



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

**M.Sc in Health Informatics Program**

**Designing web based Social Health Insurance Information System for  
Ethiopian Health Insurance Agency**

**By**

**Natnael Alemu**

**A project submitted to the school of graduate studies of Addis Ababa  
University in partial fulfillment of the requirement for the Degree of  
Masters of Science in Health Informatics**

**ADDIS ABABA, ETHIOPIA**

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## **Dedication**

I would like to dedicate this research project to my beloved family, to my dad Ato Alemu Anjulo, My mom W/ro kibebe Gebresialsie and to my beloved sister W/ro Metshet Alemu.

## I. Acknowledgment

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## II. List of Acronyms

<b>EHIA</b>	Ethiopian Health Insurance Agency
<b>EIC</b>	Ethiopian Insurance Corporation
<b>FMOH</b>	Federal Ministry of Health
<b>HI</b>	Health Informatics
<b>HIIS</b>	Health insurance information systems
<b>HIPPA</b>	Health Insurance Portability and Accountability Act
<b>HIT</b>	Health Information Technology
<b>HSDP</b>	Health Sector Development Program
<b>HSFR</b>	Health Sector Financing Reform
<b>HTML</b>	Hyper Text Markup Language
<b>ICT</b>	Information communication Technology
<b>MDG</b>	Millennium Development Goal
<b>MySQL</b>	Structured Query Language
<b>OS</b>	Operating system
<b>PHP</b>	Hypertext Processer
<b>SDLC</b>	System Development Life Cycle
<b>SHIS</b>	Social Health Insurance Information System
<b>UML</b>	Unified Modeling Language
<b>UNICEF</b>	United Nations Institute for Culture and Education
<b>WHO</b>	World Health Organization
<b>WWW</b>	World Wide Web

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## VI. Abstract

Social health insurance scheme is a mechanism of distributing or pooling of risk among individuals. The scheme can be used to reduce individual burdens and to provide service at a subsidized cost among payroll based formal sector. The Social health insurance scheme involves three stakeholders these are the insurer, the insured and the service provider. The use of information and communication technology to create cooperative working environment between the stakeholders in the scheme can improve the accessibility and use of health care services at a point of service irrespective of geographical and time location. This can help to improve the use and access of citizens to the primary and advanced health care services. The application of ICT to the major business process of health insurance enables, an ease of access for the various health insurance services the Ethiopian health insurance agency provides to the employees.

The main objective of the project is to assess the existing paper based social health insurance system and design a user friendly web based social health insurance information system for Ethiopian health insurance agency

The project was limited geographically in Addis Ababa and conceptually to the designing of the web based social health insurance information system in the formal sector. The project employed an object oriented system analysis and design technique with different data collection tools i.e. (interview, observation, relevant document review) to collect the data required for system design. Analysis and design of the proposed system was done using the UML, Microsoft Visio 2013. While MySQL Server and Dreamweaver 5.5 development environments have been used to develop the database and the prototype of the web based system respectively.

The designed and developed information system of Social health insurance for the Ethiopian health insurance Agency comprises of different functionalities like employee(the insured) registration, validation, claim adjudication, insurance registration components which will help to transform the paper based manual system to efficient, increased geographical coverage and time unconstrained system.

The web based social health insurance information system could enhance accessibility of services and information or data transaction possible with the reduction of the unnecessary time consuming process. Most importantly the users access to the system be user friendly, save data, have appropriate notifications and manage incomplete data display with appropriate layout and access path.

# Chapter One

## 1. Introduction

### 1.1 Background

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being. These rights are exercised without distinction of race, religion, political belief and economic or social condition [1].

All WHO member States made the commitment to achieve universal health coverage. The states had a central focus and belief of providing an access to the healthcare services to their people without risk of financial ruin or impoverishment. All of them had an ideology of thus, achieving better health and well-being is key for promoting human and economic development [2].

Universal health coverage is an aspiration to reach the highest attainable standard of health. This objective has guided health policy nationally and internationally. Similarly, the Alma Ata declaration which is best known for promoting primary health care as a means to address the main health problems in communities like, fostering equitable access to promotive, preventive, curative, palliative and rehabilitative healthcare services to the society is an icon [3,4].

The world health report of 2010 on health systems financing proposes that, countries of all nations at all income levels should constantly seek to modify and adapt health systems financing to the specific goal of universal health coverage in mind. The report had the twin goals of ensuring access to health services, plus financial risk protection towards achieving sustainable development [5,6].

As part of the new health sector financing reform (HSFR), initiatives with a growing international consensus towards social protection via strong health care financing, the Ethiopian Government under Proclamation No. 691/2001 established the Ethiopian Health Insurance agency [7]. In June 2011 the agency launched a pilot Community Based Health Insurance scheme. It was based on directives provided by the Federal Ministry of Health (FMoH). The EHIA acquired an objective that any beneficiary of the social health insurance scheme shall have the right to receive the different health services from health service providers that contracted with the agency. The main benefit of the scheme is reducing the need to borrow money which may have longer-term benefits in reducing vulnerability of insured's to other forms of shocks [8,9].

Health insurance is a contract between the insured and the insurer. Having the effect that, in the event of specified events, the insurer will pay compensation either to the insured person or to the health

service provider. Based on the type of people the insurance covers, the health insurance scheme is classified into two categories. These are community based health insurance, which mainly covers the large group of the community and a social health insurance which covers only formal payroll based employees [10].

Social health insurance scheme, which covers formal payroll based employees have its own distinct characteristics. The scheme has a compulsory mechanism, the members have to pay the specified premium (contribution) periodically. While the government may decide to pay the premium on their behalf. Citizens only become entitled to these benefits when they have paid the required premium regularly. The premiums and benefits are described in a social compact, usually expressed in legislation. Social health Insurance is clearly different from user fee or direct payment schemes. In Social health Insurance, the user only is responsible for the payment of his or her medical treatment. The scheme shares its characteristic of pooling of risks and contributions with health financing via regular general taxation [11, 12].

Information systems (IS) have much to offer in managing healthcare costs and in improving the quality of care. In addition to the embedded role of information technology (IT) in clinical and diagnostics equipment, information systems are uniquely positioned to capture, store, process, and communicate timely information to decision makers. Which will also enable better coordination of healthcare services at both the individual and community level [13].

Electronic information systems have an advantage of providing quality and accurate data that make, reporting potentially more flexible and efficient. While on the contrary, the paper based system data is collected and compiled manually at the point of care. This manual process has an outcome that hinders from making sound clinical decisions, planning and procurement unpredictable and time consuming in all levels. Additionally it prevents higher level of the hierarchy from viewing the various aggregated data coming from lower levels of the systems [14, 15].

Web-based applications provide the power of desktop and server applications with the flexibility and accessibility of the web. Using web browsers, users can securely access applications from anywhere within the reach of companies intranet or extranet. As the use of IT to process medical data increases, much of the critical information necessary to meet these challenges is being stored in digital format. Web-enabled information technologies can provide the means for greater access and more effective integration of healthcare information from disparate computer applications and other information resources [16].

To improve the routine health information technology there is a growing recognition that ICT can replace traditional routine paper-based health information system with flexible electronic means and could bring significant cost reduction and effectiveness in terms of timely delivery of health care services in developing countries [13].

## 1.2 Statement of the Problem

Health care and finance resource mobilization and risk pooling with the application of information communication technology for health care provision is crucial. But electronic based health information system is not reaching the expected stage. The growth of healthcare information systems being engulfed with various constraints, it would be difficult to achieve the health care services as per the standard of the government itself as well as per standards of WHO [17,18].

The world is cradling to achieve the goal of universal coverage with a theme of financial risk protection. Around the world there is a fear that out-of-pocket payment for the services may lead to further impoverishment. And also the fear for the probability that, user fees may place the greatest burden on the poorest members of society is also a central issue. Not only the third and the second world countries but also the developed nations are also struggling to maintain current health services and to make sure that everyone can afford to use them without financial, social and political constraints [19].

African governments' budgets are insufficient to address health issues with the growing of health care costs at an alarming rate in many countries. In which many of the expenditures are invested to overcome health care financial catastrophes exhibited by large wastage of data and information. These issues are majorly caused by due to unneeded interventions, duplication and clerical errors thus planning, forecasting, monitoring and evaluation of health care services became difficult [20, 21].

As part of the new health sector financing reform (HSFR) initiatives for developing countries, multilateral agencies and donor countries have shown an increased interest in health insurance. Most importantly for its application as a mechanism to collect, abolish user fees and redistribute resources for the health sector in a more equitable way. Pre-payment and risk pooling with an automated business process, recommended to be a preferable way of providing the insurance mechanism to the society [23].

Health information systems applied to the healthcare financing sector can reduce lengthy administrative bureaucracy for cost reimbursement services. HIT can play crucial role for the attainment of quality service and universal coverage of healthcare. But the question of how to provide these efficient cost reimbursement information systems in healthcare financing systems is relevant everywhere [21,22].

Health insurance information systems (HIIS) are important to facilitate the link between payers and providers whom must exchange secure data about membership, eligibility, claims and payments. The transaction of these information need a secure, fast, reliable mechanism with the full involvement of the various stakeholders. Creating an interoperable environment for the stakeholders is required in order to facilitate the core business process and functions of the health financing scheme [23,25].

Health insurance scheme involves exchange of critical and secure data between the insurance service provider, health care provider and the client (employee). In a paper based social health insurance information system the exchange of underwritings, claim and reinsurance forms is basically by scanned documents and handwritten forms which are open to fraud and are easy to be accessed by an unauthorized personnel. This act is against the security and confidentiality information rights of clients (employees) and providers. In paper based system whenever there is a change in the data submission additional use of paper forms is mandatory. Manual registrations, underwritings, claim and reinsurance process require large volumes of these documents, which will be ordered extraneously. This lengthy manual process has a side effect of providing minimal value at a great cost of time and money. [23]

Lack of persistent, interoperable insurance data and information are causing a serious barriers towards the achievement of the universal coverage in various countries up to the degree in which the eligible peoples to that insurance cannot use the expected services. Additionally individual workers who work at a distant place may lose their protection at their distant place of employment. Some employers which have an insurance for their employees will be forced to pay for their contribution in a dual coverage. This involves paying the insurance premiums while they are near and away from their permanent location/home. Not only this but also some workers during unexpected health events they may be forced to pay out of pocket for needed healthcare [23, 24].

Health care services are known for having the largest budget in the countries list of expenditure especially, health care insurance expenditures. The health insurance mechanism which involves the pooling of risks requires control methods to those expenditures in a prospective and retrospective way. These control methods emphasize majorly on the volume of care, providers service provision, payment rates and costs. But implementing these control mechanisms effectively requires substantial administrative capacity and a highly developed, interoperable information systems and infrastructure [24,26].

The design of a web based social health insurance information system that supports achieving a wide coverage of health care finance and unexpected financial risk protection by improving the availability and accessibility of health care services is important to the health care system and the health care financing scheme. An automated web based system that is of portable, scalable and reusable can improve health insurance service provision. Digital or automated data and information processing enables the clients and providers to easily practice social health insurance services with less constraints.

Automated and interoperable system can enable the achievement of a goal towards reduction of financial barriers and pooling of the financial risks. Information technology can play its crucial role as an enabler in creating interoperable working environment. And also it can play a great role for the secure transaction of information across the social health insurance stakeholders. Which in turn will have a greater impact in the fulfilling the goal towards achieving for universal healthcare coverage.

## **1.3 Objectives**

### ***1.3.1 General Objective***

The general objective of this project is designing of a web based Social Health Insurance Information System that can improve the different business processes, stakeholder's interactions, and the different data and information transactions in providing health insurance service to the citizens.

### ***1.3.2 Specific Objectives***

For the attainment of the aims of the general objective the list of specific objectives used were

- ❖ To assess the existing paper based health insurance information system in Ethiopian health insurance agency
- ❖ To collect and analyze the functional and non-functional Requirement of the health insurance scheme
- ❖ To design the web based information system of the health insurance scheme
- ❖ To develop the designed Health Insurance Information system prototype for the users of the system
- ❖ To evaluate the developed prototype

## **1.4 Scope and Limitation of the Study**

The scope of the project is the design and development of web based social health insurance information system. Social health insurance involves three groups of stakeholders in its generality. These are the insurance service provider, health care service provider and the employee (the Insured).

The project was geographically limited to Ethiopian Health Insurance agency that is located in Addis Ababa the reason behind is because of financial and time constraints.

The project focused on government employees (the Insured) in the formal sector; which is mainly payroll-based payment that allows collection of fixed dissimilar periodic premium set according to insurance plan (level of payment) with regard to their salary scale that is set by the Agency. The proposed system automated the different claim processing, vital event, demographic and clinical data registration and critical event notifications and finally ensures that the users after being registered will have their own unique individual health insurance ID. This ID will enable the insured to get insurance service irrespective of their time and geographic location.

Conceptually the project focused on the designing of a web based and development of the prototype of system. The project doesn't cover areas regarding financial transaction, referral management and pharmaceutical inventory systems. Technically the proposed project was limited up to the development of prototype. Because of time limitation and financial constraints it could be difficult to encompass whole different life cycles of web based system/software development.

## 1.5 Significance of the Study

The newly designed and developed system can provide the different stakeholders various important functionalities and simplifies the provision of the major business process easy. These stakeholders include

**The (Employee) clients-**The system can serve to provide an ease of access to insurance services through an electronic registrations, viewing client specific clinical data, demographics and status management irrespective of time and geographic location. The systems can help to minimize the rate of out of pocket expenditure and also the need to get money from others to cover their medical expenses. Additionally the system can also minimize the amount of time spent in queue during emergency cases, spontaneous labor and natural disaster cases which are critical and important.

**The insurance service provider (EHIA)-**The amount of work which is performed on paper can be minimized with the help of the system. Because of the scalable nature of web based system, it can serve to increase geographical coverage of the service and increase in the number of the users the agency aims to cover. The different clinical and demographic data that are found in the system database will help the insurer to exercise evidence based decision making at all levels.

The different branch offices that are found over the country can be integrated to provide an interoperable business process and working environment.

Besides, a controlled service usage coverage review with a secure transaction, retrieval and communication of clinical, demographic health data, insurance claim and per-authorization information can be enabled with the system.

**The health service providers-**The system can serve to help the health care provision by maximizing the availability of insurance services. Additionally the system can help in separating the finance and provision of health care services to different stakeholders.

The system can provide a means of an automated standard registration of the different clinical and demographic data. The system can also enable the notification of the reportable disease at the time of occurrence, which will enable fast intervention by the concerned body before the disease causes serious health and social problems.

**The healthcare financing-** The system can provide standard employees clinical and demographic information which is essential in the planning, forecasting and making of different health care policy and finance decisions. The standardized data transaction in the system will create transparency and accountability for the mistakes that are made during the provision of care. Most importantly, the health care financing can easily retrieve the different disease and treatment patterns in different seasons of the year. The system can also provide the different data regarding the employees and employers and healthcare service providers information that can be used an essential input for health policy design.

## Chapter Two

### Literature review

According to Ngai and Wat [28], conducting an effective literature review enables one research or a particular endeavor to build a solid theoretical foundation. This can provide a firm foundation to the selection of the methodology for the study and additionally it also enables researchers to better explain as well as understand requirements of the project. The literature review part of this project provides theoretical and empirical reviews from different journals, books and electronic sources.

#### 2.1 Historical Overview, Function and Practice of Social Health Insurance

A report by UNICEF states, having a risk sharing mechanism enables protection of community from economic shocks. This mechanism can majorly be used to enhance the support of community through the accumulation of human and financial assets. On the other hand having those mechanisms improves access of a society to different health services in the community. Health insurance is one of those social protection mechanisms that is used to safeguard the society. This mechanism addresses the various social and economic vulnerabilities of a society. Pooling of funds to cover the cost of health care for members by minimizing economic and social vulnerabilities is the central focus this protection mechanism addresses [29].

A number of low and middle income countries, in order to provide a stable source of health revenues and to protect their society through a visible flow of funds into the health sector are now considering social health insurance as the preferable mechanism. Before social protection through the application of social health insurance came to success in different parts of the world; it had to pass through various social, political hardships and various ideological controversies. The participants in conflicts over social protection policy have differed in the aspects of scope, content, and time of applicability from nation to nation. No country has acquired national health insurance without a fierce and bitter political fight [30,31].

Social health insurance was first introduced to the world, in Germany by the year 1883. Under the pioneering leadership of Chancellor Bismarck. Germany established the first system of compulsory Sickness insurance. The first Social health insurance scheme had an aim of providing independent occupation based sick funds but placing their activities under states sponsorship. The system was operational through mainly five ways these were; relief funds for journeymen, for craftsmen, factory workers, for workers or trades people (community) and relief funds for people who could not otherwise find insurance. The proposed insurance system had a goal of helping and securing workers. This Bismarckian health insurance system was indirectly pressurized by Marxist-influenced labor unions especially Miners' associations and guilds on the other hand Bismarck had an ambition to build a powerful German state by having healthy work force [30,32].

Following the footsteps of German, different European countries started adopting the ideology of social protection to the society. Austria adopted the social health insurance mechanism in 1887/8. In 1892, the Danish government adopted a variant insurance plan that gave subsidies to existing voluntary funds so that those who were already ill would be admitted. Similarly Belgium adopted same legislation, to that of Denmark in 1894 [32,33].

Britain followed Germany's lead by creating a mechanism to protect the workers from various unexpected uncertainties and illness. In the United Kingdom, Lloyd George successfully passed a health insurance act in the year 1911. However, later the Britain government brought its own mechanism of social protection which had principle of free and universal entitlement to publicly provided medical care [34].

Canada and United States haven't had any a social protection mechanism which functions nationally as that of the other western countries until 1950's. The comprehensive Canadian insurance system followed neither German nor British precedent but instead allowed the provinces to be the sole insurers for most medical services. President Lyndon Johnson of USA and his allies capped off a long, ideologically charged battle for government health insurance with the passage of Medicare for the elderly and disabled and Medicaid for segments of the poor in 1965. But all subsequent efforts to extend coverage to the remaining uninsured, including the campaign launched by President Bill Clinton in 1993, ended in failure. Similarly in 1899 referendum held in Switzerland, to adopt a German-style model was also rejected. Israel in 1995 devised an insurance mechanism which has differing operational and inclusion mechanisms. The legislation replaced premiums paid directly to the sick fund with a progressive national health tax [35, 36, 37].

African heads of state, by the 2001 Abuja Declaration, committed themselves to allocating 15% of government budgets to the health sector to help the struggle for a society to have a decent way of life. In conformance to this legislation, several African countries have designed a social insurance systems financed through mandatory employer and employee contributions. These insurances were aimed to cover health services for employees in the formal sector. The formal sector encompasses of a payroll based, paid civil servants in which the government and private employers contributes in its role as employer. The coverage mainly focused on paying for health care costs, either by reimbursing their health expenses or by creating company or intercompany medical clinics [38,39].

In Burkina Faso a Community-based health insurance scheme, which was rolled out between 2004 and 2006 was of those pioneering examples. The results where hope giving about the health insurance sector thus, there was a decrease on average catastrophic health expenditure, in average out-of-pocket expenditure and increase in health service usage. Similarly in Zaire a well-established and documented Bwamanda hospital insurance scheme which is known to be a success in district-based insurance schemes in Sub-Saharan Africa is also mentionable. Also, the South African and Ghanaian governments also devised an integrated, comprehensive national public health insurance system on community health centers, in which children's younger than 6 years and pregnant mothers would receive free treatment. But the South African system had a hidden agenda other than social protection.

It was majorly driven by the need to redress historical inequities and to provide essential health care to disadvantaged (especially rural) people. Besides Ghana took the boldest steps towards universal coverage by introducing a national health insurance scheme which ultimately covered all Ghanaians. The mandatory health insurance schemes in both countries cover quite comprehensive outpatient and inpatient services at public sector and accredited private facilities [40,41, 42].

## **2.2 Social Health Insurance in Ethiopia**

In Ethiopia where Formal health insurance coverage was limited, Eder were the major forms of indigenous social protection mechanisms. Eder is a form of traditional social institution that is established by the mutual agreement of community members in order to collaborate with each other whenever any member or their family members face adverse situations. Eder have a regular contributions resulting in significant substantial asset holdings. This saved money can be used in cases of hospitalization, fire, as well as financial services such as short term credit. These institutions also had a role of assisting victims in bereavement and executing funeral-related activities. Until then Ethiopian Insurance Corporation (EIC) was the only commercial establishment providing health insurance service as one of its service areas before the establishment of Ethiopian Health Insurance Agency in 2010 [7,43,44]

The first formal and legal government based social health insurance system was established in a year 2010 E.C under legislation passed by Council of Ministers proclamation number 191/2010. The established Ethiopian Health Insurance Agency, has been working as an autonomous federal organ having its own legal personality since its establishment. The objective of the Agency is to implement a form of managed care health insurance system in the country. The Agency is accountable to the Ethiopian Ministry of health and the Ethiopian prime minister's office. The Ethiopian Ministry of health delegated major fourteen Authorities and Responsibilities to the Agency. These are;-

1. Establish and implement efficient and effective health insurance system.
2. Collect and administer monthly contributions of the social health insurance system.
3. Conclude contracts with and effect payment to accredited health service providers and monitor their performances.
4. Receive and investigate suggestions and complaints by members regarding service provision and provide appropriate solutions.
5. Ensure that health insurance is being implemented in all institutions required to implement it.
6. Create conducive conditions to expand and strengthen health insurance, encourage and coordinate those engaged in the-field.
7. Undertake public education and sensitization on health insurance.
8. Undertake studies for revision of the benefit package and amount of contributions; present the result with recommendations to the Ministry of health; implement same when approved by the government.
9. Where necessary, establish different committees, guide and coordinate their activities.

10. Make investments pursuant to directives of the government.
11. Take measures to ensure the financial sustainability of the health insurance system;
12. Own property, enter into contracts and sue and be sued in its own name;
13. Delegate part of its powers and duties to institutions as deemed necessary.
14. Perform other activities as may be necessary for the attainment of its objectives [7].

### **2.3 Components of Social Health Insurance**

The medical care system is a complex network of information flowing from one party to another with various stakeholders and a variety of business process. Health insurance and its various components have various set of relationships, settings and perspectives in the medical care system. The Social health insurance scheme has a payment mechanism which involves access to financial services. Which provides a mechanism for sharing the risk of incurring medical expenditures among individuals. On the other hand the human component (Peoples or users), are considered to be important in which other components relay on. People are the users of the scheme who are able and willing to use the insured health services when they perceive themselves to be sick. Medical service providers are also part of the health insurance component. These components are involved in the provision of the service to the insured by being paid and on a contract basis with the insurers. These components include Hospitals Clinics and different Health Maintenance organizations [45, 46, 47].

Another important component of social health insurance is the business processes which are involved in settling of the payment and registering peoples to be included in the system and performing various activities. These components may take different forms with different operational and practice differences. The majorly known business process in the social health insurance service provision include Indemnity plan, Capitation, Cost reimbursement and the recent Managed care [48,50].

Indemnity Plan is one of the business process practiced in the social health insurance scheme. The plan is concerned with the provision of services to the patient in which any medical services can be used without any questing of justification. Thus the insured's obtains a medical service, for which he receives and pays a bill, after which he turns to his insurer in order to be reimbursed for this bill. This method is simply health insurance functioned like a credit card, paying. The plan majorly lacks both demand side and supply side control. While reimbursement plan is concerned with paying a lump sum for all the services the insured's receives based on the cost or amount of care received and which can be either larger or smaller than the cost of care received [48].

