



ADDIS ABABA UNIVERSITY
SCHOOL OF INFORMATION SCIENCE
AND
SCHOOL OF PUBLIC HEALTH
M.Sc in Health Informatics Programme

DESIGNING A WEB-BASED EYE BANK
INFORMATION MANAGEMENT SYSTEM FOR THE EYE
BANK OF ETHIOPIA

By

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JUNE, 2017

ADDIS ABABA, ETHIOPIA



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Public Health of Addis Ababa University in Partial Fulfillment of
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ACRONYMS

AAU	Addis Ababa University
AIDS	Acquired Immune Deficiency Syndrome
DBMS	Database Management System
DIN	Donation Identification Number
EBE	Eye Bank of Ethiopia
EBIMS	Eye Bank Information Management System
EBUC	Eye Bank User interface
EDMS	Eye Donation Management System
FIN	Facility Identification Number
FMoH	Federal Ministry of Health
HBc	Hepatitis B core.
HBsAg.	Hepatitis B Virus Surface Antigen.
HCV.	Hepatitis C Virus.
HIS	Health Information Systems
HIV.	Human Immunodeficiency Virus
ICT	Information Communication Technology
IT	Information Technology
OTM	Organ Transplantation Management
PIECES	Performance Information Economics Control Efficiency and Service
SDLC	Software Development Life Cycle
SSD	System Sequence Diagram
UML	Unified Modeling Language
WBEBIMS	Web- Based Eye Bank Information Management System
WHO	World Health Organization
WWW	World Wide Web

EXECUTIVE SUMMARY

Background: Eye donation can be defined as the ultimate humanitarian act of charity. In most case, many people are not willing to donate their organs after they die. Furthermore, public also do not know the procedure and the way to register, even willing to donate their eye after death, there is less advertisement, and awareness about eye donation among the community. Besides that, the interested people face many problems to register themselves because they are busy with works, and need to get the application form from only the Eye Bank of Ethiopia.

Objective: the main objective of this project is to design a web-based eye bank information management system for the Eye Bank of Ethiopia.

Methodology: the project will use object oriented system analysis and design approach and includes data collection tools such as (interview, observation and relevant document review techniques) to collect sufficient data needed for the system to be developed. Analysis and design of the proposed system will be performed using the UML tools.

Tools and Techniques: Word document, Visio diagrams, Edraw Max are some of the tools used to create this document. UML diagrams are created to describe the scenarios.

Summarization: All the systems processes and its boundary were identified and described by using use case diagram. Seventeen processes with their corresponding actors were identified for the system. The flows of the process were presented using activity diagrams sequence diagram. The object models were described by using class diagram. And finally, the system prototype was developed for the user interface testing. The results of the user interface testing shows that User test for the system prototype was done and it shows that 86% of the participants in the evaluation and testing have shown positive attitude and response for the system usability. In this project, I analyzed the current manual system, design, and try to implement prototype a Web-based Eye Bank Information Management System to the Eye Bank of Ethiopia. The prototype can be developed through iterative process along with users' feedback. From the user test for the system prototype it is identified that some parts need to be improved

Recommendation: The federal minster of health might support give guarantee by assigning sufficient budget and manpower. The Eye Bank of Ethiopia provide sustainable budget for the implementation of EBIMS and should collaborate with health institutes and also should provide information to the people to increase the awareness for maximizing number of pledge donors

The investigator recommends future researchers to implement the complete web-based Eye Bank Information Management System by enriching it with additional functionalities like equipment registration.

CHAPTER ONE

INTRODUCTION

1.1 Project Background

Organ Donation is the process of giving an organ or a part of an organ for the purpose of transplantation into another person. An organ transplant is a surgical operation in which a failing or damaged organ in the human body is removed and replaced with a functioning one. The donated organ may be from a deceased donor, a living donor, or an animal. In some cases an artificial organ is used. Organ donation also can be defined as the ultimate humanitarian act of charity. The commonly donated organs are kidney, heart, liver, lungs and pancreas, while the tissues are eyes, bones, heart valves and skin (1). The first corneal transplant was carried out by Dr Eduard Zirm, an ophthalmic specialist in Olomouc, now in the east of the Czech Republic on 7/12/1905 (1). The recipient was a laborer who had been blinded in an accident while working with lime. The man who received the first cornea transplant was given no antibiotics, no drugs to stop him rejecting the tissue - and had to endure his eyelids being sewn shut for 10 days before he knew if the procedure had worked. The operation was a success, and the 43-year-old patient could see again. He retained his eyesight for the rest of his life and was back working on his farm within three months (1).

