Username	Privilage	Status	
admin	ADMIN	Active	Update
neb	FMADMIN	Active	Update
moh	MOH	Active	Update
fmhaca	FMHACA	InActive	Update

Figure 21. Manage Accounts User Interface of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

Create Page and Add Profession Page

Setting screen is used by administrator to create new pages or new professions. It has two fields and two submits one for each page and profession creation. The newly created page or profession will be listed below each fields as shown in the figure.

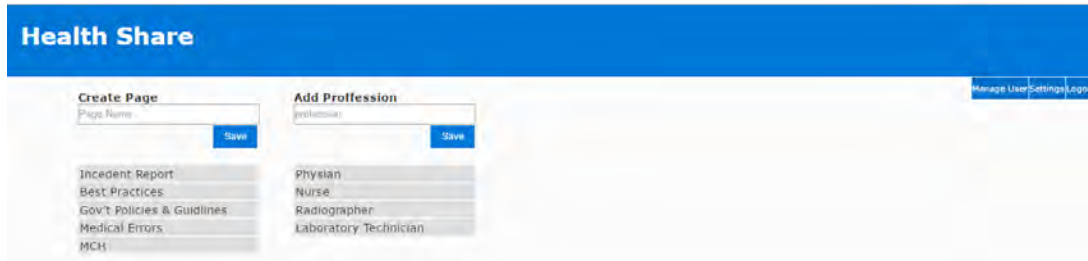


Figure 22. Setting screen User Interface of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

View Profile page

View Profile is used to view health professionals profile it contains all the attributes which a health professionals added on manage profile.

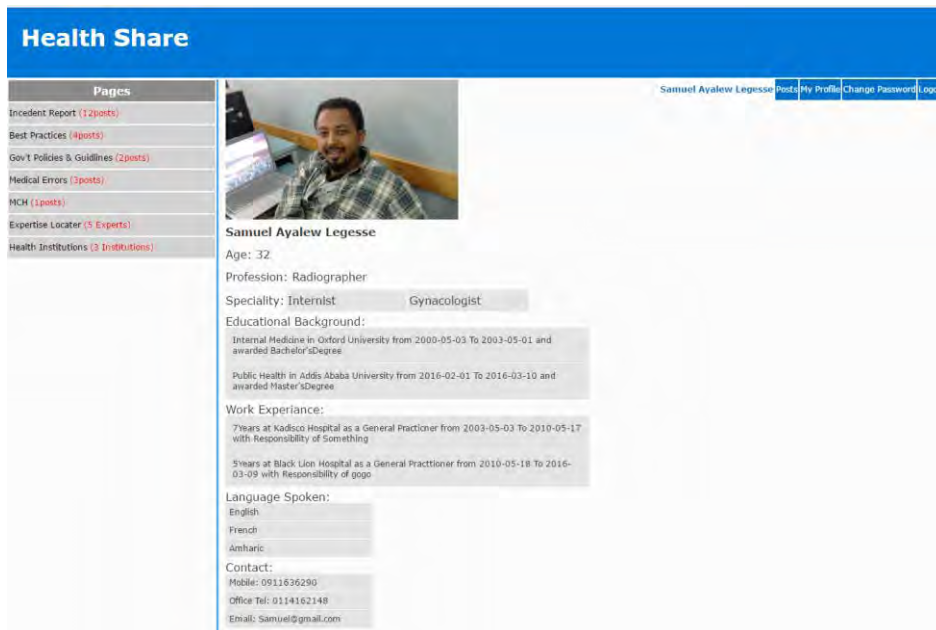


Figure 23. View Profile User Interface of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

View Health Institution Page

Any profile information or news added on health institutions could be viewed through this view health institution screen.



Figure 25. View Health Institution User Interface of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

View created health professionals accounts page

This Screen allows FMHACA Administrator to View newly created health professionals account and activate which are legitimate.