Another health insurance business process is capitation. Capitation has a form of contractual basis. It handles financial flow in a way that involves paying a provider a specific sum of fixed periodic payment for each patient in the ongoing care of a person or group of people for a particular period of time. As that of Indemnity plan, capitation also lacks supply side and demand side control [49].

Recently, the growth of the need for integrated mechanism and consistently well-functioning social health insurance system has brought the classical Managed care. Managed care has a holistic approach

towards integrating the overall components of the insurance scheme. Managed care based health insurance provides the power to control and intervene in the relationship between the provider and the insured individual. In addition they have the full power to control both sides i.e. demand and supply side service utilizations. The control mechanism is achieved by limiting service use in particular circumstances, or they may selectively contract with a defined set of providers, limiting choice of provider. Of the moves, which are thought to be one of the success of these mechanism is thus the users have the right to select providers they like ; but also , the forth coming of mechanisms for monitoring service utilization and setting different levels of payment for the different individuals based on their choice and level of income are worth mentioning [50,51].

To the success of the health insurance, monitoring of service utilization which involves placing limits on which providers, an enrollee may use or see and placing limits on what those providers can do is crucial. Employing these control mechanism also enables the insurers to ensure that the services provided by the providers meets minimum quality standards. Different Plans use a range of different management techniques, such as feedback mechanisms and continuous quality improvement programs, which provide information to physicians and assist them in improving quality and reducing costs. The use of Utilization review is particularly common for high cost services, such as hospitalizations and surgical procedures. Obtaining a pre-admission insurer authorization for hospitalization is also seen as one of service utilization control mechanisms [51, 52].

## **2.4 Web Based Health Information Systems**

The World Wide Web (“WWW” or “Web”) is a techno-social system to interact humans based on technological networks. The WWW enhances human cognition, communication, and co-operation. Web is the largest transformable-information construct which was introduced by Tim Burners-Lee in 1989[55].The use of web is growing at a phenomenal rate across the globe. The growth of web can be shortened into generation of four kinds; Web one up to four generations, as a web generation of cognition, communication, co-operation and integration respectively. The reason for the Web’s success is largely due to its simplicity for use and information retrieval. Its nature of simplicity and usability makes web to be preferably used in any sector for management and transaction of information. For the full functioning of the web, it requires cooperation between information providers and users [53].

The use of information and communications technologies (ICT) in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education knowledge and research has the potential to greatly improve health service efficiency, expand or scale up treatment delivery to thousands of patients in developing countries, and improve patient outcomes [54].

Web sites that provide patient access to electronic medical records (EMR) and electronic patient–provider communication can support more transparent and active sharing of personal health information. Sharing of the different information through the web may encourage patient activation

and more effective partnerships with providers. Viewing medical test results, after-visit summaries, requesting medication refills and participating in secure clinical messaging with providers were the most commonly used portions of the Web site by patients and providers [55].

The availability and accessibility of the web made secure transfer of confidential patient information fast and reliable. Patients can take their information wherever they go for medical care. Most importantly beyond clinicians' use of the Web as a tool to support evidence-based practice, patients may use Web-based information to enhance their interactions with physicians and to become more knowledgeable partners in managing their own health. The web can also enable patients to make informed health care choices. According to a study by Bette-Jane, most of the patients in developed nations use online support groups, chat rooms, of a particular health condition or course of therapy. Also Web based physician network is in use ever than before [55,56].

## **2.5 Health Information Management System**

Information is a valuable asset, either in its production, dissemination or acquisition. It requires expenditure of resources. Governments invest massive resources in the production of information about health and medicine, more so than in any other area. Health care is almost completely information dependent science. Information used can be, patient-specific where information is generated by and used in the care of patients in the clinical setting or knowledge-based where the scientific information are used for the care. Much of clinical practice involves gathering, synthesizing, and acting on information [57].

As most of the health information are personal and confidential, the organizations which produces those information are concerned with the management and use of them. The management of information in health care is critical. More over health care consumers need and want as much confidential and accurate information as possible concerning their consultation and treatment options. Thus well managed information can be used to lessen the adverse effect of medical errors and to enhance the quality of medical records, and the protection of patient privacy and confidentiality [57,58].

With the advent of managed care, health care institutions are increasingly turning their faces towards to document management systems and data warehouses. The establishments of these information management facilities enable the information producer to collect, administer and disseminate clinical information online safely and quickly. According to various literatures, management of health information majorly influences the use. Mainly the time needed for patient registration and insurance registrations and verification, accessing of patient records and insurance information, and payments into accounts receivables [58].

Public health with the involvement of government in the use of the generated information to pass administrative and policy decisions use health care data .Effective public health requires timely accurate and authoritative information from various sources. Health information systems play a major

in decision making by minimizing the resource and time needed to generate, analyze and disseminate data along the hierarchy. Whether in the horizontal and vertical structure of a society quality information is needed for effective clinical management and for assessing the extent to which services are meeting the needs and demands of communities [57,59].

Worldwide good public health data are known for their use as a primary indicator for the growth of a country. Most of the public health data are recorded manually which makes the process of extracting crucial information hideous and complex. The major data, vital event registration, surveillance, outbreak and epidemic case report data, vaccine-registrations and household surveys designed to measure use of health care services are some. Demographic and health surveys can also be used to generate public health related information [60].

The complex and fragmented public health information has now become important component of the health information system. The application of Information and communication technology on community health studies for the aim of collecting and analyzing data on the determinants of health, risk factors, protective factors, and consequences of ill-health that were to be found outside the health sector are now integrated. This integration and interoperability made public health and other public policy decisions more reality/evidence based and applicable [61].

## **2.6 Components of Social Health Insurance Information System**

Globally, countries are expanding their health coverage to their public/citizens through the development of national health insurance schemes. These national health insurance schemes are as varied among the countries implementing them. Despite their variation in the implementation they tend to share same common information system components that are involved in the exchange of health insurance data [62].

Information systems majorly contain six components, hardware, software, data, people, methods and process. Each one of them are laying under three category these are technology, human and process factors generally. In order for the social health insurance scheme to function fully these components must work together to bring commonly shared value. As an independent information system the input, process and products of health insurance scheme adopts those information systems components. [62].

Dissemination and use of health insurance information products by the human factor has been made ease with the advent of new technologies. According to Harold [63], though it is impossible to provide a clear cut series of listings of the main activities; registration, insurance eligibility and verification, standard Coding of diagnosis and disease with ICD, Claim procedures and modifiers, Charge entry, Claims submission, and Payment posting are thought to be common in most health insurance practices. Data exchange among the various components in the social health insurance scheme is important for the successful functioning of the business process [64].

Data privacy is a serious matter for all healthcare stakeholders including providers and patients. Patients can suffer moral, emotional and financial damage if their billing data, credit card numbers and Social Security numbers, are stolen or disclosed. According to a study by the Ponemon Institute [66], a single loss of healthcare record can cost an organization worth \$240. Mitigating risk and providing robust security to the private or confidential information in any health care service provision requires serious security measures [65].

## **2.7 Social Health Insurance Information Systems**

The application of health information technology in the health financing sector has the potential to provide benefits for patients. These include better patient-provider communication, improved quality of care, reduction in unnecessary tests and medication errors, and improvements in overall health. According to a survey conducted by the Markle Foundation [67], individuals with chronic illnesses, those caring for the elderly, those with disability and those caring for children's reported to have the highest need and most urgent interest in online based health information access.

According to the health Insurance portability and accountability Act (HIPAA) of 1996, transferring and processing of data among health plans, organizations and stakeholders should have a standard and integrated systems. The systems that are involved in the maintenance of the aforementioned tasks are capable of claim processing, handling transactions and various employees, employer's data and different mechanisms for service provision and control [68].

The Health Insurance portability and accountability Act (HIPAA) compliance[68] states, the information systems, the data elements, the datasets and standards in a health insurance system are highly impacted by enterprise relationships, business processes and data exchange. To lessen the adverse effects caused by wrong interactions between these three factors, the conceptual model is necessary. This conceptual model for the design of the Social health insurance should have; plan administration, claims management, referral data management, recipient (insureds) administration, program management, provider administration business components [69].

Many of the early developed systems for social health insurance were simple computer-coded software instructions capable of being executed by a conventional computer microprocessor to perform information processing on medical billing record information. They preferably consisted of hospital or individual doctor medical care usage billing records. A system built by William A. Hunt; Elizabeth F. Yauch; Mark Denovich [70] is a good example. The system is registered under the patent number US005933809A and known by a name Computer Software for Processing Medical Billing Record Information. The system had a main functionality of converting, sorting and storing input information from the pre-existing medical billing records into a form suitable for bill processing.

The invention of various Social health insurance information management systems like Medicare, Medicaid and Obama care etc... Paved a way for provision of fast and reliable health insurance services. Supplementary services like updated information about safety, information about patient

conditions, treatments and other pertinent characteristic were also available. The current newly developed systems had inbuilt list of standard International disease classification (ICD). This made the categorization and proof reading during service provision controllable, functional and easy. In addition to these, a reminder to providers at the point-of-care of important patient's financial information and feedback about progress was also incorporated. Public health had been greatly affected by the use and management of this information [71, 72].

One of the social health information processing systems developed is Medicaid .Medicaid is a federal-state program that provides healthcare for low-income, elderly, and disabled persons in the United States of America. Medicaid Information Management Systems are the principal tools used by the states to process and validate Medicaid claims. In addition they are used to track, control expenditures and generate required administrative reports. Medicaid has an intuitive graphical user interface, efficient information storage and retrieval using relational databases. The stem is enabled with real-time claim submissions, auditing, and acknowledgement using a standard internet browser. The system is growing; majorly accompanied by addition of decision support capabilities to the major functionalities, data warehouses and data mining techniques. Shortly thereafter, childhood immunization registries, Web portals, and many more features are now added [72,73].

Medicare is another form of social protection mechanism that covers the elderly peoples aged 65 or older and eligible residents who have some disabilities and end stage renal disease. Medicare is administered under in the same organization as that of Medicaid that is center for Medicare and Medicaid Services Medicare and Medicaid have integrated systems more importantly. The systems have flexible, adaptable nature and also they provide rapid response to changes in programs and technologies [73].

Medisoft is another a well-known health insurance information system. It is computer and Mobile based system. The system is capable of registering patient information and processing charges and claims. Demographics, emergency contact, employment information, insurance and payment responsibility, medical history, electronically sign office consent forms are also parts of the system. The mobile based, Medisoft Mobile also allows providers to access remotely from anywhere to view their schedule, enter charges to pass to the billing system for processing and quickly add patients that don't exist in the system. The reduction in data entry time, helping free up staff to address more-important tasks, verifying existing patient information, were their main advantages for the mobile based Medisoft provided [74].

OBAM CARE, named after president of United States of America, President Barack Hussein Obama, is the legislation that created the greatest single expansion of health care access and coverage in American history. This Patient Protection and Affordable Care Act introduced sweeping changes to the healthcare system in the United States. Obama care has been operating since October 1, 2013, via the [www.healthCare.gov](http://www.healthCare.gov) website [75].

Though it was an historic movement in the area of health care but from the very beginning, [www.healthCare.gov](http://www.healthCare.gov) users were complaining that the system is freezing, crashing, and other site problems. The difficulties with the users resulted in insurance issuers to send millions of cancellation notices. Furthermore with deep investigations by different intelligence and information security agencies; that the system do not only have interface and access problems but the system also has major security concerns and had poor project management issues. According to software review performed by Siegel Bernard[76], there were also another issues related to design flaws and even many users of the website were confused how to process information and access the different business processes with their functionalities [77,78].

## **Chapter Three**

### **Methodology**

#### **3.1 Study Area and Period**

The project study was conducted in Addis Ababa city administration. The study was conducted from January 2016 to May 2016 GC in Ethiopian Health insurance agency which was established in 2001 under the proclamation Number 690/2010 to provide health insurance services.

#### **3.2 Study Design**

An Object Oriented (OO) methodology was employed for the designing of web based system of the social health insurance scheme which involves different stakeholders (the insurance agency, the insured and the health care providers). This design methodology is chosen because OOD allows large-scale applications to be developed in independent modules. Object-oriented also enables decomposition method of a complex arrangement by the primary objects apparent in the system. Methodologies usually offers a guidance on a number of models that can be used to help design a system and define a set of formal notations in which the recommended models can be written down and documented [28]. For the design of web based database system for the health insurance scheme an object oriented system design methodology was used because of its highly dynamic, flexible and scalable nature. Additionally OO allows large-scale applications to be developed in independent modules. Object-oriented decomposition provides a method to decompose a complex arrangement by the primary objects apparent in the system. Once the objects are defined and the system functionality is assigned, major components of the software system can be developed independently.

#### **3.3 Source Population**

Health insurance customer service officers, claim department officers and information technology officers participated from the Ethiopian Ministry of Health and Ethiopian Health Insurance agency which were used as a source population. They were directly involved in facilitating the different information and process about social health insurance in their own respective departments. The rationale behind is because they have a direct interaction with the system for executing various insurance claims, registrations, reports and handling different client data. During the collection of data physicians/health professionals were not included. This is because the EHIA has not started accepting claims for processing from the health settings.

### 3.4 Inclusion Criteria

The study units in the research project included only health insurance customer service officers, claim department officers and information technology officers working in FMoH and EHIA. These all samples were found in Addis Ababa Head office that have processed health insurance data and information as mentioned in the table below. A total of 14 samples were selected for the research project

Table 1: Sample for the project SHHIS , January to May 2016

Department Type	Total number of respondents		
	Sex		
	Male	Female	Total
EHIA Claim department	2	3	5
EHIA Administrative department	2	1	3
EHIA Customer service officers	2	1	3
Information technology directorate of FMoH	4	1	5
Plan and program division of FMoH	2	4	6
Information technology directorate of EHIA	3	0	3
<b>Total</b>	<b>9</b>	<b>5</b>	<b>14</b>

From the different sampling techniques a type of purposive sampling called purposive expert sampling technique is used. This method is chosen because this project is a product oriented i.e system development (SHIIS) project. By using this purposive sampling technique it is possible to gather the required information from individuals that have particular expertise on that area.

### 3.5 Methods of Data Collection

A face to face interview was conducted with key informants on the existing health insurance scheme. The responses were recorded, which were used as an essential input for the defining of requirements which is important in designing of the web based information system.

In addition to the interview done, analysis of different paper based documents, different claim forms, reports and registers was conducted. These in depth analysis was conducted to have precise information and gain an insight into the structure, activities and patterns of information flow in the health insurance scheme of the existing paper based system. Different Functionalities were assessed with regard to the guide line and guiding policies set by the Ethiopian Health Insurance Agency and the Ethiopian ministry of health. The collection of the data was performed after asking the consent of the respondents whether they are willing to participate in this study and a consent request form was provided before they gave any response. The consent form is attached in the back of the document.

### **3.5.1 Requirement Data Collection Quality Assurance**

Data collection instruments were prepared according to the informational need of the research project before the requirement analysis was held. Requirement data gathering was held by the principal investigator. Finally the gathered requirements were compiled and checked for completeness before they are consumed for the development of requirements.

### **3.5.2 Data Processing, Design and Analysis**

The collected data through interview, observation and document reviews were summarized in relation with the guidance of the different policies and procedural documents from the Ethiopian Health Insurance Agency

For the designing of the web based social health insurance scheme with having the Object Oriented software design Methodology an iterative and incremental Object Oriented Analysis and Design Cycles were used. The design made use of the Unified Modeling Language like

- Use case diagram
- Class diagram
- Sequence diagram
- System Architecture
- subsystem
- Microsoft Visio 2013 was used on the designing of a system

In the development of the prototype for this project Dreamweaver 2015 version 5.5 development environment was used. HTML is used as a front end for the construction of the interface and PHP is used as a middle ware to create the different functionalities, business rules and connections to the database. MySQL server is used as a back end server to create the tables and save various data on them. The tools that are selected for the designing and development are majorly chosen on the basis their ease of use, availability, supportability of the system environment and researchers prior experience .Almost all of the tools are open sources which does not require any prior payments.

### **3.6 Ethical Consideration**

Ethical clearance was provided from Addis Ababa University School of Public Health to conduct this project. In addition official letter was provided to the Ethiopian Health Insurance Agency. In addition to these a consent form was given to all of the respondents prior to giving any information for the requirement collection.

### **3.7 Dissemination of Results**

The project final report will be disseminated to Addis Ababa University, Ethiopian Health Insurance Agency and Ethiopian Ministry of health

### 3.8 Operational Definition

**Claim-** Formal request to the insurer for asking a payment based on the terms of the insurance agreement after the healthcare service provider giving the necessary health care service to the insured.

**Claim Adjudication-** refers to the determination of the insurer's payment or financial responsibility, after the member's insurance benefits are applied to a medical claim or pre-authorization.

**Claim Processor-** is a Person who checks for claim coverage and validity. They are expected to review and assess claims submitted by patients to ensure that they were indeed covered for a medical procedure by EHIA.

**Employee, (Patient)-** person or an individual who works full-time under a legal contract of employment and has recognized rights and duties. Also called worker. The place in which he works must be registered to use an insurance service and pays money in a salary base.

**Employer-** is a registered organization in which an employee works at. A legal entity that controls and directs the employee under an express or implied contract of employment and pays (or is obligated to pay) him or her salary or wages in compensation.

**Health care service provider-** is an organization who has a contract agreement with the health insurance insurer to provide service for those employee who are registered and eligible.

**SHIS-** is a social health insurance information system which enables interpretability and automation for the social health insurance scheme

**Social health insurance-** a social protection mechanism which involves raising and pooling funds to finance health services, from those peoples who are employed in an institution and earn money on a fixed basis.

## **Chapter Four**

### **Result and Discussion**

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

##### **4.1 Analysis**

###### **4.1.1 Introduction**

Collection and analysis of the requirement is one of the basic and essential steps in the software development life cycle. Investigations of the existing system in use by various means provide the basic and necessary inputs for the system to be designed. The collected inputs should be organized in a meaning full manner to provide the proper functionalities of the system in a way that shows the flow of information, data generated and the users of the system. In this chapter the existing system in use, the business process, the system modeling and the design of the new system are presented.

###### **4.1.2 The Existing System**

The Ethiopian health insurance agency currently does most data exchange and information processing using manual paper based processing. Besides the agency was using a standalone registration system deployed by donors with the aim of saving and retrieving registration data to and from the database from the different regional branch offices. But, currently the system is not in use. As per the response given by the key informants; the system was designed without assessing the organizational basic data and informational processing needs. Additionally most of the functionalities of the system are not usable by the staffs thus made the system to be out of use.

Manual retrieval of clients (employees) insurance registration and service utilization information is time consuming and dreary. Which makes management of information hard and even sometimes, they may not find their clients information within a needed time and standard. Besides, on the claim processing office they have a manual paper based claim processing which is complex and prone to error and personal bias.

The manual claim processing according to the key informants, it's a tiring and time taking which require a lot of health professionals and accountants not only these but also its prone to error and personal judgments. This is mainly caused by because of lack of standardized working procedure. The claim processing department do not use standard ICD for coding the diseases. As per the response of the claim department focal personnel, besides the procedural problem the agency is facing serious

problems with regard to processing of claims decisions caused by lack human resource to address all the claims with in short period of time. Currently most of the personnel's that are engaged in claim decisions are Accountants. As most of the claims contain clinical information, processing the claim require basic knowledge and understanding of the diagnosis, treatment and clinical procedures. So that they need to involve physicians and specialists from different departments.

To overcome this issue the agency is trying to hire general practitioners to handle decisions regarding claims. However still there is a problem regarding some clinical issues which require specialist's advice and involvement prior and post treatment claim authorizations and decisions. In order to address these issue the agency is planning to outsource these kind of claim decisions and pre-authorizations to other organizations.

Based on the observation and the response from the key informant's, show that the agency doesn't have any mechanism to protect the confidential and personal health data of the clients. Thus anybody in the office can see the data without the consent of the client. This act of violation of personal information is against the right of the client and standard insurance procedure set by HIPPA. In health insurance system one of the major issues that need to be addressed is the physician and patient induced demand control mechanism but in EHIA there is no mechanism/system to handle these crucial scenarios.

## **4.2 Findings of the Current Organizational System**

By the use of the structured questionnaire developed for interview the following findings were identified. The identified issues are presented in accordance with the different information system components.

### **1. Data and Process in the Current system**

Based on the investigation done concerning different data, the organization uses and information generates below mentioned points are explored. The EHIA is mainly concerned in recording, storing and processing of majorly vital demographic, health (clinical, diagnostic) and financial data. The information processed in the existing system consists of registration, claim processing and eligibility assignment. Most of these processes are done on paper using manual paper based way. During gathering of requirements, manual information recording samples were taken for identifying the data types and data elements included in each type of information processing units. Each and every client's information during registration is recorded in individual different forms. These forms are collected and filled in individual basis and filed in the agencies head and branch offices. Generally the problems regarding the data and processes in the organization are

- There is data redundancy in all recording formats
- There is data overwhelming and overloading

- Recording data on the formats is very tiring and time consuming
- Incomplete and inaccurate data records occur very frequently
- Loss of filled formats from individual clients file
- Lack of standard disease and service usage coverage reporting mechanism
- Lack of control in data and information flow
- Lack of standard synchronous and asynchronous data storage and communication
- Lack of confidential storage and retrieval of health data and information
- Lack of information and process interoperability between the different departments

Information retrieval is done by searching individual names and a Microsoft Excel generated identification number of clients, which is recorded previously. The exchange of data and information between branch offices and concerned bodies is a store and forward mechanism, majorly facilitated by E-mail. Currently there is no real time automated system for data analysis and information processing in use. Besides the data and information processing there is no mechanism to check the data quality and flow control in the organization.

The utilization review of each client is recorded manually thus it has to be copied and attached with the patient file in a place the client receives service. This redundant and distributed nature of service provision makes recording of data with each visit at different service providers place with different standard that will oblige the clients to have different files at different places with varying standards.

## **2. Report /Communication in the Current system**

The organization previously tried to use the Smartcare software to generate report on member's registration. This Smartcare software had limited functionality to registration and report generation only. Besides Smartcare software, there is no automated system to generate reports regarding claims, dynamically changing member's status and other activities in the organization. The employers use paper based change request form to announce any change in the employment and membership status of their employees. These change notification process takes days even months to be processed. The service providers need client's information and insurance coverage information for validation of eligibility and controlling of service provision. In the existing paper based system there is no mechanism for actual checking of membership from supplier side except the paper card in hand with the insured, which is prone to fraud and forgery.

In the existing system insurance information flow among the Ethiopian health insurance agency, service providers, employers and employees is in a hand written way. This manual information flow, has a possibility of being lost and edited without legal and formal change handling mechanism. Within the scheme reports are prepared daily, weekly, monthly, and quarterly and annually. These reports mainly include number of insured's, service utilization, diseases patterns, treatment patterns, financial expenditure. And these reports are submitted to different donors and concerned government offices using manual paper based mechanism. Generally the way of communication is asynchronous, it is made using manually recorded documents and through E-mail (store and forward).

### **3. People in the Current system**

All the customer registration and claim processing departments have access to editing, updating any client information in the existing system without legal permission. The customer registration office, employee and employers are accountable for the errors that are made during recording of employee's data. While the service providers and claim management department are responsible for errors regarding processing of claims. In the organization all the officers have the basic computer skills. According to the information given by the IT officers almost all of the officers have a good internet usage custom. Which is majorly accompanied by social network usage like Facebook, Gmail, and yahoo and Google search engine.