Eyes can be donated only after death. A living person can only make a pledge to donate eyes after death. To translate a pledge to an actual donation after ones death, it is essential to inform your close ones about your wish. They need to call the eye bank in the hour of grief. You could help two blind persons regain vision by this noble act. Don't bury or burn eyes (1).

The Eye Bank of Ethiopia (EBE) is a nonprofit humanitarian organization established under the tripartite agreement among Federal Ministry of Health; Addis Ababa City Administration Health Bureau and Orbis International Ethiopia. The bank was inaugurated on the 28th of June 2003 by his Excellency Ato Girma Woldegiorgis, the former President of the Federal Democratic Republic of Ethiopia. The EBE is strategically located in the premises of one of the oldest hospitals in the country Menilik II Hospital. The Hospital is a tertiary training center for eye care professionals and health workers. The Eye Bank procures corneas through presumed and next of

kin consents according to an administrative directive issued by the Federal Ministry of Health (FMoH) (2).

In the healthcare industry, there are some areas where leading-edge ICT developments are employed and developments at the leading-edge will be important.

ICTs are defined as tools that facilitate communication and the processing and transmission of information and the sharing of knowledge by electronic means (3). This encompasses the full range of electronic digital and analog ICTs, from radio and television to telephones (fixed and mobile), computers, electronic-based media such as digital text and audio-video recording, and the Internet (3).

The health sector has always relied on technologies, they form the backbone of the services to prevent, diagnose and treat illness and disease. ICTs are only one category of the vast array of technologies that may be of use. Given the right policies, organization, resources and institutions, ICTs can be powerful tools in the hands of those working to improve health (3).

Health information systems (HIS) refers to any system that captures, stores, manages or transmits information related to the health of individuals or the activities of organizations that work within the health sector. Overall, a well-functioning HIS is an integrated effort to collect, process, report and use health information and knowledge to influence policy and decision-making, program action, individual and public health outcomes, and research. Sound decision-making at all levels of a health system requires reliable health statistics that are disaggregated by sex, age and socioeconomic characteristics (4).

Managers use web based information system to make decisions to solve problems, and information is used in making these decisions in the globe. Therefore, the purpose of this project was to design a web based management information system to the Eye Bank of Ethiopia.

1.2 Statement of the Problem

Eye diseases affecting the cornea are a major cause of blindness worldwide. In some areas of Africa as much as 90% of all blindness is a direct result of corneal pathology (6). Ethiopia has one of the highest prevalence of blindness in the world (7). The national blindness survey which was conducted in 2006 revealed that the prevalence of blindness in the country was 1.6% (7). There are about 1.2 million blind people in the country which means that Ethiopia alone

contributes for 2.7% of the total blindness worldwide. The prevalence of low vision (presenting vision less than 6/18, but equal to or better than 3/60 in the better eye) is also high at 3.7%. The causes of blindness are as follows: cataract accounts for 49.9% of the blindness, followed by corneal opacity (mainly trachomatous) 19.3%, refractive error 7.8%, glaucoma 5.2%, and macular degeneration 4.8% (7).

The Vision Eye Bank aspires to see Ethiopia where corneal blindness is eradicated and its mission is to alleviate corneal blindness and burden of corneal blindness by developing comprehensive, expanded and result-oriented programs. The Values Eye Bank considers sight as a basic human right guaranteed to everyone, committed to equitably treat corneal blind people, they believe in strategic networking of partners and collaborating members to increase accessibility and impact of their service, responsibility to make the Eye Bank a center of excellence in East Africa and achieve good results through limited resources –they want to devote their time for significant tasks (8).

The donor's registration processes are using manual system, where the donors need to complete pledge form and the donor's card. Then, they need to post or forward the form to the eye bank of Ethiopia and keep the donor card in the wallet all the time. The donors are not sure whether their registration is succeeded or not. They do not receive any feedback or confirmation about their application. In addition to that, there is no single point access for both donors and administrators or management. There are also problems that are identified in the current manual system. The public is not aware and less knowledge about eye donation due to less awareness even no web sites promotion which is one of the means. Moreover, the current system lacks security. It is not protected and no one takes responsibility of the system.

There are fewer functions for the management to handle the donor's registration with more efficiency. There is no reporting action where the management need to be done manually about the donor's record. All the analysis has been made by hand and the probability to make mistakes are very high. For example, the management staff could make mistake while categorization of the donors, calculate wrong amount and so forth. This can lead to operational problems and human issues.