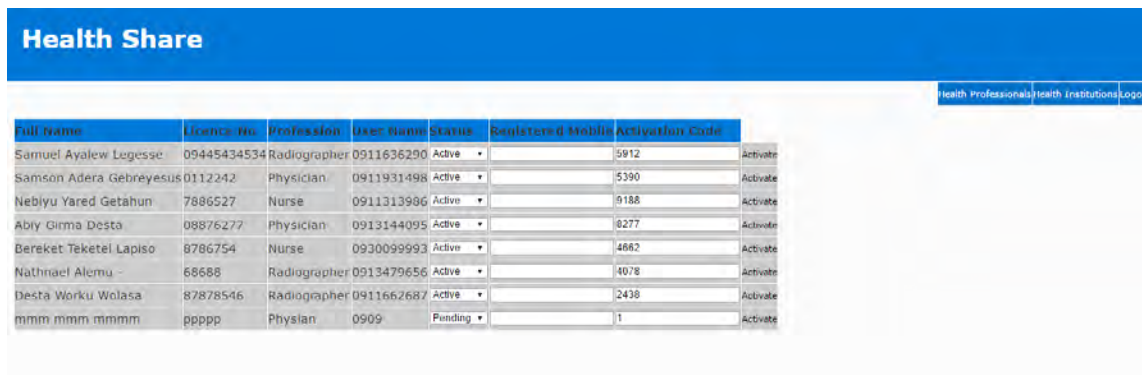
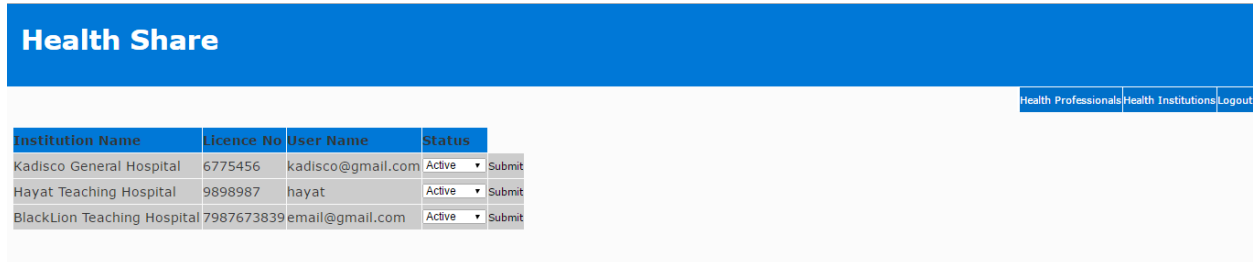


Figure 26. View created health professionals accounts User Interface of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

View created health institutions page

This Screen allows FMHACA Administrator to View newly created health institutions account and activate which are legitimate.



The screenshot shows a web application interface with a blue header bar containing the text "Health Share". In the top right corner, there are three navigation links: "Health Professionals", "Health Institutions", and "Logout". Below the header is a table with the following data:

Institution Name	Licence No	User Name	Status
Kadisco General Hospital	6775456	kadisco@gmail.com	Active <input type="button" value="Submit"/>
Hayat Teaching Hospital	9898987	hayat	Active <input type="button" value="Submit"/>
BlackLion Teaching Hospital	7987673839	email@gmail.com	Active <input type="button" value="Submit"/>

Figure 27. View created health institutions accounts User Interface of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

4.5.8 Usability Evaluation

Usability is the degree to which a software can be used by specified users to achieve quantified objectives with effectiveness, efficiency, and satisfaction in a quantified context of use [44].

The evaluation of the interface usability is an important aspects of software design and development. In order to measure the success of the design designers must evaluate the system. The evaluation of the interface for the knowledge sharing platform used a method of questionnaires with 13 major usability criteria to evaluate the interface for the prototype developed. The result is summarized on the following table.

Table 16. User interface evaluation of knowledge sharing platform for health care professionals in Ethiopia, January to May 2016

		Fully agree	Agree	Disagree	Fully Disagree
1	The system is easy to open and access	12			
2	The system is easy to navigate through desired pages	11	1		
3	The system is easy on using the different functionalities in the given privilege	12			
4	The system saves Entered data properly	12			
5	The system Views saved Data Accurately	12			
6	The system provides appropriate error and success messages	10	1	1	
7	The System response time while saving searching is acceptable	10	2		
8	The system search results are accurate.	8	3	1	
9	Overall, the interface is pleasing and easy to use	11	1		
10	All the fonts on the system are readable	8	2	2	
11	All the system input fields buttons locations are consistent	12			
12	The system validates wrong input of data types all the time	7	4	1	
13	After logging out the system do not allow to access unprivileged pages	12			
Average result		10.54	1.07	0.39	
Result Percentage		87.83%	8.92%	3.25%	

As shown on the table above a questioner were given for total of 12 respondents. The value of the responses was taken based on the Likert scale. According to the result of user interface evaluation most of the respondents that is 87.83% Strongly agreed that the system prototype has an easy to use, attractive and clear informational and functional explanation regarding the major functionalities of the system.