### **4. Management (Procedure) in the Current system**

In the existing system the organization follows a national guide line for customer insurance registration, claim processing and management .The insurance registration procedure comprises of

- Employees information registration
- Employers information registration
- Status change management
- Eligibility assignment and validation

While the claim management department has a responsibility of

- Processing claims
- Providing decision regarding claims
- Service Provider and customer service utilization control
- Fraud control
- Procedural change management

The problems in the claim department and registration process are handled by their respective focal personals in each department.

### **5. Software and Hardware in the Current system**

According to the response given by the ICT department focal personnel, claim and registration focal personnel, besides the Smartcare software, the agency is planning to purchase a system in the long run in collaboration with the donors.

The agency has a total of 75 desktop computers on different offices, thus each one of the officers have their own computer. Additionally the agency has a plan to add extra computers to improve the efficiency of the existing system. The officers use the computers majorly for browsing internet and

Microsoft Excel based report writing. The aforementioned findings are obtained from the interview and observation done on the existing system. This investigation on the existing manual system helps to identify the opportunities, problems. Moreover it will help to identify the possible stakeholders and to understand the business domain of the organization.

### **4.3 The Proposed System**

The newly proposed system for the Ethiopian Health Insurance Agency will help to facilitate an improved service provision of the stakeholders and to enhance the creation of standard data sets with secured information transaction. The new system will reduce the errors that are prevalent in the manual paper based recording. It will also help real time, fast claim data and information processing. The generation of precise report from the system will also enable a sound decision by the stakeholders. Additionally the system will help to reduce and control moral hazards, supply and demand side induced unnecessary service utilizations.

Checking the eligibility and managing any status change of both the employee and employer with full security control from the Ethiopian Health Insurance Agency in each hierarchy is also another feature of the system. The system generally will be used as a registration system, record management system, eligibility validation system, claim management system and report generating system.

### **4.4 Functional Requirements**

Functional requirements majorly deal with explaining on what has to be done by identifying the necessary task, action or activity/ and functionalities the system should provide to users and the tasks that must be accomplished. This web based social health insurance information system is designed in a way that enables the stakeholders to collect, analyze, disseminate and utilize health insurance information at all levels of the organization. Besides those functionalities it will enhance secure health information transaction, proper control of service utilization and standard data definitions across the system. The below lists are the functional requirements.

Table 2 : Functional requirement for web based social health insurance information system , January to May 2016

<b>Req ID</b>	<b>Use Case ID</b>	<b>Description of the Requirement</b>
RQ-1	EHIA-9	The system shall enable the identification of different users and their roles
RQ-2	EHIA-9, EHIA-1	The system shall support the management of actor relationships.
RQ-3	EHIA-9, EHIA-1	The system should have a feature to manage group of system users.
RQ-4	EHIA-6, EHIA-3	The system should allow search into the database by name, identification number, etc. to see if beneficiary has existing enrollment record
RQ-5	EHIA-4	The system should allow validation of the insured from the database by insurance id , or by the registered phone number
RQ-6	EHIA-9, EHIA-1	The system should Control which users have the right to update specified data sets and record the updated data
RQ-7	EHIA-6, EHIA-3	The system should accept data sets based on the set rules and policy. That is to deny some services and ineligible participants which are decided not to be included and covered by the insurance
RQ-8	EHIA-7	The system should send, reportable and epidemic diseases notification alert to the Ethiopian ministry of health.
RQ-9	EHIA-3	The system shall enable registration of employee and his family members by the registered employer.
RQ-10	EHIA-10	The system shall enable the registered user to view insurance and personal data with restricted access privilege
RQ-11	EHIA-2, EHIA-3	The system shall keep record of employers and employee's basic medical and personal information.

RQ-12	EHIA-7, EHIA-6	The system shall enable submission of claim request by the service provider
RQ-13	EHIA-7	The system shall enable secure transaction of claim adjudication request and decisions
RQ-14	EHIA-7	The system shall enable secure transaction of pre-authorization request and decision
RQ-15	EHIA-7, EHIA-5	The system shall capture name and ID number of authorized person that authenticated beneficiary during pre-authorization request
RQ-16	EHIA-7	The system shall enable the physician to submit and apply changes to the status of the employee and his family during Vital events(death, birth, disability and mental illness )
RQ-17	EHIA-10	The system should enable generation of report based on daily, weekly, monthly and annual basis

## **4.5 Non –Functional Requirement**

Non-functional requirements define the overall qualities aspect 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. These quality factors comprises of appearance, a speed or accuracy property. Majorly non-functional requirements focus on the visible quality aspects of the system and the overall attributes of the system, including portability, availability, scalability, reliability, efficiency, human engineering, testability, understandability, interface, security and modifiability.

### **1. Portability**

The system has a goal of providing social health insurance service without time, geographical and technological limitations. Thus, the web base social health insurance service provisions require real time communication, accessibility and transfer of data with various exponentially increasing stakeholders. So that service portability is essential. Portability is the ability of a system to run indifferent environments. Also it is an act of producing an executable version of a software unit or system in a new environment, based on an existing version. These different environments refer both to the hardware and software platforms that are designed by different manufacturers which help to reduce the cost of redevelopment [80].

## **2. Availability**

In the world full of unprecedented events staying healthy is the quest of all humanity. To fulfill these quest the health service providers should work 24 hours. These requires the system to run 24 hours a day and 7 days a week. There should be 24 hours running servers and power generators. Since the medical world is full of medical jargon, in order to reduce confusion on the diagnosis and treatment data entry the system should run in English language [81].

## **3. Scalability**

The system has a major aim of increasing interoperability between the head office with the branch office, the service providers, the clients and ministry of health. Since the number of employees, employers, health institutions are increasing in number through time, the system should be scalable to accommodate these changes. Though the information system is designed in a way to accommodate the growth but the network architecture should be designed to accommodate this change. These web based social health insurance information system uses the web as a platform which makes it easy to accommodate any changes. In addition to the issue of scalability the system can be extensible [81].

## **4. Reliability**

Since health insurance data have a very secure and critical value the backup copies must be stored on external hard disk and saved. The saved data should be stored in a place where they shall be protected from fire or water damage. The generated information from these stored data is used for important decisions in the health and financial sector thus the system should be backed up on a daily basis. Besides the backup, while implementing the network the design should be done in a way that supports redundancy and decoupling. A failure or incomplete efficiency may result a mistake in the output and damage to the system. The system shall be able to detect and isolate faults, and be able to correct them automatically [81,82].

## **5. Performance**

The health service providers are engaged in a stressful work environment which they want to get the information specifically they want. Not only the health professionals but also the clients want to get access to their specific informational need. In order to maximize the performance of the system, the system should allow easy sign in of user to the system. The system should be able to bring a client's records as per request of the physician. The system should be able to retrieve the clients' information with the given standard. The system should be able to list the detailed service usage information of specific patients with speed. The system must ensure that the claim be sent to the agency immediately after the entry of information into the system. The client's utilization review should be retrieved with a

speed. The system should have a flexible and convenient data import and export service with other systems [82].

## **6. Privacy and Security**

This system is engaged with processing and transaction of a highly confidential and personal health insurance information. The issue of Security is essential for this systems. During the provision of care several health care service provider organizations and individuals collaborate. These collaborative boundaries require reliable security measures. The system should grant access to each authorized client a unique identifier that is, a user name and a password. The system shall authenticate and validate each client with a unique identification number. The system's users should be authenticated prior to communication. The communication between the client and other users shall not allow any other person to intrude. The system should send the claim and claim recommendation by the physician to the agency in a strictly secure manner. The system shall guarantee the privacy of personal information [83].

## **7. Interface and Human Engineering**

Since the system involves users with different technology awareness and usage capability the user interface should be able to support these usability needs. The system interface should present an easy and user friendly interface to the user. The system interface should appear balanced with fields or groups of fields evenly positioned throughout. In cases where a form on screen has a hardcopy equivalent, the appearance of both should be consistent [83].

### **4.6 Modeling**

#### **4.6.1 Process Modeling**

A process model is the conceptual representation of the business process in the organization. Process modeling shows the overall model of the data, decision logic in business processes and activity flow in the organization. With the power of visualization, process modeling is used to communicate information regarding a process and the interaction it includes within / between organizations. Process model can also be used to show the comparison between the current system and the newly proposed system [82,83].

The conceptualization of the various functionalities and behavioral representations presents multiple granularity levels of clarity. That is from simple depiction of the workflow to simulation and execution. This enables the transparency of the business knowledge with a view to agree and bind all stakeholders in a representation that is shared within an organization and is reflected in its information

systems. Thus a common understanding of business knowledge between an organization and IT experts and thus drives the design and implementation of software systems can be achieved [83].

#### **4.6.2 Social Health Insurance Information System (To be)**

The existing system has a fragmented service provision mechanism which is done separately by different departments which require integration and interoperability. Majorly the claim and customer service departments have different functionalities which needs close and strong interoperability. The existing Customer registration business process involves registration of clients by their respective employers on a form which is prepared by the agency. The employer registers each employee and employee's family. These family registration includes spouse and children who are aged under 18. After registering each employer sends the registration data to the branch office of the agency so that an employee identification number be generated from excel based client data registration.

The other department named claim department which plays the major role of preparing, accepting, processing and validating claims from the different health service provider facilities. This department accepts the different treatment and diagnosis data then checks them to provide payment decisions. These decisions are made by analysis of the claim which is conveyed by paper which needs different professionals on a regular basis. But currently in most of the branches the department is led by accountants and few health professionals.

While the service provision facilities are majorly concerned with validating the eligibility before they provide any service to the client and after the service is given, a patient encounter form is filled with claim form prepared by the agency. These institutions provide health care services that are the heartbeat of the health insurance mechanism. They dictate the kind of relationship the insured should have with the insurer.

The proposed system will integrate those different functionalities that need to be interoperable for the full functioning as a system. The system will have a registration module which registers employees, employers, and health care service providers. After registration, the system generates individual identification number. These numbers will be used for every access need of the client data from and into the system. The identification number can also be used as a file identifier for the clients file to be saved on to the database. After having the system generated identification number, it will be used when there is a need to get access to the system. When there is a need for validation of a client to use any service, the eligibility management module will provide the eligibility checking and validation of the user.

The service providers after providing their respective health care services they will record each service provision and client's clinical data on to the database. Each physician will submit claim request with insured's clinical history onto the database. This data will be used as a reference during claim and pre authorization processing.

After receiving the claim information, the claim adjudication management module will spread the client’s data over the network. Any physician assigned as a claim processor to provide the needed decision for the claim can see it. Based on the recommendation provided by the claim adjudication physician group, the agency will reject or accept the claim request. The claim can be processed further and their payments be made in accordance with the decision. Not only claim adjudication but also some procedures which require pre- authorization by the agency can be processed and decisions be easily made. Finally the concerned stakeholder with report generation authority can generate the report according to his provided credential.

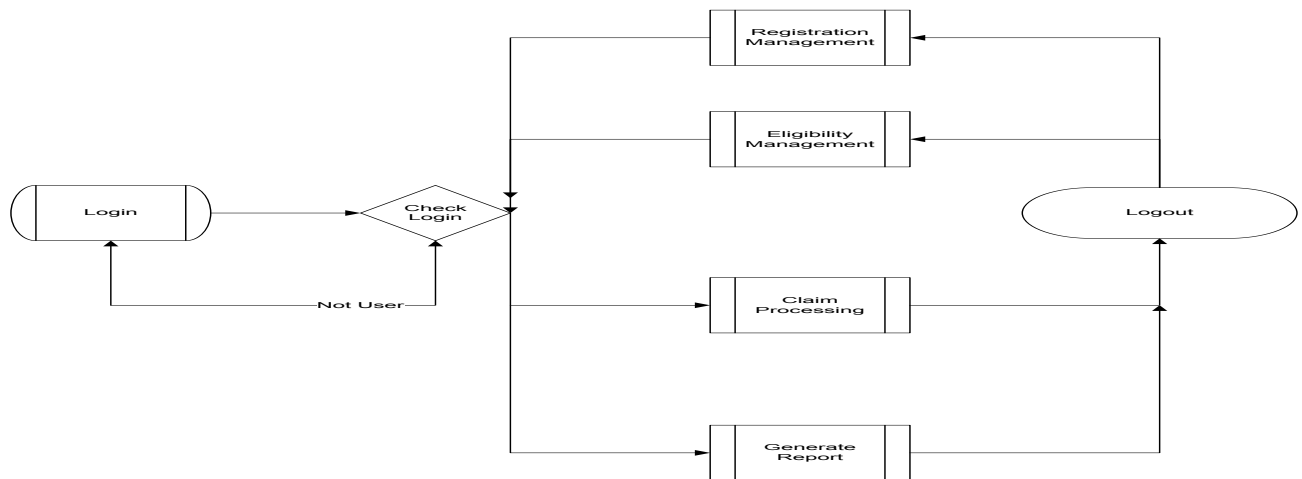


Figure 1:- Business process modeling of the proposed system/web based social health information system, January to May 2016

### 4.6.3 Contextual Modeling

Contextual modeling is one way of expressing the business process modeling which shows the context into which the business process fits into with all the external entities that receive from and contribute to the information system. Additionally they help to decide system boundaries and what functionality should be included in the system and what is provided by the system’s environment. They also provides a view of the overall business process as one process. Context models normally show the environment and the several other automated systems. However, they do not show the types of relationships between the systems in the environment and the system that is being specified [82,84].

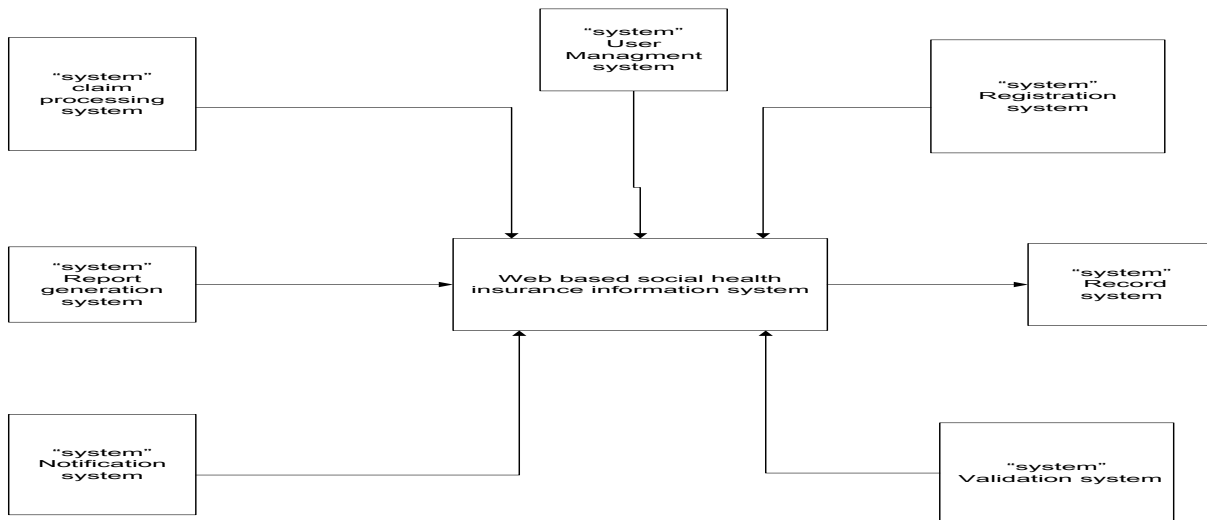


Figure 2: Contextual diagram of the proposed system/web based social health information system, January to May 2016.

#### 4.6.4 System Modeling

System modeling is the process of developing abstract models of a system. There exist different modeling approaches which allow us present a model. These models reveal different view or perspective of a system. These various models are used during the requirements engineering process to help and provide a road map to derive the requirements for a system. Most importantly system modeling is used to provide interaction, structural and behavioral perspective of a system. They have priceless value during the design process to describe the system to engineers implementing the system and after implementation to document the system's structure and operation [84,85].

#### 4.6.5 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 is used for modeling of this system . The Unified Modeling Language is a set of 13 different diagram types that can be used to model software Systems and so supports the creation of many different types of system model. Object-oriented modeling emerged, where similar object-oriented notations were integrated to create the UML. The UML is universally accepted as the standard approach for developing models of software systems [85,86].

The system modeling for social health insurance information system has majorly the interaction, behavioral and structural parts. The interaction part consists of use case and sequence modeling while the structural part has class diagram while the behavioral modeling part can be shown using activity diagram modeling to represent the system.

### 4.6.6 Use Case Modeling

Use cases are an easy 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 who is using the system, what their typical scenarios of use are, and what their goals are. This UML modeling provides interaction view; which is a more user-centric emphasis rather than focusing on the detailed functionalities of the system. The web based social health insurance information system has seven major actors in which each of them have their respective identified tasks.

Table 3 : System actors and description for web based social health insurance information system , January to May 2016

<b>Actor name</b>	<b>Description</b>
Employee[insured]	Is a person for whom the Ethiopian health insurance agency provides insurance coverage.
Employer	Is the organization in which the insured's work .
Data clerk	Is a person who works at the service provider setting and performs validation of insured's data up on employees arrival to the health center .
EHIA	Is the Ethiopian health insurance agency is a government body who is responsible for registering the organizations or employers in order to provide insurance coverage to the employees.
EMoH	Is the Ethiopian ministry of health who is responsible for controlling and overseeing the agencies functions and accountable to take responsive measures during epidemic or emergency outbreak of diseases.
Report viewer	Is a person/organization interested in viewing the reports generated by the system.
Claim Adjudicator	Is a group of health professionals who provides the claim decision.
Health professional	Is a person who works in the service provider setting, performs diagnosis, treatment to the insured and performs claim request
System administrator	Is a person who provides different security access credentials to the system

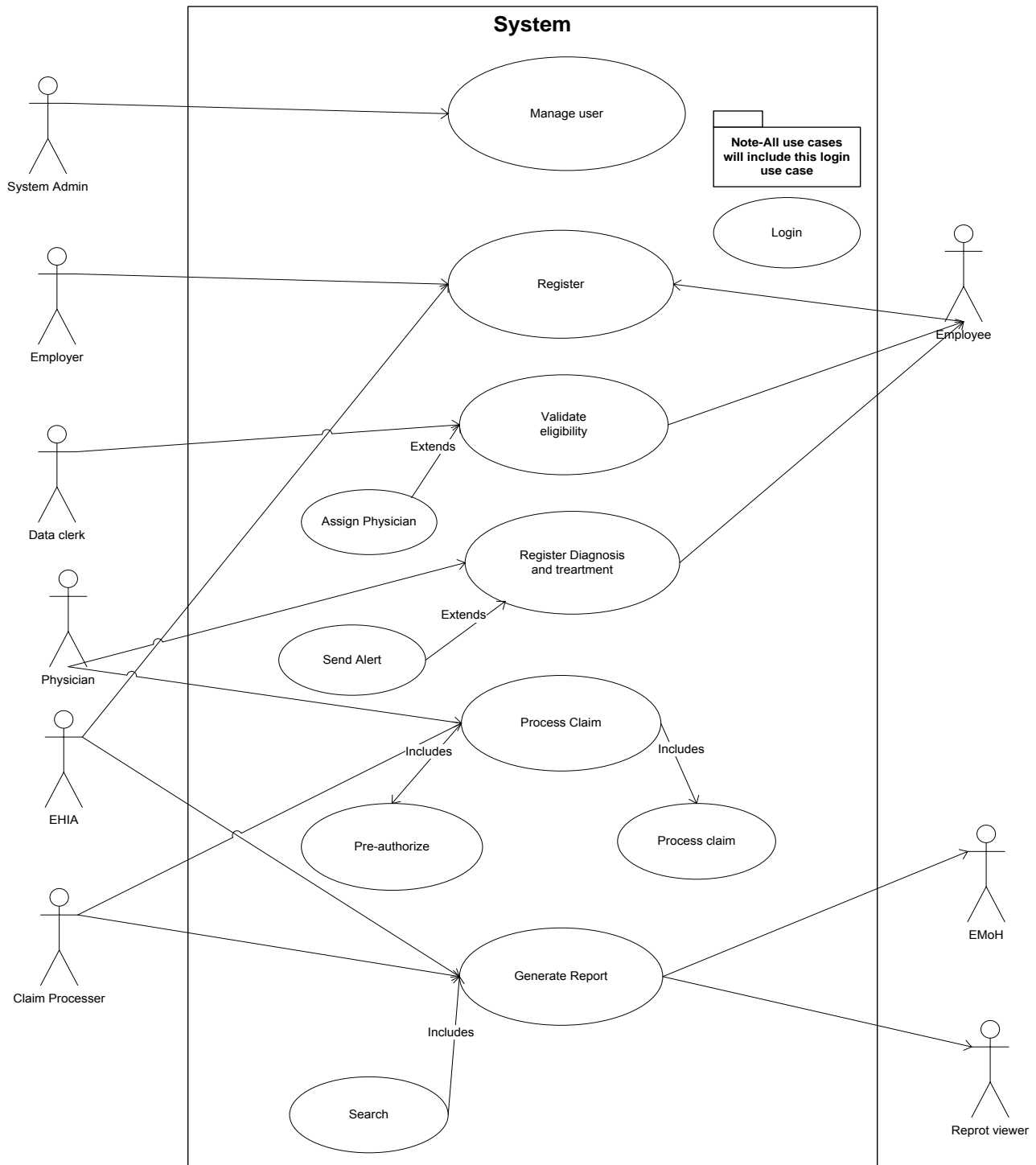


Figure 3: Use case diagram of the proposed system/web based social health information system, January to May 2016

The web based social health information system has a total of 10 use cases these are

1. Login
2. Manage user
3. Register employee
4. Register employer
5. Validate eligibility
6. Assign physician
7. Register diagnosis and treatment
8. Send alert
9. Process claim
10. Generate report

**Use case for login into the system**

Table 4 :- Login use case for the SHHIS , January to May 2016

Use Case ID	EHIA-1
Use Case Name	Login
Use case Description	Used to login into the system to obtain the different functionalities of the system
Primary Actor(s)	Ethiopian health insurance agency(the insurer), employee (Insured), physician, claim processor, report viewer, Ethiopian Ministry of health, Data clerk
Trigger	The user opens home page
Pre-condition	The user must have username and password
Post-condition	The user logs into the SHIIS system
Basic Scenario	<p>The use case starts when:</p> <ol style="list-style-type: none"> <li>1) The user initiate the SHIIS</li> <li>2) The SHIIS responds by presenting the home page</li> <li>3) The user selects the sign in options from the home page</li> <li>4) The SHIIS responds by presenting the login page</li> <li>5) The user inserts username and password in the login page.</li> <li>6) The system validates the user.</li> <li>7) The system brings the required interface that is allowed for that user</li> <li>8) The use case ends</li> </ol>

Alternative Scenario	<p>5. A. if the username or password is incorrect the system displays an error message “not registered ”</p> <p>5. B. if the user does not use the correct password the system will lock sown after five trial</p>
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### Use case for Registering Employer into the system