The Eye Bank of Ethiopia has been providing eye donation service for over 10 years. However, donor registration, data storage, backup, cornea stock, diagnosis and transplant, and reporting mechanism are still being carried out in a traditional way (Manual system).

Thus, there are many problems with manual donation system.

- ✓ Lack of security of data.
- ✓ Time consuming.
- ✓ Consumes large volume of paper work.

To avoid all those limitations and make the system work more accurately, it needs to be computerized. The web based eye bank management information system will help to improve service delivery of the eye bank of Ethiopia.

1.3 Objective of the project

1.3.1 General Objective

The general objective of the project was to develop a prototype and design web based Eye bank information management system for the Ethiopian Eye Bank

1.3.2 Specific Objectives

The specific objectives of the Project were:

- ✓ To assess the existing paper based eye bank information system in the Ethiopian Eye Bank,
- ✓ To collect and analyze the functional and non-functional requirement of the Eye Bank Scheme,
- ✓ To design web based information system of the Eye Bank Scheme, and
- ✓ Prototype implementation and testing the web based information system of the Eye Bank Scheme.

1.4 Scope of the project

This Project was limited to the development of Web Based Ethiopian Eye Bank Management System. The project started by assessing the existing situation of the eye bank and identified user and system requirements. After identification of the system requirement was made, analyzing and description were used use case model. The designing process of the system shall continue using the UML (Unified Modeling Language) for the eye bank management system. Any

additional requirement was identify in between designing process, it was accepted and added in the design after verification is done with the system users. And the user interface is designed and evaluate by the users. The design of the project does not include the supportive subclass and equipment registration, cleaning, sterilizing and other record like tissue store temperature of the refrigerator part of the Eye Bank.

1.5 Significance of the Project

This Web Based Eye Bank Information Management System (WBEBIMS) was computerizing the existing manual system with better performance. This system was easing the donors and administrators to get a single point of access regarding to eye donation. This will save the donors time to register online. Donor's information and record can be managed more efficiently when they are stored in database. A collection of data will build a block of information. Information can be produced by processing data. Good relevant and effective information is a key to make a good decision-making. Good decision making can lead and guide an organization to survive in a global environment.

Moreover, this system also will help the management and administrators to track the total number of donors who have been registered. This enhanced system will have the capability to donor register, screen donor, tissue collection, serological test, store cornea, evaluate tissue, discard tissue, request cornea, tissue distribution, fill recipient data, follow up of recipient and generate report which is consistent and precise and a powerful DBMS in analyzing the donors according to the district and organ that they want to donate in future. This function will be fast and effective with minimum human errors. The system is very simple to design and requires very low system resources and will work in almost all configurations.

The system shall enhance:

- ❖ Security of data.
- ❖ Ensure data accuracy
- ❖ Minimize manual data entry.
- ❖ Greater efficiency.
- ❖ User friendly and interactive.
- ❖ Minimum time required

The proposed project will help to achieve the VISION 2020 the five-year strategic plan in order to facilitate to prevent and treat major causes of blindness

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

A literature review is an evaluative report of information which related to the Web Base Eye Bank Information Management System (WBEBIMS). The main purpose of writing this literature review is to know what knowledge and ideas that have been established about Web Base Eye Bank Management System. It also will show the strength and weakness of the system.

Besides that, there are resources on the topic of Eye bank Management system have not been published and there are no direct related resources but somehow related information has been collected from internet journals in web site

2.2. General Literature

2.2.1. Eye Care in Ethiopia

Like most sub-Saharan African countries, there is no adequate eye care service delivery system in Ethiopia (7). Many reasons can be given for this. The country lacks sufficient number of skilled eye care professionals at all levels of hierarchy and service delivery. The number of eye care professionals is very limited and inadequate for the large population of Ethiopia. To make things worse, the available eye care professionals are unevenly distributed in the country being concentrated in the main cities. For example, of the 150 ophthalmologists in the country, 60% live and work in the capital city, Addis Ababa serving only the 2.7 million inhabitants of the capital city (7). This leaves the 71 million people living out of Addis Ababa (where majority of the blind are also residing) to be served by only 40 of ophthalmologists. The proportion of ophthalmologists to population ratio is therefore, about 1 to 1.2 million in rural areas and 1 to 45,000 in the capital. Of the 152 ophthalmologists in the country, six have been trained in community eye health, another six have been trained in cornea and external eye diseases, four are pediatrics ophthalmologists, three are glaucoma specialists, four are retina specialists and one has training in oculoplastics. The rest are general ophthalmologists (7).