Chapter Five

Conclusion and Recommendation

5.1 Summery and Conclusion

In comparisons to the previously existing custom and tradition of knowledge sharing which majorly involved the use of written, materials like books audio visual materials and various tools which don't have a fast and easy route of sharing and transferring knowledge to the health care professionals. The newly designed web based information system can enable sharing of different priceless information and knowledge within the health sector.

The requirements that are developed to the system are gathered from the various health professionals who have been directly influenced by the limited and constrained culture of knowledge sharing. the development of the system requirement was done by adhering to the policies that are devised by the ministry of health and FMAHCA. Besides the requirement, the developed requirements were given to be evaluated for their comprehensiveness by the participants of the study and they confirmed that the issues they raised were addressed in the requirement.

Based on the requirements developed the system modeling was done by the use of unified modeling language (UML). From the different types of the UML designing tools majorly use cases which describe the major scenarios and actors of the system; class diagram which shows the database structure and tables and sequence diagram which shows how the time ad object interact were designed.

The newly designed system have the different functionalities which will provide a platform for the sharing of the various knowledge domains that are found in the medical world.

The web based system can ease the trial towards disseminating and sharing medical knowledge. So that health care professional working at different locations irrespective of time and healthcare setting could have the same and comparable understanding towards the current treatment, policies, guide lines, procedural documents and various administrative directives.

The different healthcare professionals who participated during the gathering of the requirement agreed to the issues that are raised in the study. Moreover, they suggested that the newly designed web based system in the study can play an important role in the contributions to solving the current problems they are facing in their daily work environment regarding knowledge sharing within themselves and with other bodies.

5.2 Recommendation

The project attempted to study the knowledge sharing mechanism and design a new platform that will benefit the stake holders of the system. From the finding in the study the following recommendations were drawn. And these recommendations should be taken into consideration

Health professionals – health professionals have to make themselves familiar to the current trend of technological and advanced means of knowledge sharing.

Health institutions health institutions should provide resources like computer hardware, internet and motivate health professionals to be engaged in knowledge sharing. The health institutions should also prepare a dedicated time that can enable the health professionals to share their knowledge. Besides, a conducive and interactive environment which can motivate their interaction in the healthcare setting have to created.

FMoH - should consider actual implementation of the project, provide the necessary resources needed to deploy the system.

FMHACA should cooperate to integrate the developed system with licensing system to validate users of the system.

Other researchers/students

Should work on the additional features that need to be incorporated in a knowledge sharing system

Should work to identify additional gaps and factors that are prevalent in the area of healthcare knowledge sharing.