Table 5 :- Register Employer use case for the SHHIS , January to May 2016

Use Case ID	EHIA-2
Use Case Name	Register Employer
Use case Description	The Ethiopian Health Insurance Agency registers employers in different sectors to make them part of the social health insurance system
Primary Actor(s)	Ethiopian Health Insurance Agency
Trigger	The employers request to be get Social health insurance coverage for the employees and employees family of its own
Pre-condition	<ol style="list-style-type: none"> <li>1. The EHIA user must be logged into the system</li> <li>2. The EHIA user must be authenticated and authorized by its own assigned privilege</li> </ol>
Post-condition	<ol style="list-style-type: none"> <li>1. The employer data will be saved onto the database</li> <li>2. A specific employer ID will be generated</li> </ol>
Basic Scenario	<ol style="list-style-type: none"> <li>1) The System displays an employer registration home page</li> <li>2) The EHIA user selects the employer registration page</li> <li>3) The system displays employer registration form</li> <li>4) The EHIA user inserts the necessary information.</li> <li>5) The system checks for the data type whether they are in the correct format.</li> <li>6) The EHIA user clicks on the submit button or updates the filled information</li> <li>7) The system saves or stores the employer’s information onto the database.</li> <li>8) The EHIA user exits the system</li> <li>9) The use case ends</li> </ol>

Alternative Scenario	<p>2 .A. if the organization changes place, the EHIA user opens update Employer page</p> <p>2.B. The EHIA user inserts the update Information</p> <p>5. A. if wrong data type is inserted the system will notify to correct the information</p> <p>6. A. If the EHIA user skip the necessary information</p> <p>6. A.1 the system prompts an error message on the blank space</p> <p>7. A. if the employer is registered the system display “Registered” message</p> <p>7.B. if the employer is not registered the system display “Not Registered” message</p>
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### Use case for registering employee into the system

Table 6 :- Register Employee use case for the SHHIS , January to May 2016

Use Case ID	EHIA-3
Use Case Name	Register Employee
Use case Description	The employer registers employees of their own organization to enable them to be beneficiary of the social health insurance mechanism
Primary Actor(s)	The Employer Organization
Trigger	<ol style="list-style-type: none"> <li>1. The employee is employed in the organization</li> <li>2. The employee need of social health insurance service self and own family</li> </ol>
Pre-condition	<ol style="list-style-type: none"> <li>1. The employer organization must be logged into the system</li> <li>2. The employer organization must be authenticated and authorized by its own assigned privilege(user name and password)</li> <li>3. The employer organization must be registered by EHIA</li> <li>4. The employer organization must have its own unique employer identification number</li> </ol>
Post-condition	<ol style="list-style-type: none"> <li>1. The employee and employees family data will be saved onto the database.</li> <li>2. Specific employee ID and Insurance ID will be generated</li> </ol>
Basic Scenario	<ol style="list-style-type: none"> <li>1. The System displays an employee registration home page</li> <li>2. The Employer user selects the Employee registration option from the menu</li> <li>3. The system displays employer registration form</li> </ol>

	<ol style="list-style-type: none"> <li>4. The employer user inserts the necessary employees Information.</li> <li>5. The system checks for the data type whether they are in the correct format.</li> <li>6. The employer clicks on the submit button or updates the filled information</li> <li>7. The system saves or stores the employees information onto the database.</li> <li>8. The employer exits the system</li> <li>9. The use case ends</li> </ol>
Alternative Scenario	<p>4. A) if the employee has a family(children, spouse), the employer user opens register employer family form</p> <p>4.A.1) The employer inserts the family Information</p> <p>4.A.2) the employer user saves the data onto the employee database</p> <p>4. B) if the employee has no family the employer user registers no one on the employee family registration form</p> <p>5. A. if wrong data type is inserted the system will notify to correct the information</p> <p>6 A. if the employer wants to update employee information, the employer user opens update employer form</p> <p>6.A.1 The employer user inserts the employees update Information</p> <p>6.A.2 The employer user inserts the employee family update Information</p> <p>6 B. If the employer user skip the necessary information</p> <p>6. B.1 the system prompts an error message on the blank space</p> <p>7. A. if the employees is registered the system display “Registered” message</p> <p>7. B if the employees is not registered the system display “Not Registered” message</p>

**Use case for validation of user from the system**

Table 7 :- Validate system user use case for the SHHIS , January to May 2016

Use Case ID	EHIA-4
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Use Case Name	Validate user
Use case Description	The data clerk validates employee (insured's) insurance Identification number before allowing clients(insured's) to grant access to different health services
Primary Actor(s)	Data clerk
Trigger	Employee (insured's) of family of the employee (spouse and children aged less than 18 ) arrival at the health care setting to obtain health care service.
Pre-condition	<ol style="list-style-type: none"> <li>1. The data clerk must be employed in a registered employer organization</li> <li>2. The data clerk must be a Registered employee</li> <li>3. The data clerk must be logged into the system</li> <li>4. The data clerk must be authenticated and authorized by its own assigned privilege</li> <li>5. The employee(the Insured ) is registered</li> </ol>
Post-condition	The system validates the insured by its phone number and identification number
Basic Scenario	<ol style="list-style-type: none"> <li>1) The system displays Validate Client home page</li> <li>2) The data clerk selects Validate Client form</li> <li>3) The data clerk inserts an identification number or phone number on to the form.</li> <li>4) The system searches for the entered data from the database</li> <li>5) The system prompts result</li> <li>6) The data clerk exits the system</li> <li>7) The use case ends</li> </ol>
Alternative Scenario	<p>5.A. if the identification number or phone number is correct the system display "Eligible "</p> <p>5.B. The system proceeds to the Assign physician page.</p> <p>5.C. if the identification number or phone number is incorrect the system display "Ineligible "</p>

### Use case for Assigning physician in the system

Table 8 :- Assign physician use case for the SHHIS , January to May 2016

Use Case ID	EHIA-5
Use Case Name	Assign physician
Use case Description	The data clerk assigns the insured to the physician of a specific department in which the physician works in the health care setting
Primary Actor(s)	Data clerk
Secondary Actor (s)	The physician
Trigger	1. The employee(the Patient) is validated by the specific identification Number
Pre-condition	<ol style="list-style-type: none"> <li>1. The Data clerk must be logged into the system</li> <li>2. The Data clerk must be authenticated and authorized by its own assigned privilege</li> <li>3. The Data clerk must be working in the same organization with the physician</li> <li>4. The physician must be registered as an employee by the organization</li> </ol>
Post-condition	<ol style="list-style-type: none"> <li>1) The system assigns the employee(patient) to the physician</li> <li>2) The assigned Employee(patient) identification number is sent to the specific physician account</li> </ol>
Basic Scenario	<ol style="list-style-type: none"> <li>1) The system displays Validate Client home page</li> <li>2) The data clerk selects assign physician option form from the Validate Client home page</li> <li>3) The system opens assign physician form</li> <li>4) The data clerk selects the specific physician from the lists of departments and physicians</li> <li>5) The system asks the clerk to check the availability of the physician</li> <li>6) The system assigns the employee(patient) to the specific physician</li> <li>7) The specific employee (patient) appear in the specific physician account</li> <li>8) The system prompts result</li> <li>9) The data clerk exits the system</li> <li>10) The use case ends</li> </ol>
Alternative Scenario	<ol style="list-style-type: none"> <li>5.A if the physician is not available the clerk cancels the assignment</li> <li>6. If the employee(patient) is assigned to physician</li> <li>6.A.the system prompts "Assigned" message</li> </ol>

	<p>6. B . If the employee(patient) is not assigned to physician</p> <p>6.B.1.the system prompts “Not Assigned” message</p>
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**Use case for Registering diagnosis and Treatment**

Table 9:- Register diagnosis and treatment use case for the SHHIS , January to May 2016

Use Case ID	EHIA-6
Use Case Name	Register diagnosis and treatment
Use case Description	The system registers the full medical and clinical data of the employee
Primary Actor(s)	The physician
Trigger	The employee is in not heeling healthy
Pre-condition	<ol style="list-style-type: none"> <li>1) The physician is working in a registered organization</li> <li>2) The physician is a registered employee</li> <li>3) The employee(patient ) is eligible</li> <li>4) The employee(patient ) is assigned by the clerk to that physician</li> <li>5) The physician must be logged into the system</li> <li>6) The user must be authenticated and authorized by its own assigned privilege</li> </ol>
Post-condition	Registration of full clinical diagnosis and treatment information
Basic Scenario	<ol style="list-style-type: none"> <li>1. The system displays Social health insurance Service provider Account(physician account)</li> <li>2. The physician selects from the list of employee’s Insurance identification number.</li> <li>3. The physician clicks on process employee’s information option</li> <li>4. The system displays patient encounter form (clinical information registration).</li> <li>5. The physician inserts the necessary information into the patient encounter form</li> <li>6. The physician saves the data onto the employees database</li> <li>7. The physician exits the system</li> <li>8. The use case ends</li> </ol>

Alternative Scenario	<p>5. After the physician saves the data identification number of the employee employee's database</p> <p>5. A.1) The identification number of the employee will go to the claim processor's account database.</p> <p>5.B. if employees data is saved on to the employees database</p> <p>5.B.1 ) the system prompts "saved"</p> <p>5.B.2) if the system do not save the data on to the database the system prompts "Not saved"</p> <p>5.C) after saving the data onto the employees database the physician selects discharge option</p> <p>5.C.1) the system clears the identification number of the client from the list</p> <p>6. A) if the diagnosis and treatment to be provided is prohibited by the agency it will not be saved onto employee's database.</p> <p>6. B) if the employee encounters one of the vital events. The physician selects the vital event notification option menu.</p> <p>6. B.1) the system displays the vital event notification form.</p> <p>6. B.2) the physician selects the type of the vital event.</p> <p>6. B.3) The physician saves the data onto the employees database</p> <p>6. B.4) The system will apply the selected vital event change to the employee's data on employee's database.</p> <p>6. B.5) The physician exits into treatment and diagnosis home page</p>
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**Use case for sending Alert**

Table 10 :- Send alert use case for the SHHIS , January to May 2016

Use Case ID	EHIA-7
Use Case Name	Send alert
Use case Description	The system sends an alert message of reportable disease to the Ethiopian Ministry of Health
Primary Actor(s)	The physician
Secondary Actor(s)	The Ethiopian Ministry of Health
Trigger	The physicians finding from the list of reportable diseases
Pre-condition	<ol style="list-style-type: none"> <li>1. The physician is working in a registered organization</li> <li>2. The physician is a registered employee</li> <li>3. The employee(patient ) is eligible</li> <li>4. The employee(patient ) is assigned by the clerk to that physician</li> <li>5. Full registration of patient encounter form is done The physician must be logged into the system</li> <li>6. The user must be authenticated and authorized by its own assigned privilege</li> </ol>
Post-condition	The system send a notification of the finding of reportable diseases to the Ethiopian Ministry of Health
Basic Scenario	<ol style="list-style-type: none"> <li>1) The system displays patient encounter form home page</li> <li>2) The physician inserts the necessary data into diagnosis and treatments form</li> <li>3) The physician saves the data onto the database</li> <li>4) The physician selects diagnosis and finding option from the diagnosis and treatments menu</li> <li>5) The system opens diagnosis and finding form.</li> <li>6) The physician inserts the different clinical and physical diagnosis and finding the into diagnosis and finding form</li> <li>7) The physician selects the different reportable disease finding into reportable disease form from the list of reportable diseases</li> <li>8) The physician saves the data onto the database</li> <li>9) The system will send the report to the Ethiopian Ministry of Health account as an alert</li> <li>10) The physician exits the system</li> <li>11) The use case ends</li> </ol>

Alternative Scenario	<p>9.if the system send the reportable disease notification</p> <p>9.A ) the system prompts “Notification sent”</p> <p>9.B) if the system fails to send the reportable disease notification</p> <p>9.B.1 ) the system prompts “Notification Not sent”</p>
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### Use case for processing claim

Table 11:- Process claim use case for the SHHIS , January to May 2016

Use Case ID	EHIA-8
Use Case Name	Process claim
Use case Description	The physician after providing the necessary service will send all medical information to the claim processor with which the claim processor takes as an evidence to provide the claim decision.
Primary Actor(s)	The claim processor
Secondary Actor(s)	The Ethiopian health insurance Agency
Trigger	The Ethiopian health insurance Agency need the data for processing payment and store as an evidence.
Pre-condition	<ol style="list-style-type: none"> <li>1) The claim processor is working in Ethiopian health insurance Agency.</li> <li>2) The claim processor is a registered employee</li> <li>3) Full registration of patient encounter form is done</li> <li>4) The claim processor must be logged into the system</li> <li>5) The user must be authenticated and authorized by its own assigned privilege</li> </ol>
Post-condition	The Employee claim data is processed and decision be made on claim requests
Basic Scenario	<ol style="list-style-type: none"> <li>1) The system displays claim adjudication home page</li> <li>2) The claim processor selects pending claim authorization option from the menu</li> <li>3) The system displays pending claim authorization page</li> </ol>

	<p>4) The claim processor selects employees claim appearing by their social health insurance identification number.</p> <p>5) The claim processor selects the specific identification number</p> <p>6) The claim processor clicks on that specific identification number</p> <p>7) The system displays the full medical history of that employee</p> <p>8) The claim processor provides decision</p> <p>9) The claim processor exits the system</p> <p>10) The use case ends</p>
Alternative Scenario	<p>4. A.1 ) if the pending claim authorization is pre-authorization</p> <p>4. A.1.1) The claim processor selects employees claim ordered by their Social health insurance identification number.</p> <p>4. A.1.2)The claim processor selects the specific identification number</p> <p>4. A.1.3) The claim processor clicks on that specific identification number</p> <p>4. A.1.4) The system displays the full medical history of that employee</p> <p>4. A.1.5) The claim processor provides pre-authorization decision</p> <p>4. B.1 ) if the pending claim authorization is claim</p> <p>4.B.1.1) The claim processor selects employees claim ordered by their social health insurance identification number.</p> <p>4. B.1.3) The claim processor clicks on that specific identification number</p> <p>4. B.1.4) The system displays the full medical history of that employee</p> <p>4. B.1.5) The claim processor provides claim decision</p>

**Use case for managing user account claim**

Table 12 :- Manage user account use case for the SHHIS , January to May 2016

Use Case ID	EHIA-9
Use Case Name	Manage user account
Use case Description	The use case describes how the system administrator Activates, inactivates and provides privilege to the users of the system
Primary Actor(s)	System administrator
Trigger	For the users to access the different services based on their provided privilege
Pre-condition	<ol style="list-style-type: none"> <li>1. The System administrator must be logged into the system</li> <li>2. The System administrator must be authenticated and authorized by its own assigned privilege</li> <li>3. System administrator must be a registered user</li> <li>4. The system administrator must be part a registered employer</li> </ol>
Post-condition	Different user account information are managed
Basic Scenario	<ol style="list-style-type: none"> <li>1) The System administrator opens the system administrator home page</li> <li>2) The System administrator selects system administration page.</li> <li>3) The System presents the different users of the system.</li> <li>4) The system displays a new account creation form</li> <li>5) The System administrator checks staffs have a user account from the list of Identification numbers</li> <li>6) The System administrator fills the required forms</li> <li>7) Click submit button to save the data</li> <li>8) The system creates account that is the system provides privilege to use the system</li> <li>9) The system validates and confirms the inserted data</li> <li>10) The use case ends</li> </ol>
Alternative Scenario	<ol style="list-style-type: none"> <li>6. A) if the system administrator wants to update system user data</li> <li>B) selects the identification number of the user</li> <li>C) The system administrator changes the information of the user</li> <li>D) the system administrator updates the needed data</li> <li>E) the system administrator clicks update</li> <li>F) the data will be saved onto the database</li>   <li>8. A) if the system administrator wants to deactivate the user</li> <li>B) click on the identification number of that user</li> <li>C) The system displays the information of the user</li> </ol>

	<p>D) the system administrator clicks on the user Inactivate button  E) the system will inactivate the user from the database  F) the data will be saved onto the database</p> <p>8. if the primary password mismatches with the confirmation password</p> <p>A) the system notifies the passwords mismatch  B) the system lets the user to reinsert password</p> <p>9. If the system administrator skip the necessary information</p> <p>A.1 the system prompts an error message on the blank space</p> <p>A.1.1) if the information is updated the system display “Updated” message</p> <p>A.1.2) if the information is not updated the system display “Not Updated” message</p>
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**Use case for generating report**

Table 13 :- Generate Report use case for the SHHIS , January to May 2016

Use Case ID	EHIA-10
Use Case Name	Generate Report
Use case Description	The use case describes the generation of report from the system by the privileged viewers of the report
Primary Actor(s)	MOH, EHIA,
Trigger	The report viewer request to generate report
Pre-condition	<ol style="list-style-type: none"> <li>1. The prerecorded data must exist on the database</li> <li>2. The prerecorded data have a content of report viewer data need.</li> <li>3. The report viewer must have the security access grant to the type of data he/she can see</li> <li>4. The user must be authenticated and authorized by its own assigned privilege</li> <li>5. The report viewer must be logged into the system</li> </ol>
Post-condition	<ol style="list-style-type: none"> <li>1. Report is generated based on the need of the report viewer</li> </ol>

	2. The generated report information is saved and stored in the database
Basic Scenario	<ol style="list-style-type: none"> <li>1) The report viewer opens the view report home page</li> <li>2) The report viewer selects the generate report menu.</li> <li>3) The system presents the list of available reports types.</li> <li>4) The report viewer selects the report of his/her need</li> <li>5) The system presents the description of that report</li> <li>6) The report viewer confirms the report if it is what he/she needs</li> <li>7) The system generates the selected report</li> <li>8) The system displays the selected report on the users screen</li> <li>9) The system saves the report onto the database</li> <li>10) The report viewer click on print button to print the generated report</li> <li>11) The use case ends</li> </ol>
Alternative Scenario	<ol style="list-style-type: none"> <li>7 A) The system displays the available options of report type</li> <li>7 A.1) The report viewer select one or more sifting criteria from the options <ol style="list-style-type: none"> <li>7.A.1.1) if there is no data match with report viewers request</li> <li>7.A.1.2) The system prompts no matching data found</li> </ol> </li> <li>8. A.) if the user wants to have the report in different format <ol style="list-style-type: none"> <li>8.A.1) The report viewer click on the export report button</li> <li>8.A.2) Select the file type of the report</li> </ol> </li> </ol>

### 4.7.7 Class Diagram

Class diagram is an integral part of the unified modeling language. This diagram shows the object classes in the system and the associations between these classes. Class diagrams are used when developing an object-oriented system model to show the classes in a system and the associations between these classes. It can be used as to provide a general overview of the system objects and their interactions. An association is a link between classes that indicates that there is a relationship between these classes. Consequently, each class may have to have some knowledge of its associated class (attribute) and the actions that class performs (operations). These attributes, operations are found together in a single block of box during the designing of the class diagram [86].

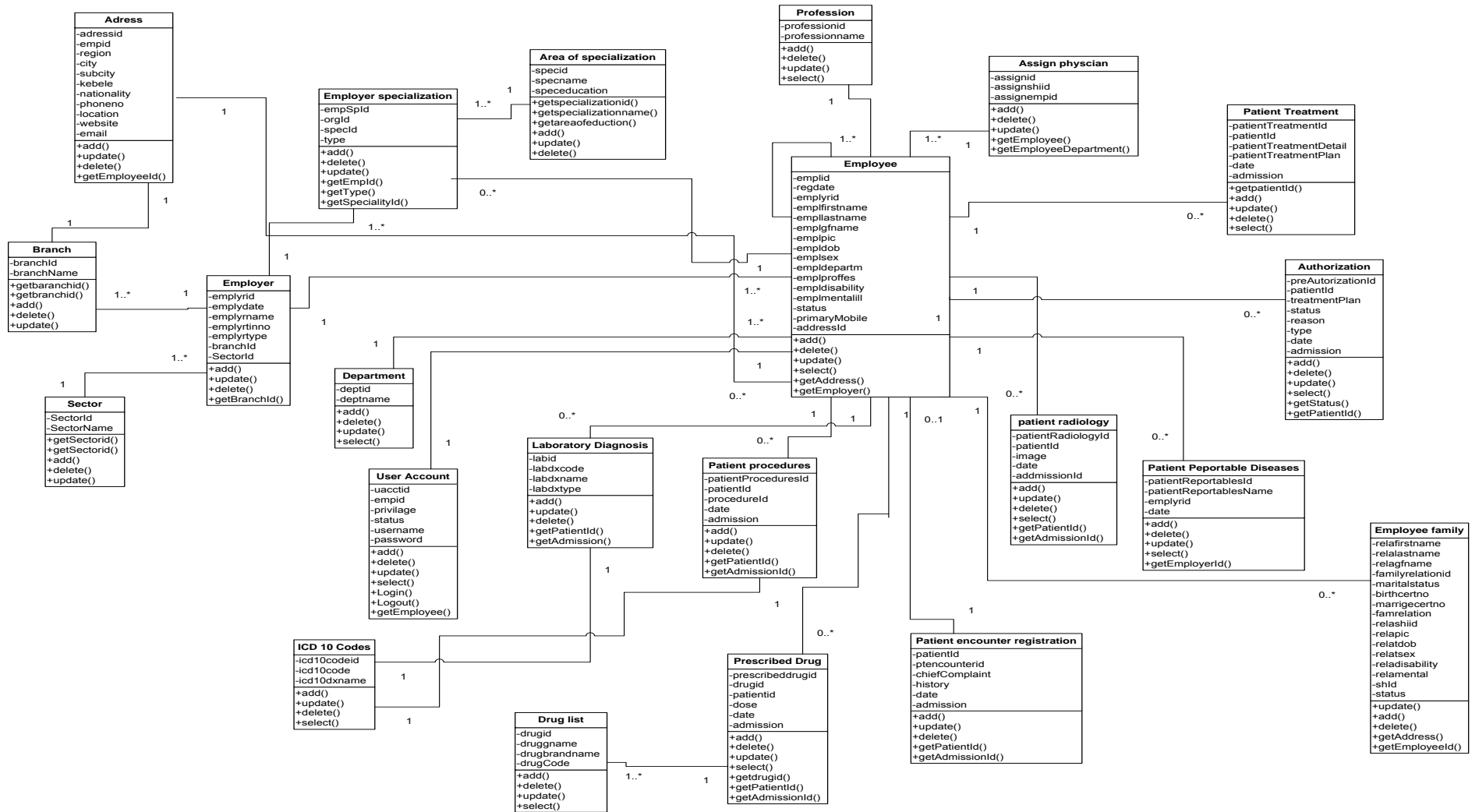


Figure 4 :- Class diagram for the web based Social Health Insurance information system for the SHHIS , January to May 2016

## 4.7.8 Sub System Description

In order to make the understanding of the system easier and clear the whole system can be easily broken down into the subsystems. These subsystems categorize those functionalities which have the same purpose into one group or category.

### **Interface subsystem**

The newly designed web based Social health insurance information system has a total of nine basic interface subsystems and eight interfaces which are part of the basic interfaces subsystems. The basic interface and their parts subsystems include

**Login interface** This user interface is responsible for providing the authentication and authorization of the users to the different functionalities that the system provides.

**Registration interface** This user interface enables the user to save and insert different important demographic, clinical and personal data onto the database so that they can be used to the different decision and information processing needs. On the system there are four registration forms each having their own independent functionalities they provide to the system these are.

**Employee Registration interface** Enables the employer to register the employee's demographic and personal data.

**Employee family Registration interface** This user interface enables the employer to register the family members of the employee during the registration of the employee

**Employer Registration interface** This user interface enables the Ethiopian health insurance agency to register the different employers that the employees works at.