In comparison to the country's population, the number of eye care personnel is as small as there are few training centers for eye care professionals in the country. Until recently, there was only

one training center for ophthalmologists (Addis Ababa University) which graduates only 4 to 5 ophthalmologists each year. For the last three or more years, Jimma and Gonder University have started training ophthalmologists as well as cataract surgeons. Recently there has been some progress in this regard, even 52 ophthalmologists will graduate as the end of 2009 E.C. and also in the training center for cataract surgeons, ophthalmic officers, optometrists and ophthalmic nurses are opening in different areas in the country (7).

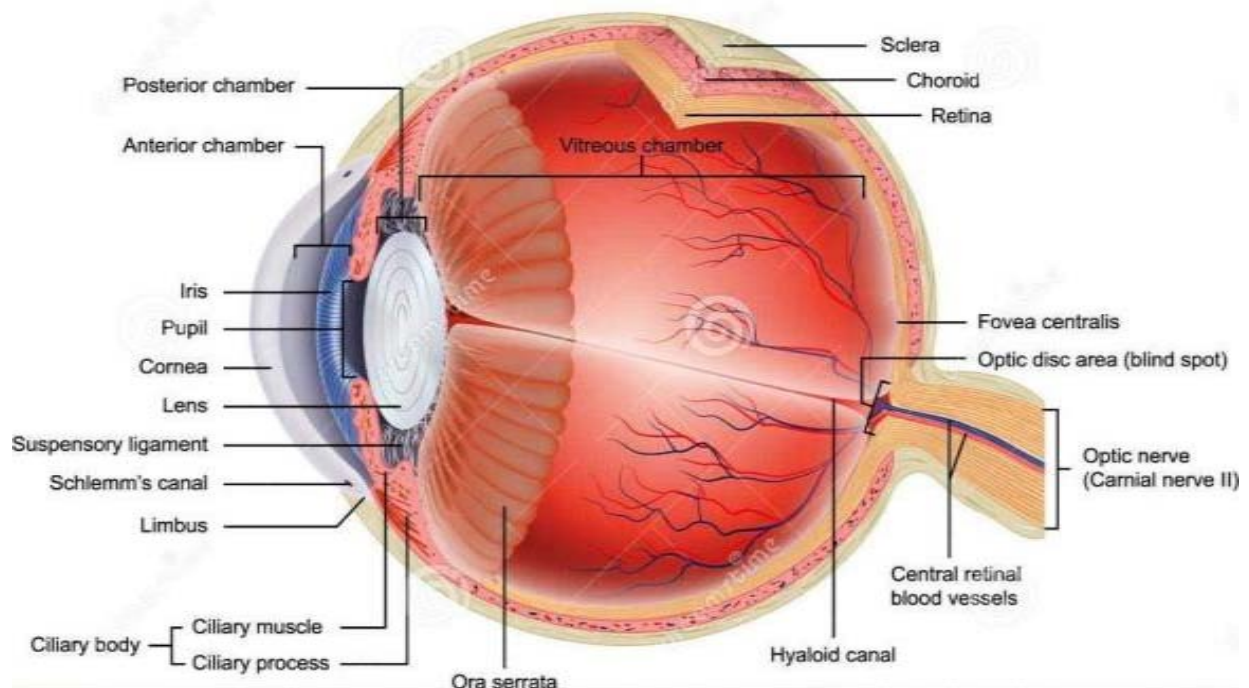
2.2.2. Cornea , its Diseases Cause, And Transplant

2.2.2.1. Cornea

The cornea is the transparent part of the eye that covers the front portion of the eye. It covers the pupil (the opening at the center of the eye), iris (the colored part of the eye), and anterior chamber (the fluid-filled inside of the eye). The cornea's main function is to refract, or bend, light. The cornea is responsible for focusing most of the light that enters the eye. The cornea is composed of proteins and cells. It does not contain blood vessels, unlike most of the tissues in the human body. Blood vessels may cloud the cornea, which may prevent it from refracting light properly and may adversely affect vision. Since there are no nutrient-supplying blood vessels in the cornea, tears and the aqueous humor (a watery fluid) in the anterior chamber provide the cornea with nutrients. The cornea is comprised of five layers: the epithelium, Bowman's layer, the stroma, Descemet's membrane, and the endothelium. The first layer, the epithelium, is a layer of cells covering the cornea. It absorbs nutrients and oxygen from tears and conveys it to the rest of the cornea. It contains free nerve endings. It also prevents foreign matter from entering the eye. The cornea tends to repair itself quickly from minor abrasions. However, deeper abrasions may cause scars to form on the cornea, which causes the cornea to lose its transparency, leading to visual impairment (9).