References

1. Nor'ashinkin A, Alexei T, Dick W, Inga H. Determining the KMS success factor for Healthcare. Newzealand, Palterton North: Massey University; 2009.
2. Rimal RN, Lapinski MK. Why health communication is important in public health. Bull World Health Organ. 2009.
3. Wall I, Robinson L. Left in the dark: the unmet need for information in humanitarian responses. In BBC World Service Trust; 2008; 2008; London.
4. Measuring the internet society: the ICT Development Index. In International Telecommunications Union; 2009; Geneva.
5. Internet world statistics. [Online].; 2009 [cited 2015 November 28. Available from: www.internetworldstats.com.
6. Fox S JS. The social life of health information.; article 2009.
7. van Uden-Kraan CF, Drossaert CH, Taal E, Smit WM, Moens HJ, Siesling S. Health-related Internet use by patients with somatic diseases: frequency of use and characteristics of users. Inform Health Soc Care; 2009.
8. Zhao Du1, Xiaolong Fu, Can Zhao, Ting Liu, and Qifeng Liu. University Campus Social Network System for Knowledge Sharing. ComSIS. 2012 December; 9(4).
9. primarypsychiatry.com. Social Networking: Now Professionally Ready. [Online].; 2012 [cited 2015 November 29. Available from: www.primarypsychiatry.com.
10. Ferri F., Grifoni P., Guzzo T. New forms of social and professional digital relationships: the case of Facebook. Social Network Analysis and Mining Journal. 2012; 2.
11. comScore. Social networking increases worldwide as sites increase their focus on cultural relevance. [Online].; 2009 [cited 2015 December 5. Available from: www.comscore.com/Press_Events/Press_Releases/2008/08/Social_Networking_World_Wide.
12. Report of Human Resource Department. Addis Abab: City Government of Addis Ababa Health Bureau, Human Resource; 2011.
13. Adem A. Knowledge Sharing Among Health Professionals the Case of Felege Hiwot Referral Hospital Bahirdar. 2010.
14. WHO. Health Systems: Improving Performance. World Health Report. Geneva: World Health Organization; 2000.
15. Andualem M, Kebede G, Kumie A. Information needs and seeking behaviour among health professionals working at public hospital and health centres in Bahir Dar, Ethiopia. 2013.
16. Lemma L. Assessment of access to health information resources among HPs working in HIV/AIDS and family health units of public health centers in Addis Ababa. 2009.
17. WHO. Learning from Error. World Health Organization, Patient Safety Workshop. 2008.
18. Tsion Assefa, Mirkuzie Woldie, Shimeles Ololo, Kifle Woldemichael. Patient safety practices and medical errors: Perception of health care providers at Jimma University Specialized Hospital. Open Journal of Preventive Medicine. 2012.

19. Brian S McGowan, Molly Wasko , Bryan Steven Vartabedian, Robert S Miller ,Desirae D Freiherr Maziar Abdolrasulnia. Understanding the Factors That Influence the Adoption and Meaningful Use of Social Media by Physicians to Share Medical Information. Vol 14, No 5 (2012)
20. Marjolijn L. Antheunis,Kiek Tates, Theodoor E. Nieboer Patients' and health professionals' use of social media in health care: Motives, barriers and expectations; 2013
21. C. Lee Ventola Social Media and Health Care Professionals: Benefits, Risks, and Best Practices Vol. 39 No. 7; July 2014
22. Caroline De Brun. ABC of Knowledge Management, NHS National Library for Health. 2005.
23. Knowledge Management for public Health. Seattle, Washington: Association of State and Territorial health office; 2005.
24. L. A. Knowledge Management as a tool in Healthcare System Optimization-The case of Narsjukvaran Osterlen. Msc Thesis. Denmark: Nordic School of Public Health; 2006.
25. Bolarinwa OA, Salaudeen AG, Akande TM. Overview of Knowledge Management Application in Healthcare Delivery of Developing Country. Academic Research.; 2013.
26. Managing knowledge to improve Reproductive Program. Baltimore, Maryland: John Hopkins Bloomberg School of public Health, Center for communication Program; 2004.
27. Becerra-Fernandez I, Sabherwal. Knowledge management: systems and processes New York: M.E. Sharpe, Inc., 2010.
28. Hanif R, Anne P. Knowledge Management Process to support Evidence Based Practice in Healthcare. A Swedish case study. Sweden: 2014.
29. Nadeem M, Aquil B, Zain A, Kasinf R. Data and Knowledge Management in Designing Healthcare Information System. International Journal of Computer Application. 2012.
30. Sirous P, Jason W, Hellen P. Potential of social media for Tacit Knowledge Sharing Amongst Physicians. In 23rd Australian conference on Information System; 2012; Australia.
31. Alavi L. Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues. 2001.
32. P.G.W Keen. Shaping the Future. Cambridge, Massachusetts: Harvard Business School Press; 1991.
33. MAINA E. Knowledge Management Strategy Development, Implementation and Impact at The United Nations Environment Programme.; 2015.
34. Lau A TE. Application of Web 2.0 technology for clinical training.; 2009.
35. Miltiadis D. Lytras P. Social Web Evolution: Integrating Semantic Applications and Web 2.0 Technologies. New York: 2009.
36. Zeng Qun ZX. The Design of Individual Knowledge Sharing Platform Based on Blog for Online Information Literacy Education. China: Nanchang University, College of Information Engineering; 2012.
37. Ansgar Scherp FSNI. Web 2.0 and Traditional Knowledge Management Processes.; 2010.
38. Upcity. [Online].; 2015 [cited 2015 December 5. Available from: www.upcity.com/blog/top-20-social-networks-for-doctors/.
39. Ming-Yu Cheng, Jessica Sze-Yin Ho, Pei Mey Lau. Knowledge Sharing in Academic Institutions: a Study of Multimedia University Malaysia.; 2008.