**Diagnosis and treatment Registration interface** enables the physician to register the different diagnosis and treatments that are given to the employee during the visit of the employee to the physician office

**Update interface-** enables the different users of the system to add or delete the data of the employee and employer.

**View interface-** enables the different users of the system to view the different data of the employee and employer.

**Manage user account interface-** enables the system administrator to provide various privileges that the user needs and also it helps the system administrator to enable or disable the users in the system.

**Claim processing interface**-enables the claim processor to view the different claims and pre-authorization requests that are sent by the physician after providing the different care and treatment procedure. In addition to these the claim processing user interface enables the claim processor to provide the different claim and pre-authorization decisions with reasons that are important to the insurance service provision.

**Validate employee interface**- enables the data clerk to check the eligibility of the employee that is whether that employee is registered or not on the database to have an insurance service.

**Assign physician interface**- enables the data clerk to assign the employee which is validated by the system during care provision to the different physicians that are working in the different departments in the health care setting.

**Account interface**-enables the assignment of different users in the system process data according to their privilege.

**Employee Account interface**- enables the employee to see the various clinical and diagnostic data that he/she had previously.

**Employer Account interface**-enables the employer to view the different employees that are registered on that employer organization

### 4.7.9 Sequence Diagram

It is one of the unified modeling language, system designing tool. The sequence diagram majorly shows the interactions between actors and the system and between system components. The UML has a rich syntax for sequence diagrams, which allows many different kinds of interaction to be modeled. Besides its use of showing the interaction, Sequence diagram also shows the sequence of interactions that take place during a particular use case or use case instance. Sequence diagram employs different representation for the objects and the sequence or time interaction. The objects and actors involved in a particular use case or scenario are along the top of the diagram, with a dot-ted line drawn vertically from these. Interactions between objects are indicated by annotated arrows. The rectangle on the dotted lines indicates the lifeline of the object concerned (i.e., the time that object instance is involved in the computation) [85,86].

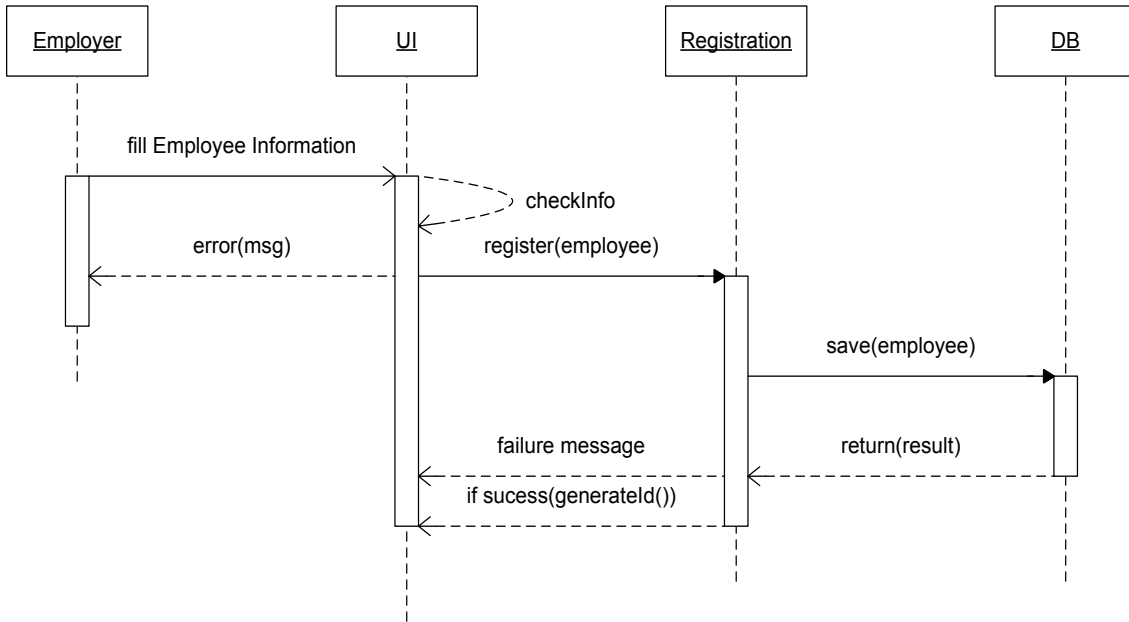


Figure 5 :- Sequence Diagram for SHIIS register employee , January to May 2016

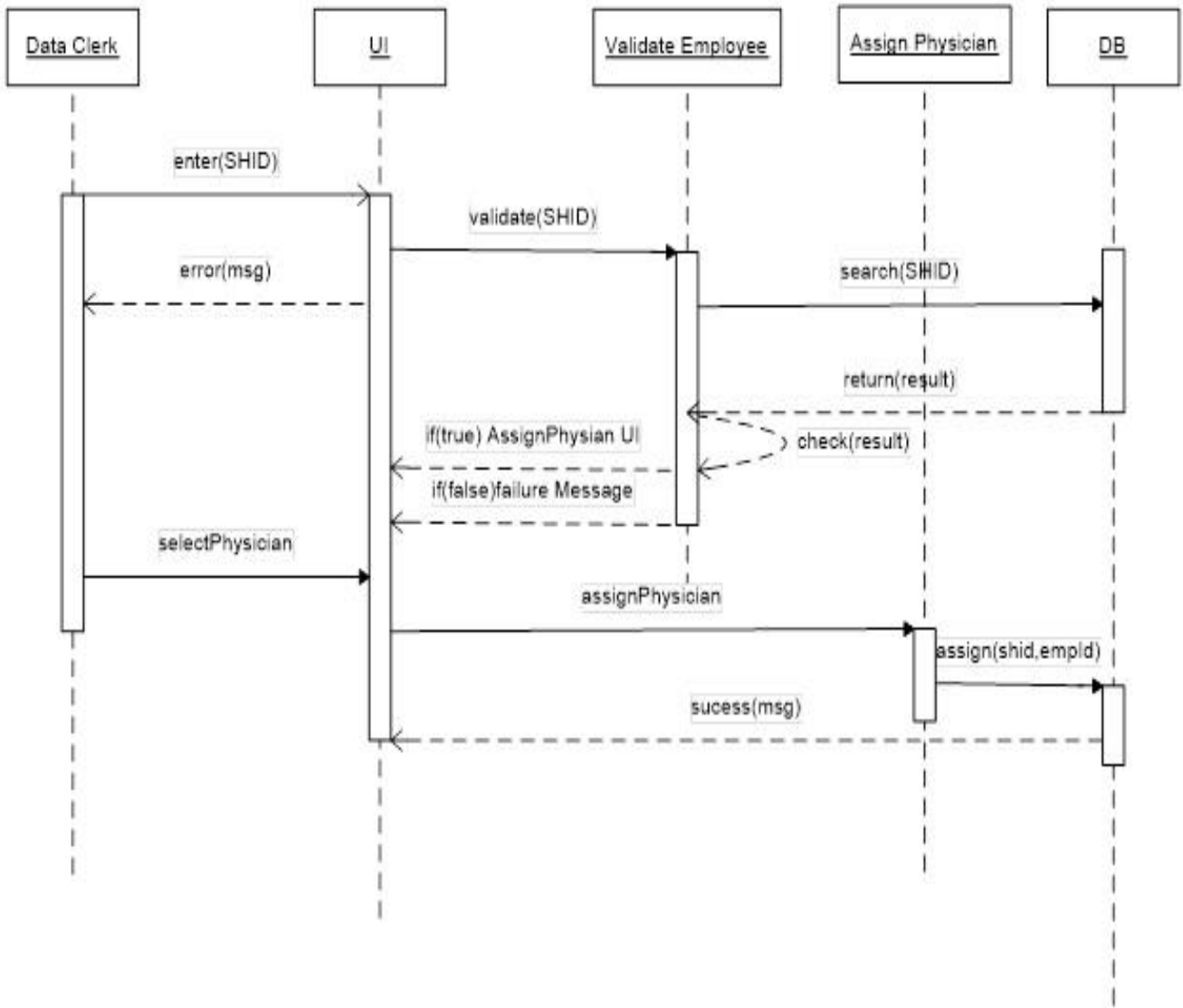


Figure 6 :- Sequence Diagram for SHIIS Validate employee and assign physician, January to May 2016

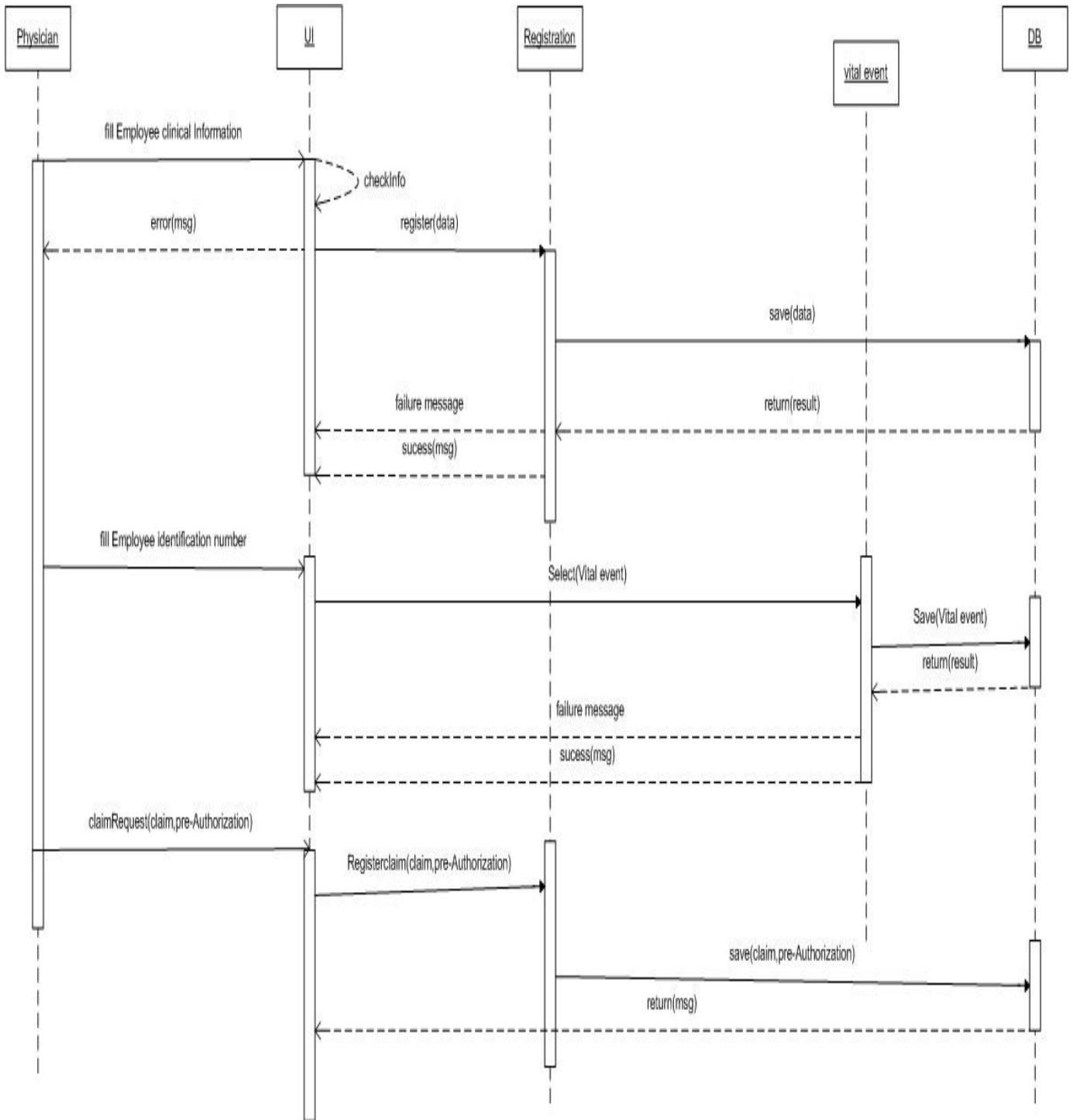


Figure 7 :- Sequence Diagram for SHIIS register diagnosis and treatment, January to May 2016

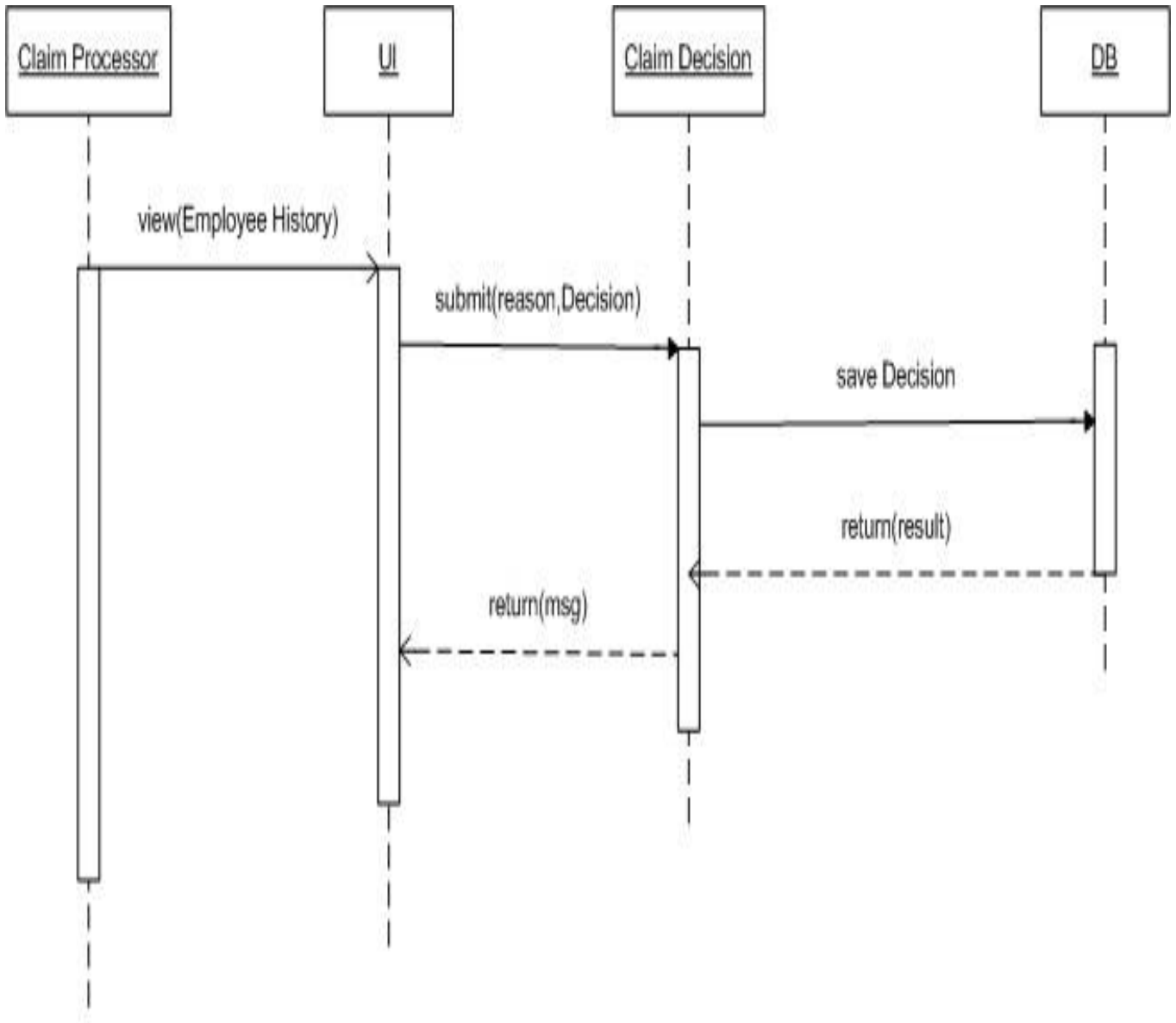


Figure 8:- Sequence Diagram for SHIIS claim decision , January to May 2016

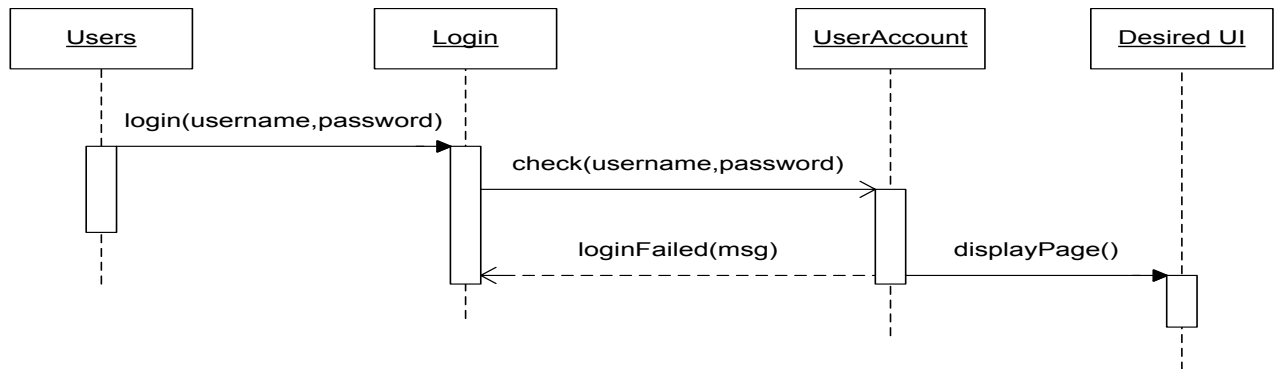


Figure 9 :- Sequence Diagram for SHIIS Login, January to May 2016

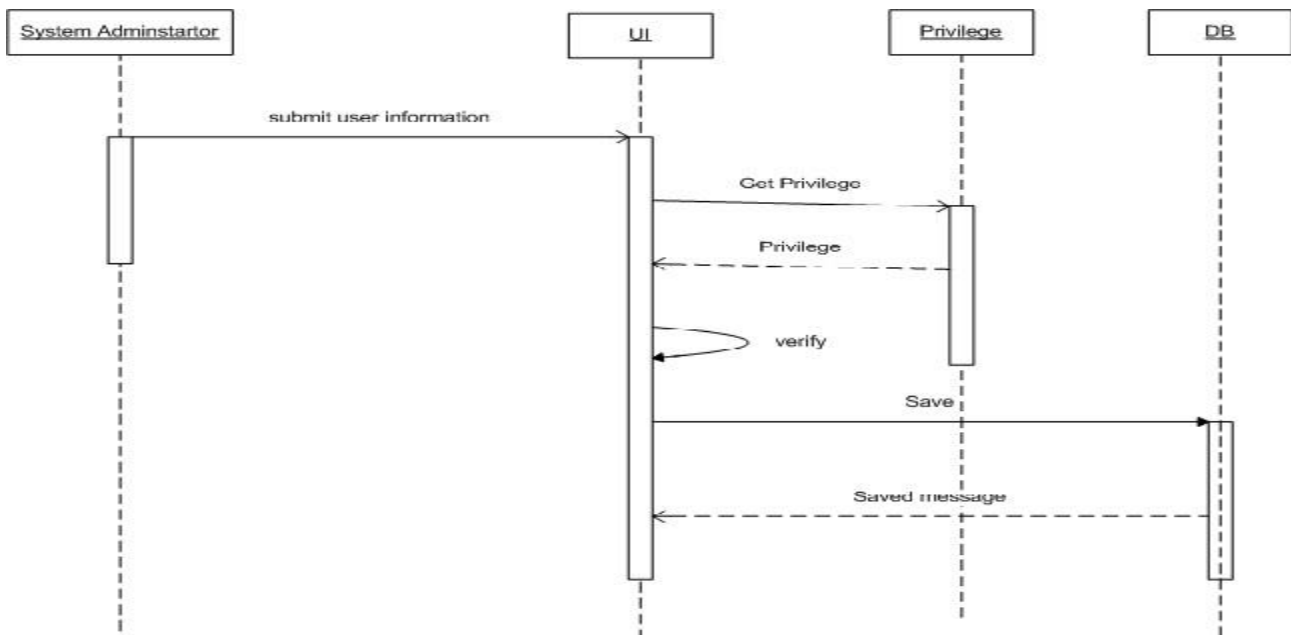


Figure 10 :- Sequence Diagram for manage user SHHIS , January to May 2016

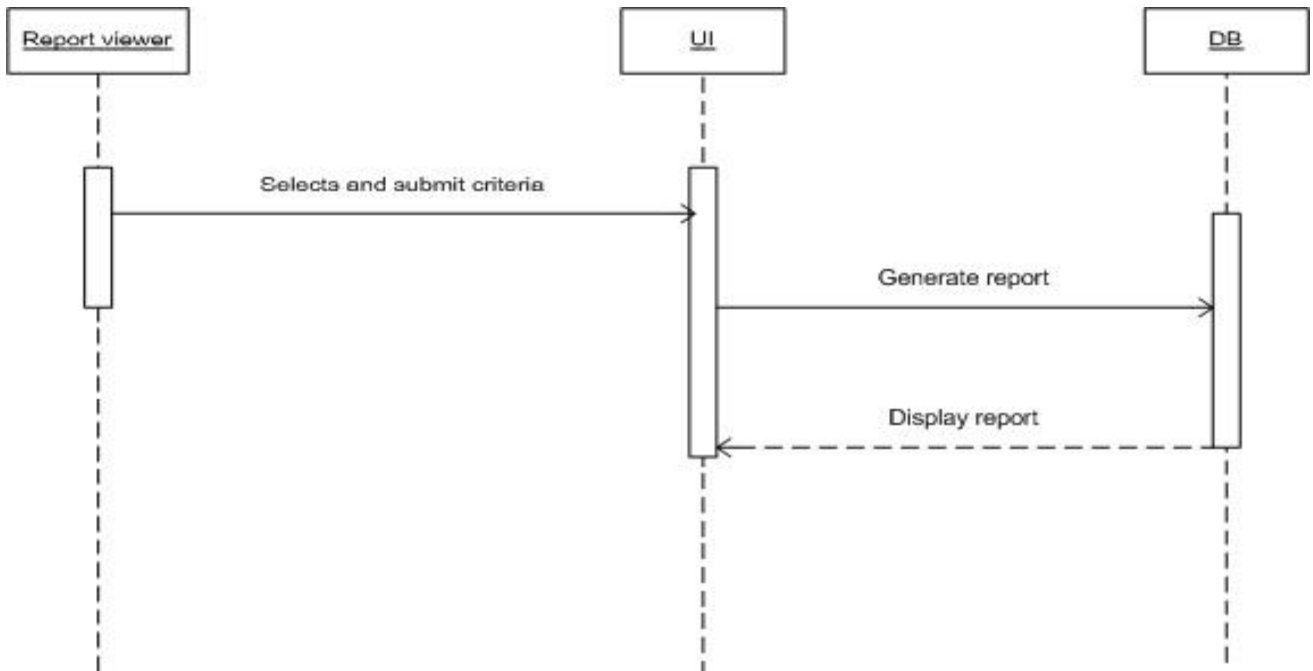


Figure 11 :- Sequence Diagram for generate report for the SHHIS , January to May 2016

## 4.8 The Proposed System Architecture

Health insurance data are important sources of various critical information in a health care. Information that differ in content and size. They are accessed and saved onto the databases and data warehouses on a regular basis for the purpose of reveling different social and health matters. The accessibility of these secured information should differ based on the need and the authority of the personnel trying to access it [87].

Social health insurance information system has its interrelated components working together for the common goal of achieving to the full performance of a given task. Systems and technologies are integrated with one another within an organization and outside of it to enable smooth working condition. The degree to which systems and technologies interface within and outside organizations and agency computer systems varies with the need and the type of task designated. These different informational needs and process are described in information system architecture.