The cornea is also the clear, dome-shaped tissue covering the front of the eye. It is about the size of a dime and the thickness of a credit card. The cornea is kept moist and nourished by a thin layer of tears. It is kept smooth by the blinking of the eyelids. If the cornea becomes distorted in shape, scarred, or hazy (opaque) from disease or injury, the light rays passing through it are distorted and the vision is reduced. In some cases, a corneal transplant may be necessary to replace the diseased or injured cornea with a healthy, clear cornea to restore good vision (3).

Fig.1 cornea tissue



2.2.2.2. Cause of Cornea Blindness

There are many different conditions which can damage the structure and shape of the cornea leading to visual impairment and blindness (10). These include infectious, nutritional, inflammatory, inherited, iatrogenic (doctor-caused), and degenerative conditions. Disease patterns vary in different environments. Overall, in low- and middle-income countries, infectious keratitis tends to be the most common problem. However, other conditions, such as trachoma or onchocerciasis, may dominate in some areas (10).

2.2.2.3. Cornea Transplant

The cornea, a transparent layer over the front of the eye, functions as a refracting and protective "window" membrane through which light rays pass on the way to the retina. While there are no blood vessels in the cornea, there are many pain fibers, so that most injuries do cause severe pain(11).

Corneal ulcers Scarring or perforation due to corneal ulceration is a major cause of blindness throughout the world (11). Usually such ulcers can be treated if attended too quickly. Ulceration may be caused by bacteria such as streptococcus, viruses (herpes simplex keratitis being one of the most common), fungi, vitamin A deficiency, or other disorders. New drugs have aided the treatment of many of these conditions. Degenerative corneal conditions Keratoconus, a rare

degenerative condition which is inherited, causes a general thinning and an abnormal protrusion of the central cornea, as well as some scarring. Blurred vision results, and in advanced cases there may even be perforation of the cornea. While contact lenses (especially the new soft types) can aid vision in the early stages, corneal transplants are sometimes performed before extreme thinning takes place, and in such cases reading vision can usually be obtained (11).

Other degenerative conditions include corneal dystrophy and arcus senilis, an extremely common condition in elderly people. Other types of corneal disorders may be indicated by pain, irritation, or blurred vision; however, some corneal ailments can be detected only by a trained eye specialist (11).

Corneal Transplant (Keratoplasty) When the cornea becomes scarred, hazy, or opaque or when there is danger of perforation of a corneal ulcer, an ophthalmic surgeon may remove the affected cornea and replace it with a healthy one taken from a donor. It is easy for one to donate eyes for this purpose at death. Only the cornea is used in such cases. There is no immediate prospect of successful whole eye transplants. Surgeons would prefer to use the donated cornea immediately, but it may be used within sixty to seventy hours after death if handled properly. New techniques for this procedure involving surgery under a microscope and use of finer suture material have constituted a major advance in treatment of corneal disorders (11). Ordinarily using a knife called the trephine, which functions rather like a cookie cutter, the surgeon performs what is called a "penetrating keratoplasty." The defective cornea is cut with the knife and lifted out. A matching piece of the donor cornea is cut with the same knife, used to replace the excised piece of the defective cornea, and held in place by very fine sutures. The convalescence from this surgery is relatively brief and uncomplicated these days. Best vision returns when the sutures are removed about one year after surgery. Chances of rejection of the new cornea are rated by most authorities at from one to five percent (11).

2.2.3. Health information system

Health information systems in most developing countries are woefully inadequate to provide the needed information support (12). There is a need by the health sector of developing countries to use the limited resource effectively in order to provide an efficient and equitable health service to the communities. This then requires sound management that is based on information, which is

crucial at each level of the health service management. Correct and up-to-date information is critical, not only for the provision of high-quality clinical care, but also for continuing health care, maintaining health care at an optimal level, clinical and health service research, and planning and management of health systems (4).

Health information systems refer to any system that captures, stores, manages or transmits information related to the health of individuals or the activities of organizations that work within the health sector. Overall, a well-functioning HIS is an integrated effort to collect, process, report and use health information and knowledge to influence policy and decision-making, program action, individual and public health outcomes, and research. Sound decision-making at all levels of a health system requires reliable health statistics that are disaggregated by sex, age and socioeconomic characteristics (13).