40. Prantik Bordoloi NI. Knowledge Management Practices and Healthcare Delivery: A Contingency Framework. Bangkok, Thailand: Asian Institute of Technology, School of Management; 2012.
41. Zaid T. Alhalhouli ZBHHS. Factors Affecting Knowledge Sharing Behavior among Stakeholders in Jordanian Hospitals Using Social Networks. International Journal of Computer and Information Technology. 2014 September; 3(5).
42. Mulusew Andualem. Knowledge and experience sharing practices among health professionals in hospitals under the Addis Ababa health bureau, Ethiopia. 2012.
43. Gebretsadik T, Gebremeskel M, Kidane T, Wondwossen. Knowledge sharing practice and its associated factors of healthcare professionals of public hospitals, Mekelle, Northern Ethiopia. American Journal of Health Research. 2014 September.
44. Tirusew Y. Assessment of Knowledge Sharing Practices of HealthCare Professionals in Hospitals Under Addis Ababa Health Bureau. 2011.
45. Wilson C. User Interface Inspection Methods, A User-Centered Design Method Elsevier; 2014.
46. Ambler, Scott W. [Book] The Elements of UMLTM2.0 Style; 2005.

Annex I. Interview Guideline

ADDIS ABEBA UNIVERSITY SCHOOL OF INFORMATION SCIENCE AND SCHOOL OF PUBLIC HEALTH MSC IN HEALTH INFORMATICS PROGRAM

My name is Nebiyu Yared. I am post graduate student of health informatics program in Addis Ababa University. I am doing a research project on designing knowledge sharing platform for health care professionals in Ethiopia. The following interview is designed in accordance to strengthen the informational need of the project on how to design, implement and achieving the improvement of knowledge sharing practice. Thus you are kindly requested to provide genuine and correct answers for the questions posed by the principal investigator. The information's you provide are confidential and will be used only for the purpose of this study. Sir/madam, if you have anything, you want to be clarified do not hesitate to ask the investigator/the interviewer. Your full cooperation and participation until the completion of the interview is very necessary and crucial for the completion of the assessment. I kindly ask you to provide your genuine willingness.

THANK YOU IN ADVANCE FOR YOUR COOPERATION

1. Is there a knowledge gap between health professionals?
2. What is the importance of knowledge sharing among health professionals?
3. What kind of health related knowledges should be shared?
4. Is there a way to document health professionals working practice? What ways do you use?
5. How do health professionals share knowledge? What is the current ways of knowledge sharing you are using?
6. What challenge do you face on the current knowledge sharing practice?
7. What measure should be taken in order to facilitate effective knowledge sharing?
8. How do you handle Medical errors? Is there a way to share it to public?
9. Is there an adequate infrastructure in health centers to use IT applications?
10. Do you think developing an online knowledge sharing platform would solve the problem you are facing? How?
11. If knowledge sharing platform is to be developed what kind of features do you want to be included?
12. Are you willing to participate on evaluation of the system?

Annex II. Prototype Evaluation Questionnaire

	Rate your agreement with the following statements (Place a X in the appropriate column)	Fully agree	Agree	Disagree	Fully Disagree
1	The system is easy to open and access				
2	The system is easy to navigate through desired pages				
3	The system is easy on using the different functionalities in the given privilege				
4	The system saves Entered data properly				
5	The system Views saved Data Accurately				
6	The system provides appropriate error and success messages				
7	The System response time while saving searching is acceptable				
8	The system search results are accurate.				
9	Overall, the interface is pleasing and easy to use				
10	All the fonts on the system are readable				
11	All the system input fields buttons locations are consistent				
12	The system validates wrong input of data types all the time				
13	After logging out the system do not allow to access unprivileged pages				

DECLARATION

I, the undersigned, declare that this project work is my own original work and effort and that it has not been presented for a degree in any other university, where other sources of information have been used, they have been duly acknowledged

Signature:

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

Signature

Date

Demeke Assefa (MD, MA) _____

Workshet Lamenu (Ph.D.) _____

July 2016

Addis Ababa, Ethiopia