Architecture is a process by which stakeholders needs and concerns are captured. Information systems architecture is used to implement the key elements and relationships that make up an organization. For the successful implementation of the Enterprise architecture, information system facilitating the communication between the building blocks and showing how the building blocks fit together is necessary[88].

While designing a web based application it is desirable to separate the web server from the dataset and the user should be easily located in its working environment. Because of its ability to incorporate afore mentioned concerns three tiered information system architecture is preferable. The health sector has a complex nature which needs different standards and involves various stakeholders. These stakeholders are geographically differing and have different informational needs. They need information from those differing locations with various protocols and data definitions and data structures. The database layer (data tier) (which contain data model, metadata dictionary, and standard diseases classifications), applications layer (software applications, user interfaces) and technical or presentation layer (hardware platforms local and wide area networks) are needed to address the stakeholder's requirements in the three tier information system architecture [89].

The proposed system as it involves web based information transaction, retrieval and processing that can be implemented using a web browser on any device that has an access to the internet; thus the system uses a three tier system architecture. These three tiered system architecture will run on a web technology. The proposed web based technology provides a great scalability, portability, increased efficiency, reusability with ease of maintenance during anomalies. The system has a dynamic nature thus the retrieval and entry of data can be performed whenever possible irrespective of time and geographic constraint. Each tier for the proposed system is designated to handle its own determined task.

## **The Proposed Front Tier (Web Browser)**

The system involves participants that need to access and retrieve various data from various locations and devices. The advantage of web applications can be used to make the availability of the services throughout the country. Besides the scalability of the web applications on the front end, a number of users can be served at the same time from the same or different locations. This issue depends on the capacity of the server, speed of the internet and processing speed of the computer

From the various web protocols HTTP and HTTPS are already built in most computers web browsers. As these tier is the front end with which the users get access to the system through the web protocols they need a serious security controls. The different stakeholders in the system are assigned with different privilege to access functionalities of the system. This is made by varied credentials to each user according to the type of stakeholder group assigned. The assignment of the grouping is made by the type of functions each user is engaged with and the informational need of each user. In order to address this secured communication, information transaction and authentication the use of certificates and secure socket layer connection that controls and encrypts information exchange between the front and the middle tier is we propose.

## **The Proposed Middle Tier (Web Application Server or Web Server)**

The middle layer of the system holds the business logic and the rules in which the system has to perform in accord. The web application layer holds all the applications codes that make possible the communication between the database and the front end. In this layer most of the application logic and translates clients processing needs into database queries and brings databases responses with regard to the informational and data need of the user. It act as a bridge between the user and the database and functionalities' the user needs from the system. The client's validation, user account checking and the various queries that are found on the Social health insurance information system are found on this layer.

## **The Proposed the Back End Tier (Database layer)**

The third end or the back end layer of the system stores and provides the different data that are required for the full functionalities of the system. In this layer the different data that are collected via registration, patient clinical data, demographic data and different employment and financial data are stored and used for retrieval.

The SHIIS can be adoptable to the four tier architecture. This is applicable, whenever to the system there is a need to scale down the system, add extra additional nodes, device-tailored experiences or both internal services and applications as well as 3rd-party services. The major functionalities that the system provides are gathered in a modularity basis. This creates an opportunity for the system to adoptable to the new advancing four tier technology.

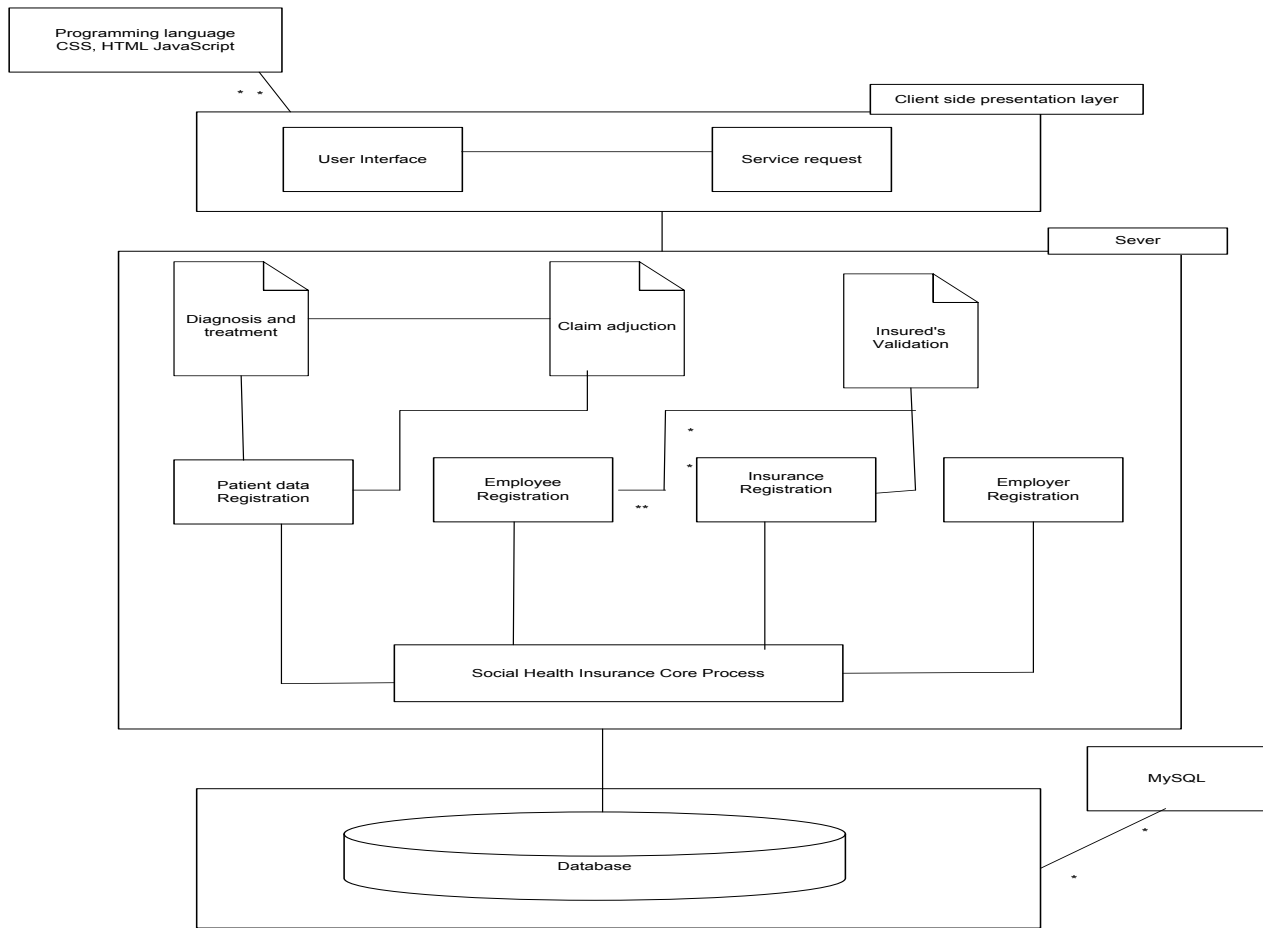


Figure 12 :- Proposed web based Social health insurance Three tier information system for the SHHIS , January to May 2016

### 4.8.1 User Interface Prototyping

A prototype is a working model that does not normally have all the required features or provide all the functionality of the final system. The main purpose of developing a prototype database system is to allow users to use the prototype to identify the features of the system that work well, or are inadequate, and if possible to suggest improvements or even new features to the database system. In this way, we can greatly clarify the users and developers of the system and evaluate the feasibility of a particular system design [90].

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. The below

diagram provides an architectural view of how each users in the system is allowed to use and access different functionalities and data entry usage based on their own administrator assigned privilege

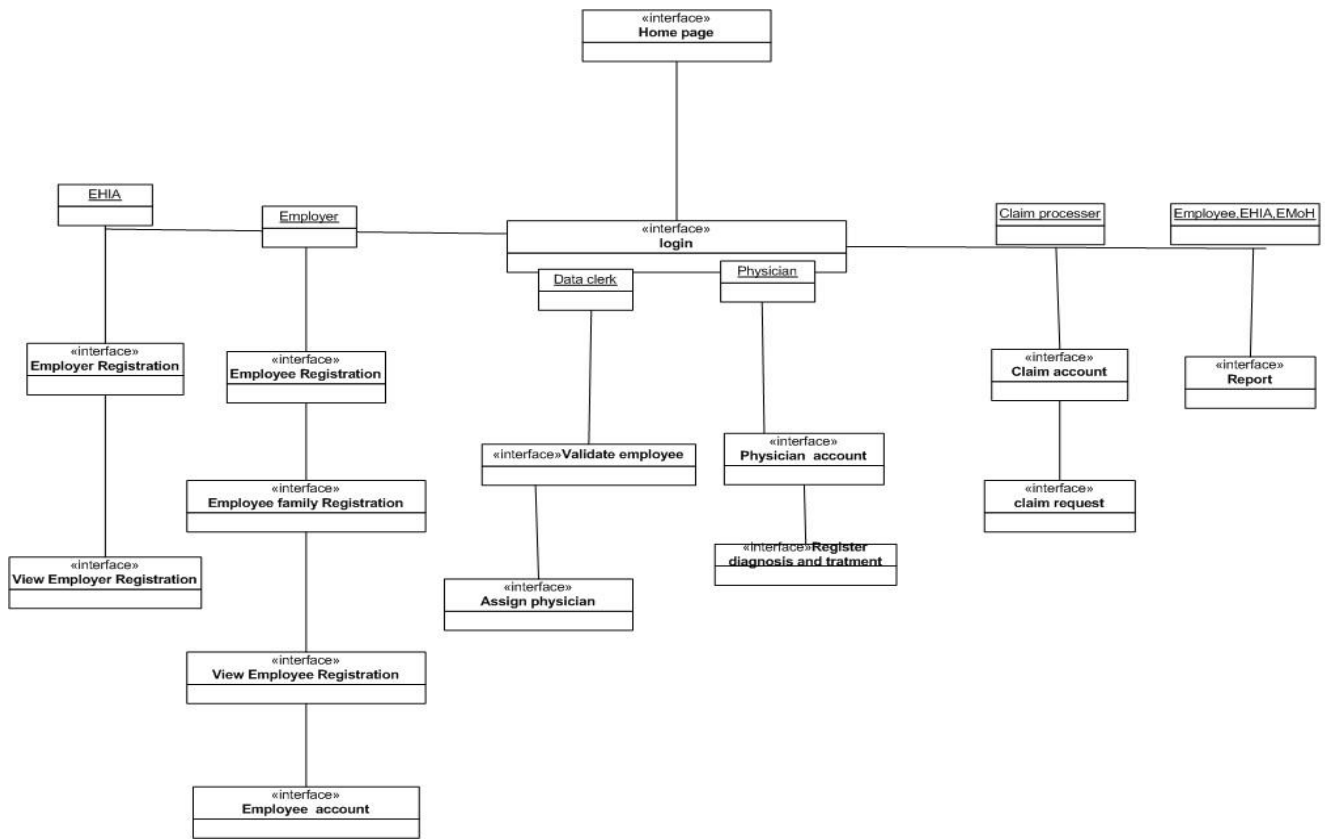


Figure 13 :- User interface flow diagram for web based social health insurance information system , January to May 2016.

## User Interfaces of the Web based Social Health Insurance Information System

The first user interface the actors of the system will obtain the home page prior to getting access to the different pages and functionalities.



Figure 14 : Home page user interface for SHIIS, January to May 2016

The home page provides the different information about the services, locations and various hyperlinks that the EHIA has. The hyperlinks that are found at the top, each one of them lead to different locations and provide different functions. Most importantly in order to get the required services from the system the user must login into the system thus the user have to click on the **Sign In** button



Figure 15 :- The login user interface for SHIIS , January to May 2016

This user interface is a gate way to the different functionalities of the system. Each user before logs into the system must have the appropriate password and user name and privilege assigned by the administrator of the system.



# Social Health Insurance System Administration Form



Date	<input type="text" value="05/20/2016"/>				
Name	<input type="text"/>				
Privilage	<input type="text"/>				
Username	<input type="text"/>				
Password	<input type="text"/>				
Confirm Password	<input type="text"/>				
Status	<input type="text" value="Active"/>				
<input type="button" value="Create"/>					
	Name	Privilage	Username	Status	
	Abebe Bekele Alemu	EHIA	EHIA		
	Abebe Bekele Alemu	Employer	Employer		
	Abebe Bekele Alemu	Clerk	Clerk		
	Abebe Bekele Alemu	Physician	Doc		
	Abebe Bekele Alemu	Admin	admin		
	Abebe Bekele Alemu	Claim-Processor	cl		
	Abebe Bekele Alemu	Clerk	ne		

Figure 16 :- System administration user interface for SHIIS, January to May 2016

The system administration user interface is used to provide the different users of the system their respective user privilege. Thus the users can access the different functionalities that are required from the system according to their job assignment and responsibility.



**Social Health Insurance Organization  
Registration Form**

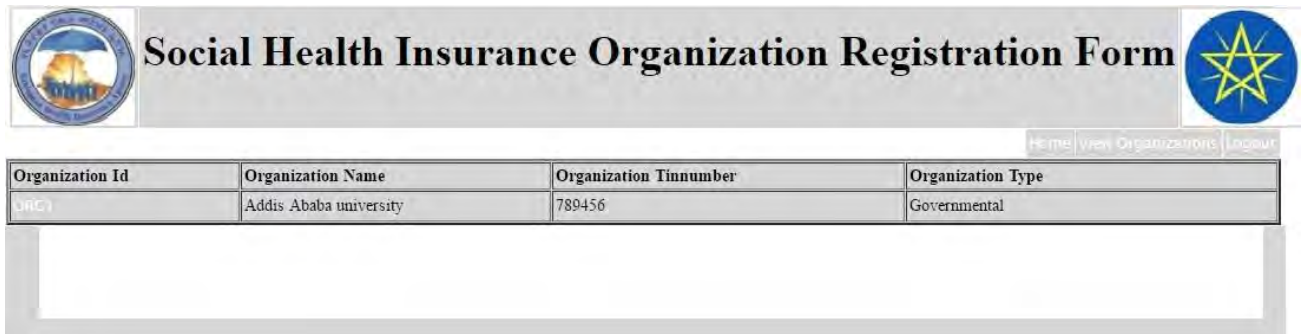
[View status](#) | [Logout](#)

<b>Organization ID</b>	ORG2	<b>Date</b>	05/20/2016
<b>Organization Name *</b>		<b>Tin Number *</b>	
<b>Area of specialization</b>	<input type="text"/> Add *	<b>Insurance Branch</b>	<input type="text"/> *
<b>Organization Type</b>	<input type="text" value="Governmental"/> * Governmental Private Non-Governmental		
<b>Region *</b>	<input type="text"/>	<b>City</b>	<input type="text"/>
<b>Sub-city *</b>	<input type="text"/>	<b>Kebele</b>	<input type="text"/>
<b>Phone number *</b>	<input type="text"/>	<b>Location</b>	<input type="text"/>
<b>Website</b>	<input type="text"/>	<b>E-mail</b>	<input type="text"/>

Please fill the mandatory fields with \*

Figure 17 :- User interface for Employer registration SHIIS, January to May 2016

The user interface of the employer registration provides a registration functionality to the EHIA so that the agency could know which organization is working in which area and the major specializations and the branch in which that organization is functioning with the employer organization address.



**Social Health Insurance Organization Registration Form**

[Home](#) | [View Organizations](#) | [Logout](#)

Organization Id	Organization Name	Organization Tinnumber	Organization Type
ORG2	Addis Ababa university	789456	Governmental

Figure 18 :- User interface for view Employer registration SHIIS, January to May 2016



# Social Health Insurance Organization Registration Form



[Home](#) | [View Organizations](#) | [Logout](#)

Organization ID	ORG1	Date	06/01/2016
Organization Name	Addis Ababa university	Tin Number	789456
Area of specialization	<input type="text"/> Add	Insurance Branch	<input type="text"/>
Organization Type	Governmental		
Address			
Region	<input type="text"/>	City	<input type="text"/>
Sub-city	<input type="text"/>	Kebele	<input type="text"/>
Phone number	<input type="text"/>	Location	<input type="text"/>
Website	<input type="text"/>	E-mail	<input type="text"/>
<input type="button" value="Update"/>			

Figure 19 :- User interface for view and update Employer registration SHIIS, January to May 2016

This user interface enables the EHIA to update and view any information regarding the employer organizations. Thus any change regarding address, name or any other information of the employer is handled by using this interface



# Social Health Insurance Employee Registration Form



Employee Registration | Employee Profile | Employee View | Logout

Employee ID	EMP4	Date	06/03/2016
Employer ID *			
Primary Mobile *		Insurance ID	EHIA4
First Name *		Last name	
Grand Father name		Employee Picture	
Date of Birth	mm/dd/yyyy	Sex	Male ▾
Department *	▾	Profession *	▾
Area of specialization	▾ Add *		
Disability	Yes No	Mental illness	Yes No
Username *		Password: *	
Address			
Region *		City *	
Sub-city		Kebele	
Nationality			
Secondary Phone number		E-mail	
Submit			

Please fill the fields with \*

Figure 20 :- User interface for Employee registration SHIIS , January to May 2016

This user interface is used to insert the basic and necessary data about the employee which works at a specific registered employer organization. Each employee after registration will have his own automatically system generated identification number. Every employee in order to be eligible to the insurance services he/she should be registered by using this form. By using this interface the employer provides the appropriate username and password to the employee that will provide entry of the employee to access the system.

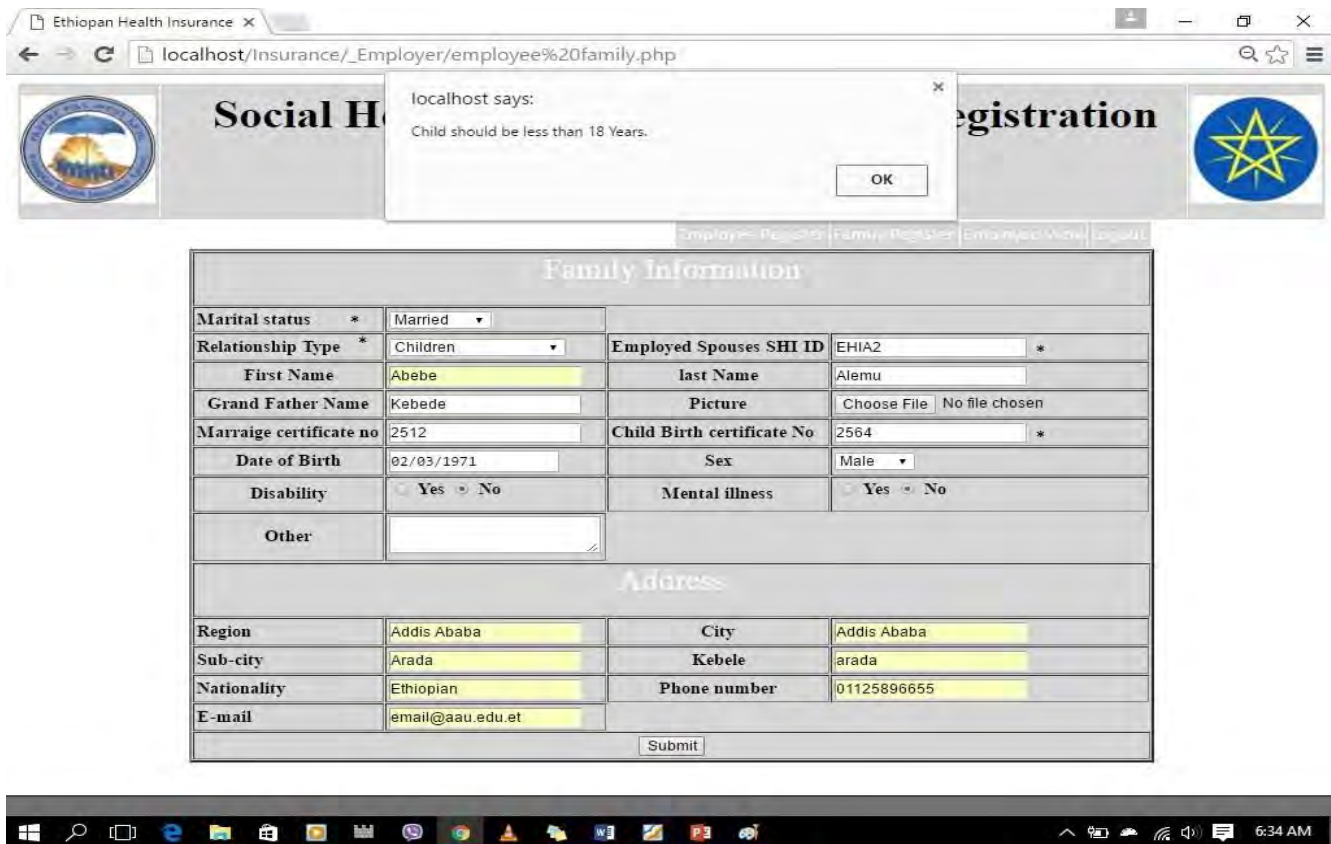


Figure 21:- Employee family registration user interface for SHIIS, January to May 2016

The registered employee may have spouse and children who are under the age of 18. According to the 2001 proclamation of the EHIA all family members that is spouse or children who are under the age of 18 should be registered in order to be able to use the different insurance services provided by EHIA. This user interface verify if the user is under the age of 18 and also registers the birth and marriage certificate of the user with other necessary information.



Figure 22 : - View employee information user interface SHIIS, January to May 2016

Each employee after being registered appears on this form thus the employer easily can see the employee and be able to update data and various information of that specific employee.

The screenshot shows the 'Social Health Insurance Employee Registration Form' interface. At the top, there are two logos: a circular one on the left and a star-shaped one on the right. Below the title, there are navigation tabs: 'Employee Register', 'Family Register', 'Employee View', 'Employee Work', and 'Logout'. The main content area contains a form with the following fields:

Employee ID	EMP2	Date	0000-00-00
Primary Mobile	91355555		
First Name	Abebe	Last name	Bekele
Grand Father name	Alemu	Employee Picture	
Date of Birth	05/11/2016	Sex	Male
Department		Profession	
Area of specialization	MCH		
Disability	Yes No	Mental illness	Yes No
Username	Employer	Password:	***
Address			
Region		City	
Sub-city		Kebele	
Nationality			
Secondary Phone number		E-mail	

An 'Update' button is located at the bottom of the form.