2.2.4. Historical Overview of Eye Donation

Organ Donation is the process of giving an organ or a part of an organ for the purpose of transplantation into another person. An organ transplant is surgical operation in which a failing or damaged organ in the human body is removed and replaced with a functioning one. The donated organ may be from a diseased donor, a living donor, or an animal. In some cases an artificial organ is used. Organ donation also can be defined as the ultimate humanitarian act of charity (1). The commonly donated organs are kidney, heart, liver, lungs and pancreas, while the tissues are eyes, bones, heart valves and skin. In this modern day, not many people are willing to donate their organs after they die (1). Furthermore, public also do not know the procedure and the way to register. There are less advertisement and awareness about organ donation among the community. From the entire organ donated, eyes are desperately needed to restore sight for people with corneal disease or injury (1). The Procedure has a 95% success rate.

2.2.5. Eye Donation and its Benefit

Eyes can be donated only after death. A living person can only make a pledge to donate eyes after death. To transplant a pledge to an actual donation after one's death, it is essential to inform close ones about our wish. Closed people need to call the eye bank in the hour of grief. You could help two blind persons regain vision by this noble act (2).

Corneal Transplant is the most frequently done organ transplant and also the most successful among organ transplants. Sight can be restored to people who have lost vision due to damaged cornea, which is the transparent layer in the front portion of the eye. Vision may improve fully (6/6) or partially, if there are other eye problems. Corneal transplants can fail in some patients, due to rejection and non-rejection problems (2).

Sight cannot be restored if blindness is due to damage to structures other than the cornea, such as the retina and optic nerve. The whole eyeball cannot be transplanted and only the damaged cornea can be replaced with a donated healthy cornea (2).

Any person, irrespective of age, sex, blood group and religion can donate eyes after death. Prior registration is not essential. Diabetes, patients with blood pressure, those using spectacles, those with prior eye surgery or eye problems can all donate (2).

When there is a risk of disease transmission from one person to another, eyes cannot be donated. Persons having infections such as AIDS, jaundice (Viral Hepatitis), rabies, meningitis, tetanus, and septicemia (generalized infection) etc. cannot donate. Blood cancers and cancers which have spread to the eye or the brain cannot also donate (2).

2.2.6. Eye Bank of Ethiopia

An eye bank is a non-profit organization that is involved in the donation, procurement, testing, processing, preservation, storage and distribution of human ocular tissues and cells for use in corneal transplantation, ocular surgery, research and education (4). The Eye Bank is responsible for all aspects of the process of providing safe, quality tissue to ensure maximum success for the recipients. The Eye Bank operates a comprehensive Quality Assurance system conforming to the highest international standards for safe tissue, and the highest ethical standards for ensuring respect and consideration of the donor's gift (4).

The Eye Bank of Ethiopia in Addis Ababa has been in existence since 2003. It is associated with Menelik II Referral Hospital, a tertiary referral center, where most of the transplants are done. The eye bank also sends corneas to two university referral hospitals in north western and southern Ethiopia (3).

2.2.7. ICT developments in healthcare industry

The big stories in ICT development are not of particular breakthrough technologies, but rather those of rapid and continuous improvement in price performance of both computing and communications, the explosion of bandwidth capacity in fixed and mobile networks, and the emergence and development of the internet and internet-based applications. Perhaps the most important development is the convergence of technologies, which is opening up new possibilities in a number of fields (14).

There are some areas where leading-edge ICT developments are employed and developments at the leading-edge will be important. In other areas, the health system is some way behind other industries in the adoption and application of information management and information systems. In general, the situation seems to be one of relatively slow progress through the evolving computing paradigms of functional computing, enterprise computing and network computing. Some functions are highly automated, but integrated enterprise computing in hospitals and clinics is still rather rare (14).

2.3. Related work literature

2.3.1. Transplant Management (OTM) system

The study conducted in 2010 shows that the Organ Transplant Management (OTM) system is a modular software agent-based platform, including adaptive and user friendly graphical interfaces to facilitate the access for nurses, physicians, surgeons, etc. (who are not necessarily IT experts) to both the data and the mechanisms required for effective coordination of the main OTM tasks. Agent technology is one of the most promising approaches for designing and implementing autonomous, intelligent and social software assistants capable of supporting human decision making (15).

2.3.2. web based project management system for the Company

The study conducted in Anne-Mai Adamssoo in 2010 shows that working web based project management system for the company. It increase an efficiency of a product, many web development companies are using different project management systems. A company may run a number of projects at a time, and requires input from a number of individuals, or teams for a

multi-level development plan, whereby a good project management system is needed. They believed a proper project management system plays a distinctive part in ensuring reliable, robust and high quality web applications for customers. Developing a web based project management system and showing how, in turns, it helps users to handle projects. These processes in every days working life, was the scope of the project. The reliability and robustness of a web based project management system has also been set as the structure of the current project.

A web based project management system has been developed, which highly meets the standards and requirements set by the company. The primary goal for the project was to make a complete project for daily use in one small company, which should confirm all requirements. The web based project management system is written in PYTHON programming language, and has some PHP and HTML inside. Additionally, the most suitable and obvious application was found, but it is already made, implemented and the application is widely used all over the world. The readymade application was chosen for implementation, than starting to create whole application from zero. Modifying and deploying the application was quite challenging, because to improve an already made application and to suite it to companies requirements, needs by developer more concentration and understanding of the whole structure of a system. Finally, a web based project management system has been developed, which highly meets the standards and requirements set by the company and User management tool is a good appliance for keeping eye on the project and for giving rights to different users by system administrator in company (16).

2.3.3. Online Organ Donation Management System (OODMS) in Malaysia

The study conducted in Chitra A/P Ramasamy in Malaysia at 2007 shows that the online organ donation management system (OODMS) is developed mainly for general hospital (GH), clinics and other centers to manage the donor registration and user maintenance. It is an online system which only can be or valid in Malacca. The public can retrieve information about organ donation in this web site. People who interested can register themselves through this system. The application will be processed by the administrator and each donor will be receiving feedback about their application status. Furthermore the authorized user's account may be maintained by the administrator. The donor record will be managed by four main users such as administrator, doctor, medical assistance and management staff. Only administrator has an authority and privileges to print organ list report and total donation report according to district form this

system. The methodology of this system is structure system analysis and design (SSADM). An analysis study has been based on the current manual system and all the problem statements and requirement have been identified. Moreover, OODMS is three tire architecture systems which involve client tire, business tire and database management tire. The interfaces for OODMS have been designed according to the requirement and needs of the current market. Rather than that, this system also has been tested and evaluated in real life. This online Organ Donation Management system will help to improve the performance of current satiation and overcome the problem that arises now a day (17).

2.3.4. Online Blood Donation Reservation and Management System in Malaysia

The study conducted in TEH GEOK TUAN in Malaysia at 2006 shows that Online Blood Donation Reservation and Management System (OBDRMS) is a web database application that enables the public to make online session reservation, to view nationwide blood donation events online and at the same time provides centralized donor and blood stock database. This application is developed by using JSPI Servlet technology from J2EE with the MySQL 5.0 as the database management system. The methodology used to develop this system as a whole is Object Oriented Analysis and Design; whilst, the database for OBDRMS is developed by following the steps in Database Life Cycle. The targeted users for this application are the public who is eligible to donate blood,' system moderator, administrator from National Blood Center and the staffs who are working in the blood banks of the participating hospitals. The main objective of the development of this application is to overcome the problems that exist in the current system, which are the lack of facilities for online session reservation and online advertising on the nationwide blood donation events, and also decentralized donor and blood stock database. Besides, extra features in the system such as security protection by using password, generating reports, reminders of blood stock shortage and workflow tracking can even enhance the efficiency of the management in the blood banks (18).

Generally, it is online blood donation reservation and management system in Malaysia used by the hospital blood bank. It is a web database that contains donor and blood stock information and it has the ability to keep track of the blood stock in the hospital and the donation records of the donors. This website will enable the public to make online reservations and includes online advertising for all the blood donation events. The hospital managers can manage the donors and

blood stock appointments. The targeted users are the manager from National Blood Center, the public who want to donate blood, and the staffs from participating hospitals (18)

2.3.5. Web-Based Blood Bank Information Management System in Ethiopia

The study conducted by Gadisa Kebede in Addis Ababa, Ethiopia in June/2016 shows that to design a web-based blood bank information management system for the National Blood Bank of Ethiopia. This project is carried out at National Blood Bank Center, Addis Ababa. The project follows a design methodology and an object oriented system analysis and design approach to analyze and design the system. In-depth interview, document review and inventory were done to analyze the existing situation. To model the analysis and design of the proposed system Unified Modeling Language (UML) modeling techniques is used and both Hyper-Text Transfer Protocol (HTML) and Hypertext Preprocessor (PHP) is used to develop the system prototype. And My Structured Query Language (MySQL) database management system is used to design the prototype database (19).