Figure 23: - View and update employee user interface for SHIIS, January to May 2016

This user interface enables the employer to handle a change regarding the basic demographic and personal data of the employee. Additionally any change regarding the employee family like divorce, new marriage is handled using this interface

The screenshot shows the 'Social Health Insurance Employee Registration Form' interface for family information. At the top, there are two logos: a circular one on the left and a star-shaped one on the right. Below the title, there are navigation tabs: 'Employee Register', 'Family Register', 'Employee View', and 'Logout'. The main content area contains a table with the following data:

Full Name	Relation Type	Picture
Abebe	Spouse Employed	
Abebe Alemu	Children	
Abebe Alemu	Children	
Abebe Alemu	Children	
Abebe Alemu	Children	

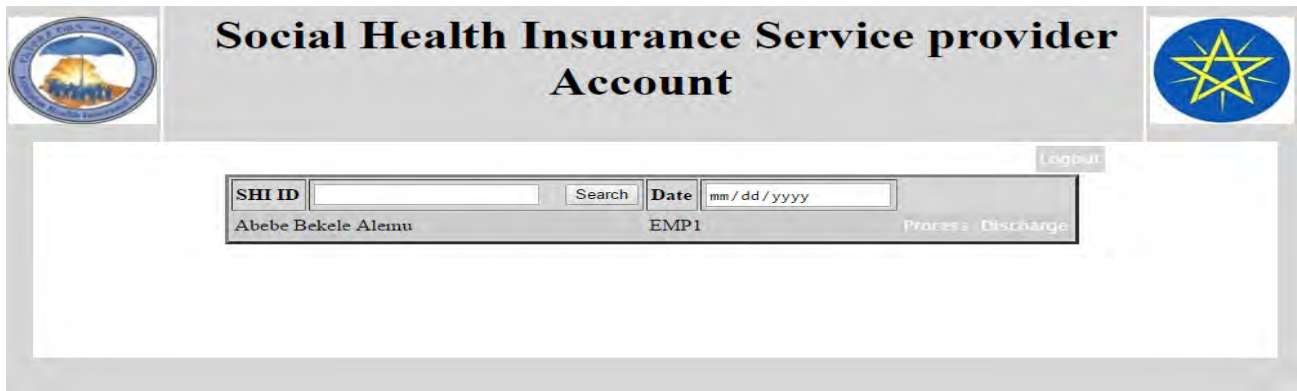
Figure 24: - View and update employee family information user interface for SHIIS, January to May 2016

Figure 25 : - Validate employee user interface for SHIIS, January to May 2016

The validation of the user is an essential and integral process in provision of insurance service and to make sure the correct membership of the registered employees at the healthcare setting. These user interface provides a user authentication access to the database upon the employee arrival at the health care setting to get health care services.

Figure 26 : - Assign physician user interface for SHIIS, January to May 2016

The data clerk after validating the employee assigns the employee to the specific physician who is working at the specific health care setting in which the clerk works at. This minimizes the time that the users spend on queue waiting for the available physician on the different departments in the healthcare settings

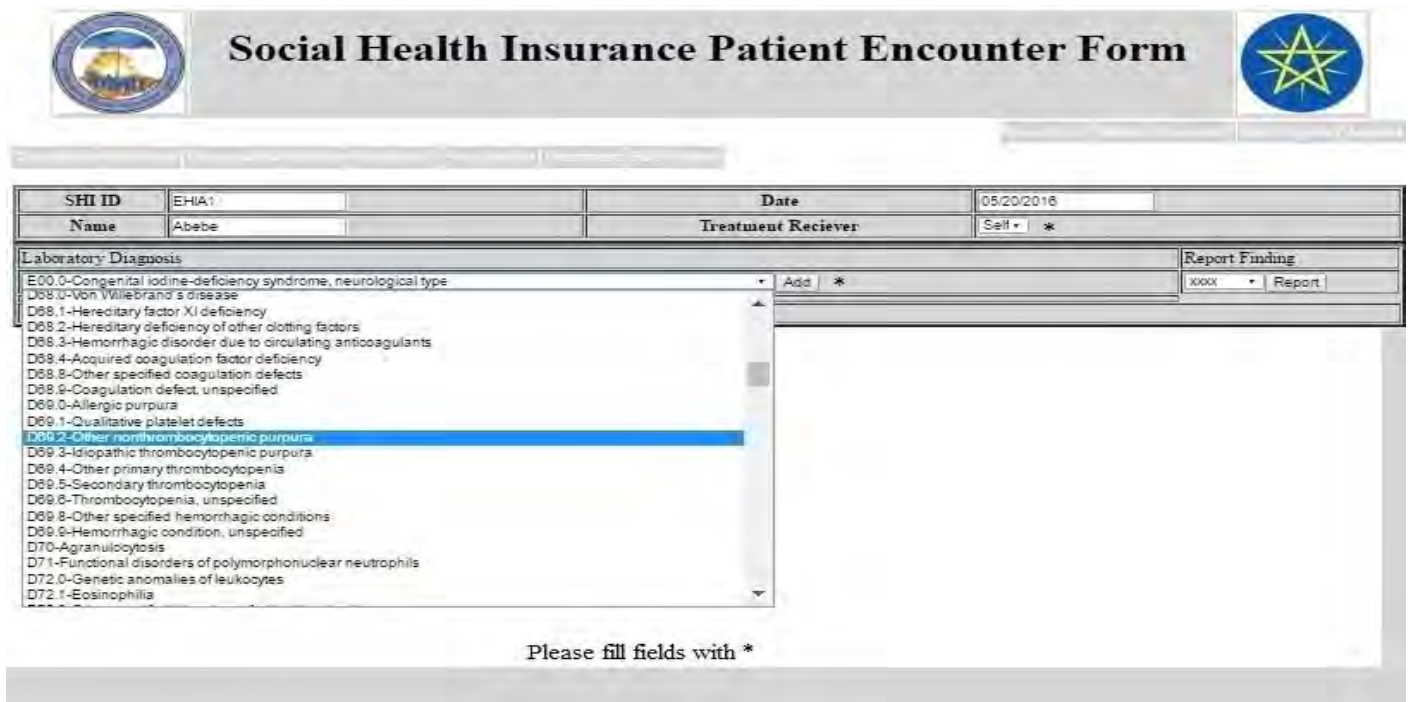


The interface features a header with two logos: the Ethiopian Social Security Agency logo on the left and a yellow star logo on the right. The main title is "Social Health Insurance Service provider Account". Below the header is a search bar with the following fields:

SHI ID	<input type="text"/>	Search	Date	<input type="text" value="mm/dd/yyyy"/>	Logout
Abebe Bekele Alemu		EMP1		Process   Discharge	

Figure 27 : - Physician account user interface for SHIIS, January to May 2016

After the clerk assigned the employee to the specific physician the name and the identification number of the employee will appear on the personal account of that physician so that the physician can easily see and access the employee demographic and personal information. Additionally the physician after finishing the treatment can discharge the employee using this interface.



The interface features a header with two logos: the Ethiopian Social Security Agency logo on the left and a yellow star logo on the right. The main title is "Social Health Insurance Patient Encounter Form". Below the header is a registration form with the following fields:

SHI ID	<input type="text" value="EHIA1"/>	Date	<input type="text" value="05/20/2016"/>
Name	<input type="text" value="Abebe"/>	Treatment Reciever	<input type="text" value="Self"/> *

Below the registration form is a "Laboratory Diagnosis" section with a list of ICD10 codes and a "Report Finding" section with a "Report" button.

Please fill fields with \*

Figure 28: - Patient encounter registration user interface for SHIIS, January to May 2016

During the provision of care and performing claim decision full information regarding the employees (patient) information is valuable. This patient encounter registration user interface provides access to the registration of those essential different clinical information that the physician undertook during the provision of care. The international classifications of diseases code (ICD10 codes) integrated with the SHIIS provides a standard coding of the different diseases and procedures. This enables the claim decision and different Medco-legal issues and decisions standard. Moreover it improves the usability of the system. Having every data finished the

physician send the claim request to be processed by the claim processor or pre-authorization request to claim processor to provide decision.

Figure 29 : - View employee full history user interface for SHIIS, January to May 2016

Recording the history of the patient has been an integral part in the provision of health care service. After every visit the system will keep record of the employee data on the database. This, employee full history user interface makes these data visible to the physician and the employee based on the time of need.

Figure 30 : - Vital event notification user interface for SHIIS, January to May 2016

This user interface enables the physician to report cases if there is any event (death, birth, and disability) that has happened to the employee and the employee’s family at any time of the day. It also enables to delete the

employee when the employee pass away and add a family member during birth and update if any physical or mental disability happens to the employee.

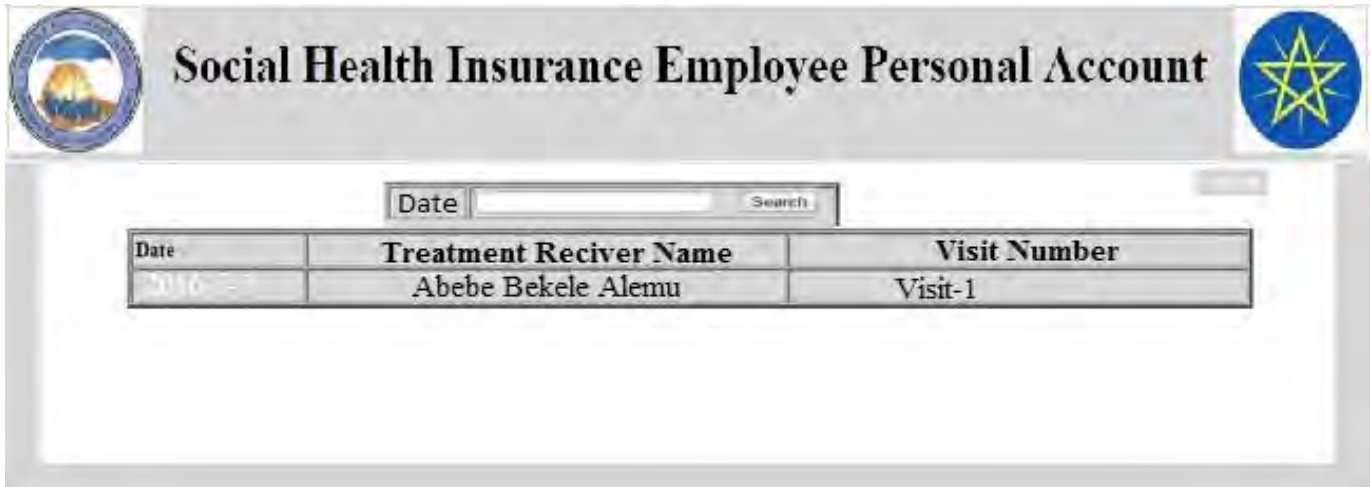


Figure 31 : - Employee Account user interface for SHIIS, January to May 2016

This interface enables the employee to view the whole medical history of his own and those family members registered as employee’s family members. In addition it is enabled with search capability by date of treatment received.

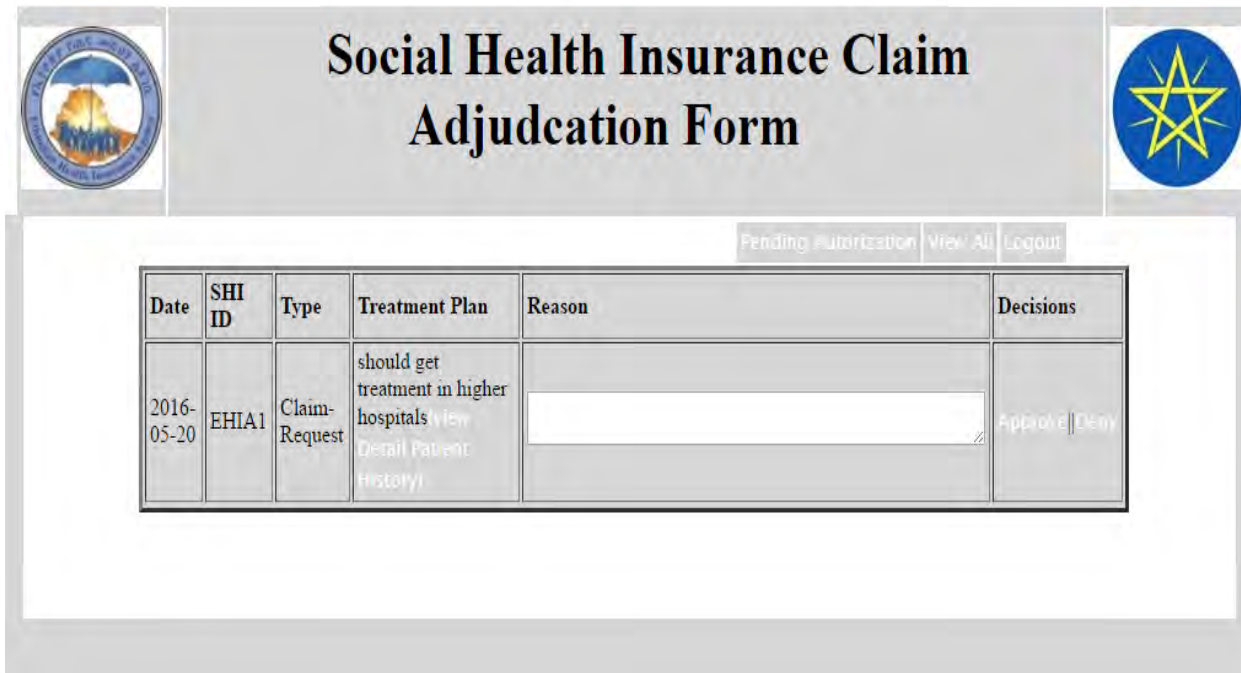


Figure 32 : - Claim adjudicator (claim processor) account user interface for SHIIS, January to May 2016

After the physician submits the general report regarding the patient’s treatment and diagnosis the requested claim or pre-authorization request will appear on the claim processor account. This claim processor account is given to those personnel’s who are assigned by the system administrator as the claim processors and chosen by

the EHIA to provide the claim decision work. On this page the claim processor can see the full medical and clinical history of the employee (patient) before providing the claim decision. This will enhance evidence based decision provision mechanism most importantly accuracy of the decision is improved.

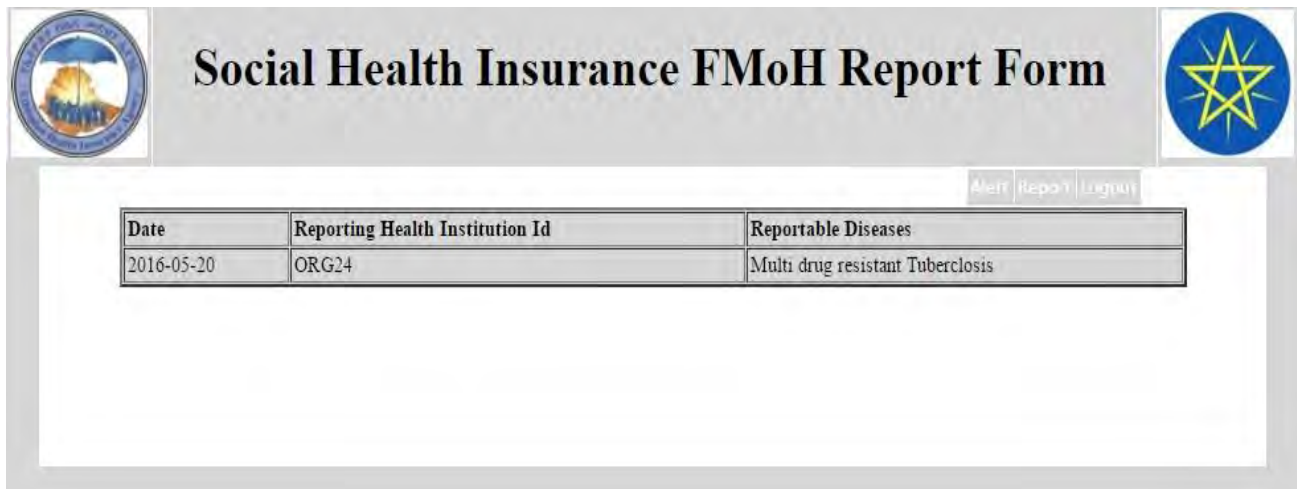


Figure 33: - Ethiopian federal ministry of health view reportable diseases user interface for SHIS, January to May 2016

This user interface provides the view of the report of the major reportable and epidemic diseases outbreak happened at some area that is reported by the physician working at some healthcare setting. This will enable the ministry to take immediate action on time on that specific healthcare setting, employee’s family and the organization in which that specific individual is found to be infected.

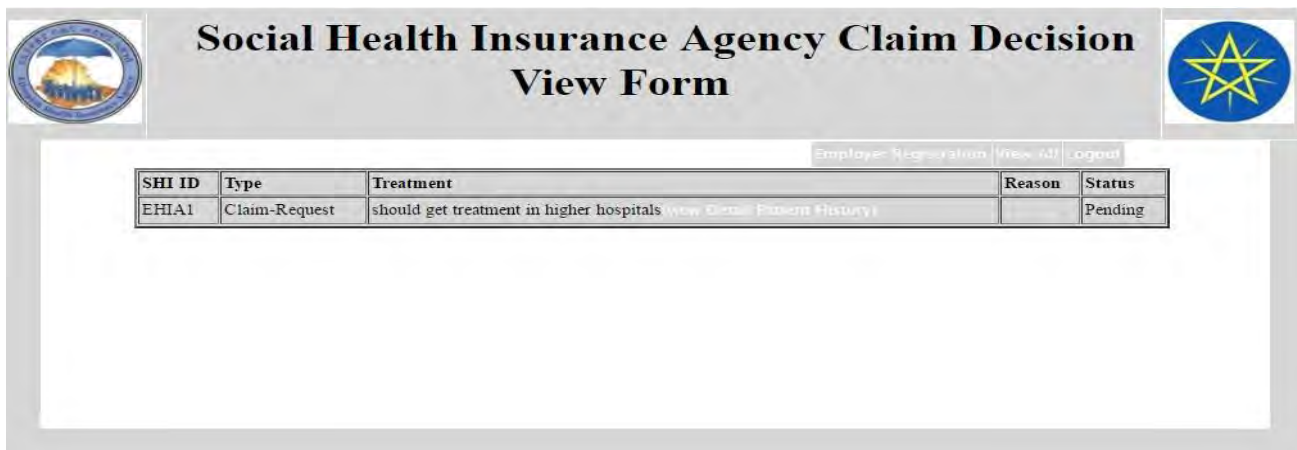


Figure 34 : - Ethiopian Health Insurance Agency view Claim decision user interface for SHIS, January to May 2016

This user interface enable the EHIA to view the various claim decisions regarding the physician claim request that is made by the claim processor. The interface brings the claim decisions with the reasons thus the EHIA can easily process the bills or use the decision for any administrative issues

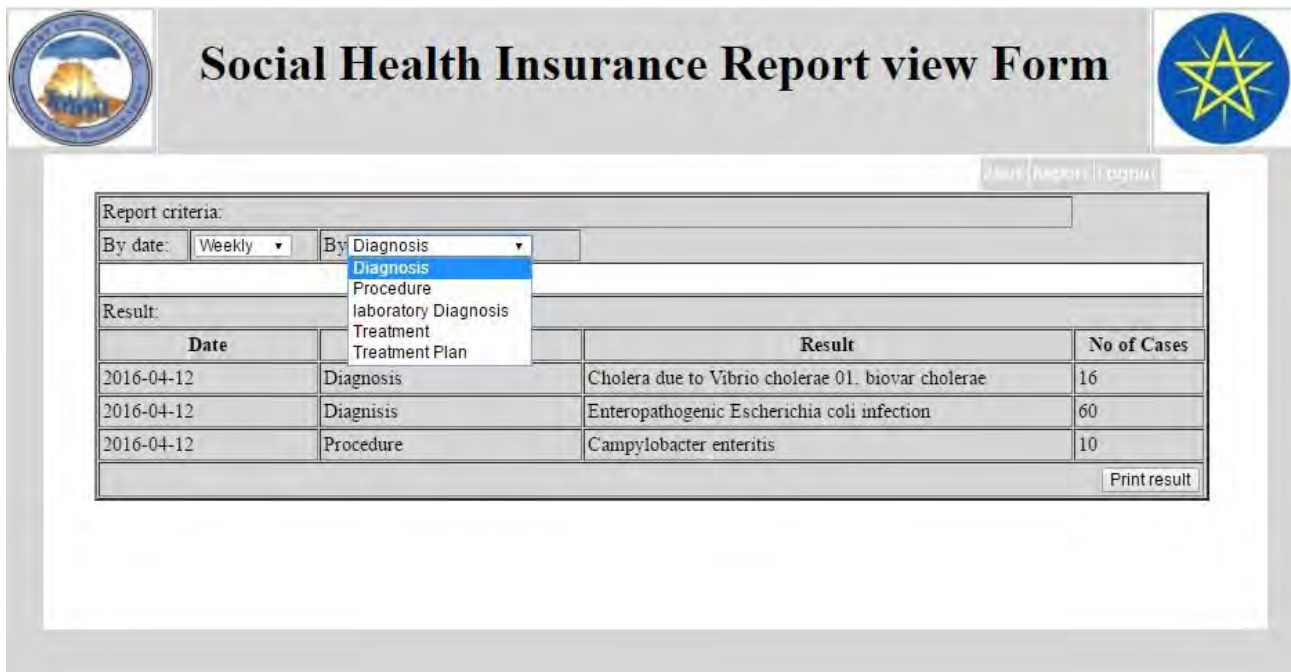


Figure 35: - Ethiopian federal ministry of health view report user interface for SHIS, January to May 2016

This user interface enables the EMOH and the EHIA to view the required report based on the report need. The report generation interface can only be accessed to the concerned bodies and the type of report to be generated depends on the organizations authentication provided during registration.

#### 4.8.2 User Interface Evaluation

Usability is the extent to which users can use a computer system to achieve specified Goals effectively and efficiently while promoting feelings of satisfaction in a given context of use. Usability evaluation (UE) consists of methodologies for measuring the usability aspects of a system's user interface (UI) and identifying specific problems [84,90].

The evaluation of the interface is undoubtedly one of the most important aspects of software design and development. Without evaluation, designers would have little indication as to the successful and, more importantly, the non-successful interface designs. The evaluation of the interface for the web based social health insurance information system used a method of questionnaires to evaluate the interface for the prototype developed. Questionnaire method that has been adopted is used, for it is cost effective.

Heuristic evaluation inspection method was employed in the SHHIS. Heuristic evaluation a usability testing method that asks usability practitioners and other stakeholders to evaluate a user interface based on a set of principles or commonsense rules. This method was originally conceived as a discount

usability method that could be used to find problems early using wireframes, prototypes, and working products. A side benefit of the method is that evaluators learn about the principles that support good usability [90, 91].

During evaluating the interface of a system the users should be representative of the typical user of that application and the number should be of optimal size for the anticipated evaluation results. The tasks should represent a whole user task and will allow assessment of the interface for consistency between user's conceptual models of the tasks. The usability tests should be performed on real products or working prototypes [91].

Table 14 : - User interface evaluation of Web based Social Health insurance information system for the SHHIS , January to May 2016

No	<b>Functionality Questionnaire</b>					
	Rate your agreement with the following statements (Place a X in the appropriate column)	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	It was clear to access the different options menus				2	12
2	It was clear to choose from the different options in the system				1	13
3	It was clear to save the different data onto the database			1	3	10
4	It was clear on using the different functionalities of the system in the given privilege			2	5	7
	<b>Interface Questionnaire</b>					
		Never	Some of the Time	Neutral	Most of the Time	Always
5	Overall, the system provided adequate functions for registration and data retrieval				3	11
6	The way the system respond to a user actions consistent at all times				1	13

7	Are status messages informative and accurate			2	3	9
8	Is it clear what different parts of the system do				1	13
9	Is the system flexible in allowing the user to choose options			3	3	9
10	Does the system protect against errors in user actions			2	2	10
11	Overall, the interface was pleasing and easy to use				1	13
		Average result		6.45	16.15	77.4
		Total agree value		93.55%		

The result of the user interface evaluation is shown above. The value of the responses are taken based on the Likert scale that is for the Functionality of the system Questionnaire response Strongly Agree =5 Agree=4, Neutral=3, Disagree=2, strongly Disagree=1 and for user Interface of the system Questionnaire response Always=5, Most of the Time=4, Neutral=3, some of the Time=2, Never=1. According to the result of user interface evaluation most of the respondents that is 93.55 % agreed that the system prototype has a good and clear informational and functional explanation regarding the major functionalities of the system.

#### **4.9 Discussion of the Result**

The newly designed system in comparison to the previously existing paper based manual system can be made interoperable to minimize the various time and resource consuming business process in the Ethiopian health insurance agency. In addition to these the new system can provide a priceless information that are crucial to the administrative and claim decisions.

The study done in USA [63] shows that having an automated health insurance mechanism can be used as a mechanism to eliminate unreasonable limits usage of health care services. The limits which are majorly caused by lack of pocket money during spontaneous events can be abolished by the use of an automated system. In addition to these the automation can help to standardized to set the amount of treatment and medicinal cost nationwide [45]. Having the automated means of health insurance has also shown to improve the coverage of preventative and curative medical services in the different areas in which the scheme was functional [41].

The electronic business process that are incorporated in the newly designed system include registration subsystem that registers the various actors, which have different data and information. While the user validation subsystem provides authentication of the registered user upon the arrival to the health center. This is crucial in checking the eligibility of the user for the services that are provided by the health centers. Further to the validation of the user these subsystem also enables the data clerk to assign the specific employee (patient) to the specific department and physician. These can create a conducive environment for the employee (patient) to receive the required service without ups and down. In addition to these it creates an accountable environment that makes easy to identify which physician has made a mistake during treatment and diagnosis process.

In health institutions in which the application of an automated health insurance scheme been applied have shown an improved exchange and coordinated recording of medical data across the system [64]. Besides this, any employee working in a registered organization was made able to apply for and enroll in insurance services and the exchange employee's data through state-run web based systems. An automated system of Medicaid and Medicare programs and the exchange of different information on real time basis has coordinated the enrollment procedures to provide seamless enrollment for the insurance service. Hospitals that are connected with the insurance service providers are permitted to provide Medicaid and Medicare services during a period of convincing eligibility to members of all health insurance eligibility categories [68]. This intern increased the coverage and usage of health services in the country

According to Alma Ata declaration [4] and many other health care agreements, everyone should get healthcare without financial risk or impoverishment. In order to facilitate these core policy having an automated means of providing an insurance mechanism plays a priceless role. With this automation the insured can get any medical treatment in 24 hour basis. Not only this, but also the health care service providers can use the system as a means of standardized registration module for diseases registration [71].

The registration of the different diagnosis and treatments are made easily accessible and standardized in the newly developed system. The international classification of diseases (ICD10) is integrated to the system to make the registration standard, easy and understandable. In addition to these the reporting of the reportable diseases to the ministry of health is also made possible at the instant the physician encounters any of those reportable diseases.

The widely spread health centers and hospitals in the country were obliged to register clinical, demographic and vital event data on uniformly standardized documents. This paved ways for an evidence based decision provision. Whenever there is an appeal by the consumers the insurer can go back and see the consumers utilization review. This review can be used to provide the necessary decision [72]. This has also made the decision on claims trustable, easy and reasonable by the consumers.

The newly designed system has a claim processing functionality. This process is enabled with accepting claims from the registered physicians who work at the registered organization. Having this

functionality, makes the processing of claim easy and evidence based. Which contributes directly to the accuracy of the decisions being made. Thus the claim processor can decide on the claim request based on the full clinical information of the patient. This strengthens the path towards accomplishment of evidence based decision making.

The report generating module which has become an integral part of the system has a function of generating report based on the informational need of the report viewer. This makes the retrieval of the information from the database easy, customized and appropriate.

Each of the activities in the system starting from the registration up to the generation of report is done on a privilege based manner. That is, each of the user of the system will have a personal account and be provided with its own specific privilege by the administrator of the system according to the user's position in the insurance process. These privilege allows the user to be able to use the specific functionality of the system at that level of authority or privilege. Besides that, it improves the security of the confidential information of the employee to be uncovered by the unauthorized and illegal body.

Generally the system can help the different users in the system in registering, validating, recording, retrieving and processing different data and information regarding claim in the Ethiopian health insurance agency. The different stakeholders who participated in this research project after going through the design, proposed system architecture and the user interface document, provided their agreement on the descriptiveness of the document and the real contribution of the research project in solving a problem regarding social health insurance data and information processing.

## **Chapter Five**

### **5. Conclusion and Recommendation**

#### **5.1. Conclusion**

The previously existing Social health insurance system in the Ethiopian health insurance agency was functioning manually. This manual system made problems regarding retrieval, recording, validating,

authorizing and processing the claims of the insured person. According to the respondents of the study, the existing paper based manual system caused and is causing problems in their daily work. Most of the problems are manifested regarding the quality of the data they receive. That is duplication of records, incompleteness, difficulty in retrieval, long time spent searching for insured's data, difficulty in processing the claims because of unstandardized data definitions etc. In addition to these the agency was having difficulty in unsecure transaction of claim data, long time taken to process claims, personal bias on claim decisions and validating the insured's eligibility to use the insurance services. These all problems all together made the difficulty in making the required decision timely. The research project can contribute to enhance and improve the agencies business process faster and evidence based decision making easier.

Based on the requirement gathering done on the basic information system components ; the need for organized registration recording of various demographic and clinical data, validation of the insured to check the eligibility , reporting of various incidents, the secure transaction of claims and processing of these claim decision were identified. According to the response by the key respondents, the EHIA doesn't have real time automated means of handling any status change, validating the insured and following the overall procedures of the insured. Besides these, the agency uses Microsoft Excel Identification number generation for assigning illegibility on the branch offices which is unsecured and unreliable. This research project by assessing the problems and using the various government standards and policy guide lines, developed the necessary requirements of the system to be designed.

After having the essential requirements, the design and analysis for the system was done. This step involved the stakeholders of the system. The functional requirements were gathered and developed to address the major business requirements of the system that the stakeholders need from the system. These functional requirements included the registration, validation, notification, reporting, processing of claim data and decision needs. Beside the functional requirements, the non –functional requirements which are required to keep the system running like security, scalability, interoperability and performance requirements were also identified.

Based on the analyses of the requirements, the design of the system was accomplished. The design of the system consumed object oriented system analysis and design methodology. In order to transcribe the analysis into a design, unified modeling language (UML) was used. From the different types of the UML tools the interaction modeling tools (use case and sequence) diagrams and association modeling tool (class diagram) was used. In order to implement the system a three tired system architecture was proposed. These can enable a secure and networked web based system.

With all the inputs from the requirement analysis and design, a prototype to the system was designed to show the working model of the system. The user interface prototype consisted of the display, different functionalities and navigational need of the system users. The satisfaction of the users on the developed prototype can be achieved by evaluating the prototype. Though technical evaluation of these newly developed system was done the behavioral aspects of the system users were not addressed in this research project.

Finally the web based social health insurance information system addresses the various procedural (business process) and informational processing needs of the EHIA which improves the overall insurance procedures involved in the Social health insurance service provision.

## **5.2. Recommendation**

The In this study, an attempt is done to study the existing health insurance information system and develop a system that will benefit most stake holders involved in the process. From the finding in the study the following recommendations were drawn. And these recommendations should be taken into consideration by the Ethiopian health insurance agency, and the other stakeholders which are concerned in the social health insurance service provision to solve the existing constraints regarding the current social health insurance service provision.

### **Ethiopian Health insurance agency**

- The agency should work on the implementation of the system in the various regional and main branch offices.
- The agency should strengthen and create a mechanism to enhance the usability of the system by providing various capacity building mechanisms to the insurance service officers in the various branches and the health professionals which have direct access to the system.
- The agency should closely follow the correct usability of the system in the different health institutions and should provide the necessary system support.

### **The Ethiopian Ministry of Health**

- The ministry should work in collaboration with the agency and the physicians at the health care setting by providing the necessary procedural and clinical guideline documents which are necessary in increasing the usability of the system.
- The ministry should work in collaboration with the agency in the implementation of the system in various health care settings

### **Health Centers**

- The health centers should be able to provide the necessary infrastructural support during the implementation of the system like electric power, internet access.
- The health centers should provide the hardware that is required to deploy the system in the health care setting.

### **To researchers/students**

- The researchers/students should continue the project and work on the development and implementation of the system

- The researchers/students should continue the project and work on the remaining parts of the system.
- The system has limited functionalities that do not handle financial transactions and referral management etc. So the researchers/students should work on how to integrate the system with other systems and increase the overall functionality domain of the system.

### **5.3 Implementation Strategy**

Social health insurance information system which creates a direct connection between insurers, insured and health care service providers is both mission and rate critical. The system registers and sends different patients (employees) data on a real time basis. A single failure on a transaction of information may cause a serious damage on the provision of care and also on the day to day activity of the physicians at the health care setting. The web based SHHIS system has to function 24 hours a day and 7 days a week. Besides the criticality issue, major technological issues like maintainability, reliability and availability are also concerned.

During the deployment of the system at each branch and health care setting there should be an IT personnel who will be in charge for providing any technical and professional guidance. Because of the SHIIS is a web based system any failure regarding the software can be handled remotely. This can be done from the different EHIA branch offices after being informed by phone or any other communication means.

Besides the technical aspect the availability of electric power, internet connection and band width strength are crucial for the full functioning of the system. Because of the issues of security and internet traffic a dedicated virtual private network is recommended to connect the EHIA with the different health care service providers for the secure transaction of claims and medical records that can be used as an evidence during claim decision making.

The issue of inadequate power supply may pose a constraint on a proper use of the system. In order to overcome this issue the EHIA have to work in collaboration with EMOH and health facilities. Besides these there should be an exact hard copy or soft copy replica of the system interfaces (Store and forward mechanism) have to be available at the health care setting. The hard copy must contain all the necessary information that the automated system requires. Another mechanism which involves using of scanner and electronic mail can also be used. This mechanism involves, if the health care setting has a dedicated electronic mail they have to be provided with a scanner to scan the documents. Which can be used in to handle and send data during uncertain events related to light and connection.

The connection problems which may cause serious problems on the transaction and overall process can be handled by making the network infrastructure redundant and hierarchical. This mechanism allows unexpected loss of data, network congestion and system traffic. For the implementation of this mechanism various networking devices that have a fast response time and artificially intelligent devices have to be taken into consideration. The below mentioned table (15-18) shows the list of software and hardware requirements that are recommendable for the deployment of the system.

As any other information technology system design and development project, SHIIS starting from the planning to the implementation it will be constrained by major three factors. These factors are cost, scope, and time [93]. For estimating the cost, time and the effort need to complete the project the well-known COCOMO II model (Constructive cost model) can be used. This model is fact based, easy to use and interpret. Anyone can clearly understand how it works. It can also easily accounts for various factors that affect cost of the project. COCOMO II model enables application composition model (for early prototyping efforts) and the more detailed early design and post- architecture models (for subsequent portions of the life cycle). As this prior mentioned issues are major parts of SDLC they can directly affect the cost estimation of the project [94].

In the COCOMO II model, every software development projects are included in one of the three major groups these are Organic, Semidetached and Embedded projects ranging from simple to complex system development projects. In each category the calculation for the time, cost and effort is different. These variations arose as result of that, each category require different scope, programing knowledge, professionals involved and different resource usage [95]. The SHHIS is included under Semidetached

system development project. The rationale is thus, as the EHIA is new in its establishment. This makes the system development process with an involvement of a mixture of experienced and inexperienced staff in the major business process. Not only these but also the employees at the EHIA may have limited prior experience on related systems. In addition to these they may not have prior experience with some aspects of the system being developed. Not only these, the new system involves interaction between various users with different skill, profession and background. In order for the full development of the system the human resources required will include one system analyst, two senior programmers, three junior programmers, one project manager, as an option two persons for testing of the system.

In the newly developed system the web pages are developed by using PHP, JavaScript, HTML and Ajax languages. In each web page on average there are 400 codes per page and totally there are 80 pages that will give an average total of 32,000 codes. By using the COCOMO model we can calculate the cost, time and effort by using the below listed formulas [93,95 ].

$$Effort = 3.0(KLOC)^{1.12} PM$$

$$Time\ of\ dev = 2.5(Effort)^{0.32} Months$$

$$Cost\ required\ to\ develop\ the\ product = Time\ of\ development \times 1\ person\ Salary/month.$$

$$Human\ resource\ (for\ coding) = Effort/duration$$

*KLOC (kilo lines of codes), PM (a person month is 152 hours in month )*

$$Lines\ of\ codes = 32,000\ codes = 32KLOC$$

$$Effort = 3.0(32)^{1.12} PM = 48.8 PM \approx \mathbf{49PM}$$

With the above result we can calculate time for development

$$Time\ of\ dev = 2.5(Effort)^{0.32} Months$$

$$Time\ of\ dev = 2.5(49 PM)^{0.32} Months \approx \mathbf{9\ months}$$

To calculate the human resource needed a formula i.e *Effort/duration* can be used thus  $49/9 \approx 6$  programmers are required. For the sake of calculating the amount of cost needed let's assume the average salary for the programmer per month be ten thousand birr/ month. Cost required to develop the product can be calculated by

$$Cost = Time\ of\ development \times 1\ person\ Salary/month.$$

$$Cost = 13\ month \times 8\ thousand\ birr/\ month = \mathbf{90,000\ Ethiopian\ birr}$$

This cost only resides for the human resource specifically to the personnel's involved in programming of the system. Because of the daily fluctuating material cost it could be difficult to estimate the cost of materials necessary for networking and computers. As the SHIIS has an impact on the day to day

working custom of the stakeholders, organizational issues must be taken into considerations during implementation. Project pricing should involve senior management (i.e., those who can make strategic decisions), as well as software project managers that had previous experience in another software development projects. Besides the development, requirements collection, analysis and specification should be given priority in budgeting. As it provides the main inputs for the system to be developed. Because of the involvement of various professionals with various skills the collection of requirements cost will be expensive. Thus it is recommendable to look for personals that have experience on an analogous systems development projects in a local settings for estimating the cost for the collection of requirements.

In order to increase the usability and acceptance of an information system the measurements regarding an operational feasibility is essential. These feasibility issues determines the acceptability of the system during system migration to the newly developed web based system. The dimensions that the operational feasibility include are performance, time of processing of the information, economy, Control, efficiency, services reliability [96]. The newly developed system is enabled with a fast response time for the execution of different functionalities. With this enhanced performance the end users and managers can get real time, relevant, specific and accordingly formatted standard information. This will simplify the time taken by the physicians in recording clinical and diagnostic data. In addition to these having a self-generated options of a list of standardized list of disease can take short time to register long clinical information in short. Most importantly by the use of easy menu options and selectable the system can be used by any physician without requiring advanced computer use knowledge

The newly developed automated system can help the EHIA in minimizing the amount of money required for printing and copying a paper based forms and different costs enquired during the day to day working. Besides the minimized material resources usage, the system enables the EHIA to use human resources efficiently in the branch offices. In addition to these a secured environment for the transaction of secure medical and clinical data enables the users to be confident during their use of the system. Besides this with having a modular basis the system can be made flexible, expandable and can also be used from any kind of device that has an internet connection. With having the prior advantageous uses the system can have increased feasibility for use by the stakeholders.

## **Hardware and software**

This portion provides the hardware and the software requirements needed for effective and efficient running of the system. As this system is using three tiered architecture for the full functionality of the system; best performance is needed thus the below listed are recommended for the implementation. In addition to these, security issues have to be taken into consideration thus it is recommendable that the servers have to put in a safe and secure room.

Table 15 :- Server side hardware requirements for the SHHIS , January to May 2016 [99,100]

Component	Recommended
CPU	2 quad core Intel®/ Core i[X] or Xeon processors at 2.33 GHz-3.5GHz series processors[implementing 64 bit architecture]
Hard disk	3 TBSAS disk array at 10K rpm [3 TB]
DVD-ROM	48 DVD+/- RW
Memory	From 12GB up to 64 GB
Screen/video adapter	17’’ flat panel
Backup streamer	Digital tape streamer with the same capacity as the total disk space
NIC	1 GB, network card supported by the network installed
Number of users	2,200 to 3,600 users available access the system. Database engine with 2,200 to 3,600 users easily to manage

Table 16 :- Client side hardware requirements for the SHHIS , January to May 2016 [99,100]

Component	Recommended
CPU	Intel Pentium® Dual core CPU ES400 at 2.33/2.49 GHz processor
Hard disk	160 GB SATA
RAM	2 GB or more RAM
Screen/video adapter	A monitor with a resolution of 1024X768
NIC	Network card supported by the network installed 100 Mbps for best performance
Printer	Windows compatible printer
Scanner	Windows compatible Scanner

Table 17:- Server side software requirements for the SHHIS , January to May 2016 [99,100]

Component	Recommended
Operating system	Windows server 2003/2008 64 bit [server edition is required for network with>10 workstations]]
Microsoft.net framework	.NET 3.5 SP1 is a requirement for SQL server 2008 when you select database engine, reporting services, master data services, data quality services, replication, or SQL server management studio

Table 18:- Client side software requirements for the SHHIS , January to May 2016 [99,100]

Component	Recommended
Operating system	Windows XP/Vista/7/8/10
Anti-virus program	Licensed[updated]

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## Annex I

### Guidelines and questions for requirement collection

#### **Requirement collection standards**

According to health metrics network and world health organization [97,98] community wide health information data collection and management system can include the following functionalities:

#### **1. Client Management Services**

- Client specific tracking of intake process, including program entry and exit
- Socio-demographic data, including capacity to record family and household relationships

- Retention of client specific historical data
- Remote Client data Management:

## **2. Case Management**

- Client specific assessment of needs
- Retention of client specific historical data
- Ability to track client specific goals and outcomes
- Ability to share client level data across agencies
- Flexibility for data sharing to accommodate agency selected data element masking [ability to close part or all of a client record to other agencies], including the ability to impose time limits on the sharing of all or part of a client record.

## **3. Service Tracking**

### **Service Delivery Management:**

- Ability to document and retain history of client specific services received by client, including ability to document planning, scheduling and follow up on delivery of services

### **Referral Management:**

- Ability to document and retain history of client specific referrals, including follow up, reminder capabilities, and status/outcome

### **Information and Referral**

- Real time link to community's Information and Referral database of available resources or capacity to build and maintain an integrated Information saving and retrieval within the community's HMIS
- Electronic submission of applications for mainstream resources
- Benefits eligibility assessments

## **4. Reporting Capacity**

- Capacity to generate program, agency, community, and, if applicable, collaborative level reports.

- Standard, built-in reports and forms.
- Data validation reports, an unduplicated client count report, and basic client demographic reports.
- Integrated ad hoc reporting capacity that maintains user level security restrictions while allowing for user flexibility in choosing tables and fields as well as filtering and conditional report aspects.
- Capacity to import and export data through XML and CSV formats, including ability for regular, community initiated imports and exports and ability to securely strip data of identifiers and manage data transmission while insuring a high accuracy of un-duplication rate.

## **5. System Security**

- Integrated technical safeguards to ensure a high level of privacy and security, including Back end server[s], including data encryption and transmission
- Administrator controlled user name and password access
- Automatic timeout/log-off
- Administrator controlled user level read, write, edit and delete capabilities
- Administrator controlled user level module and sub-module access
- Automated audit trail
- Information Security Industry Standard encryption and
- All technical safeguards required to be HIPAA compliant
- All security safeguards required for compliancy to the HUD HMIS Data and Technical Standards

## Annex II

### Requirement collection questions

The questions are devised by taking considerations of the above standards, templates and previously done projects and also by including the possible information system components that are important for system development. The number of people included in the interview are all EHIA insurance officers in the head office and focal personnel's from Ethiopian ministry of health. It is adopted from previous research papers and from

# ADDIS ABEBA UNIVERSITY

## SCHOOL OF INFORMATION SCIENCE AND SCHOOL OF PUBLIC HEALTH

### MSC IN HEALTH INFORMATICS PROGRAM

My name is Natnael Alemu. I am post graduate student of health informatics program in Addis Abeba University. I am doing a research project on designing of web based social health information systems for Ethiopia health insurance Agency. The following interview is designed in accordance to strengthen the informational need of the project on how to design, implement and achieving the Agencies organizational mission and goals. Thus you are kindly requested to provide genuine and correct answers for the questions posed by the principal investigator. The information 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. Besides, you have the right to turn down if you are not voluntary to participate on the interview, thus you can fill/mark the **NO** box

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

**THANK YOU IN ADVANCE FOR YOUR COOPERATION**

### **Interview questioning guideline for Designing of Web based Social Health Insurance Information System.**

#### **1. Data and process/Functionality**

1. What types of information is processed in the current system?
2. What data are included in each type of information processed?
3. How are client data collected and stored?
4. How are data retained for any period of time?
5. What are the problems with the current existing forms?

6. How do you retrieve client information in the current system?
7. How do you get client history?
8. How do you record data during processing of insurance service in the current system?
9. What kinds of computations or data transformations are performed?
10. Is that information included in the client's record?
11. How is the social health insurance process started/initiated?
12. What are the current problems on data processing?
13. Are there several modes of procedures?
14. What types of error happen most in record and process?
15. What are the appropriate reactions to possible stimuli?

## **2. Interfaces**

16. Is input coming from one or more other systems?
17. Is output going to one or more other systems?
18. For both input and output, is there a standard format of the data be?

## **3. Users/people**

19. Are there several types of users?
20. How is client information accessing privilege provided for the professional?
21. Who is responsible for clients record error and how?
22. Who makes reports?
23. What is the skill level of each user?

## **4. Management /procedure**

24. Do you have guideline to help the different Insurance process?
25. What are client information recording procedures include?
26. How is problem on client information recording process handled?
27. Do you have any mechanism to trace the problem?

## **5. Software**

28. Is there a planned approach to automate the current system?
29. Do you have any software used to prepare the reports? Which software?
30. Do you have computer network for sharing information?

## 6. Hardware

31. Do you have computer? How many?

32. For what purpose do you use it?

# THANK YOU

## Annex III

### User interface Evaluation Questionnaire

The below mentioned table was developed to collect the required response from the stakeholders of the system to help in assessing and evaluating the user interface for the newly developed system prototype. The questionnaire was modified after being adopted from *Renato Iannella*, which is used to evaluate graphical user interface evaluation for messaging and directory Systems [92].

Table 19: - User interface evaluation questionnaire for Web based Social Health insurance information system, January to May 2016

No	Functionality Questionnaire					
	Rate your agreement with the following statements (Place a X in the appropriate column)	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	It was clear to access the different options menus					
2	It was clear to choose from the different options in the system					
3	It was clear to save the different data onto the database					
4	It was clear on using the different functionalities of the system in the given privilege					
<b>Interface Questionnaire</b>						
		Never	Some of the Time	Neutral	Most of the Time	Always
5	Overall, the system provided adequate functions for registration and data retrieval					
6	The way the system respond to a user actions consistent at all times					
7	Are status messages informative and accurate					
8	Is it clear what different parts of the system do					
9	Is the system flexible in allowing the user to choose options					

10	Does the system protect against errors in user actions					
11	Overall, the interface was pleasing and easy to use					

## **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

	<b>Signature</b>	<b>Date</b>
Dr. <b>Wondwossen Mulugeta</b> (PhD )	_____	_____
Ato. <b>Alemayehu Hailu</b> (PhD Candidate)	_____	_____

June 2016 Addis Ababa Ethiopia