All the system's processes and its boundary were identified and described by using use case diagram. Eight processes with their corresponding actors were identified for the system. The flow of the process was presented using activity diagrams. The object model was described by using class diagram. And finally, the system prototype was developed for the user interface testing. The results of the user interface testing shows that User test for the system prototype was done and it shows that 75% of the participants in the evaluation and testing have shown positive attitude and response for the system usability (19).

CHAPTER THREE

METHODOLOGY

3.1. Introduction

A phased development methodology of object-oriented approach was applied to the study of the design system. Interview and document analysis were used as the main tools to capture the business system requirement along with observation. Unified modeling language (UML) development techniques applied in the process of requirements capture, model organization business system and design. Visio and Visual Paradigm Software were employed in analysis and design models diagramming. Besides, the study result should be disseminated to the responsible stakeholders by considering ethical issues with the appropriate operational definition.

3.2. The Study Setting

The study was conducted in the Eye Bank of Ethiopia which is strategically located in the premises of one of the oldest hospitals in the country, Menilik II Hospital constructed in 1910, located in the Eastern side of Addis Ababa. It is a tertiary training center for eye care professionals and health workers. The Eye Bank procures corneas through presumed and next of kin consents according to an administrative directive issued by the Federal Ministry of Health (3).

3.3. Source and study Population

The source populations of the study were staffs working at Ethiopia Eye Bank. And the study populations were lab-technician, lab-technician supervisor, Eye Bank managers, and medical director of the Eye banks. Observation of the overall activities to seek additional information was done.

3.4. Study Design

As some people said, 'a good beginning leads to half of then success' ; the right choice of system development methodology and proper beginning is crucial to the success of the whole system development as well as the project itself.

Object oriented design methodology was used to design as well as to develop the prototype of system. Object oriented design is an advance in the software engineering field which has an iterative and incremental nature. The Object oriented methodology was chosen in order to reduce software development time, and resources required to support existing programs and applications, increase code reusability.

3.5. Software Development Life Cycle (SDLC)

A systems development life cycle is composed of a number of clearly defined and distinct work phases which are used by systems engineers and systems designer to plan for, design the information systems. A SDLC aims to produce high quality system design that meet or exceed customer expectations, based on customer requirements, which move through each clearly defined phase, within scheduled time-frames and cost estimates. To manage this level of software development life cycle, a number of SDLC models or methodologies have been created, such as "agile"(19).

3.6. Agile Approach

Collecting all the requirements from the user at the beginning of project development is very difficult. Users typically have difficulty explaining what they need, and the problems increase when developers fail to translate requirements into working software. The total time given for the accomplishment of the project is of course about less than five months and also select respondents from the study area source and study population available all the time to collect the relevant information. Therefore, for delivering the project within the any time and due to unlimited constraints agile software development methodology shall be applied in the study. This method follows the following major phases in a sequential manner.

- ❖ System Investigation
- ❖ System Analysis
- ❖ Design
- ❖ Prototype Implementation

3.7. System Investigation

The requirement collection carried out in the Eye Bank of Ethiopia starting from December 2016.

3.8. Requirement Collection Instruments

The requirement was collected using different types of instruments, including document review, observation, and interview. For the people (managers, and users) interview would use because through interview the feeling, opinions of the peoples could understand rather than observation and documentation analysis , for the data's and procedures interview and document analysis would use.

3.9. System Analysis

After requirement captured using the interview, observation and document review the result will be analyzed. The result was present by summarize from the requirement collection of the existing system. The result of the system modeling that helps to understand the system models used for analysis of the system would done by using tools like the use cases diagram, , class diagram ,sequence diagram.

Models

A model is a representation of an important aspect of the real world. It is sometimes called an abstraction as it is used to separate out and aspect of particular importance. Data depiction was make using the following models

1. Use case diagram
2. Class Diagram
3. Sequence diagram
4. Activity diagram

3.10. System Design

Communication with users is needed, it combines both data and process and it identifies the relationship and collaboration between end users and the system plus it increases program code reusability. It's also flexible and easily Manageable during changes. The system used a unified modeling language analysis models to represent what objects should be included in the system.

3.11. System development tools

It is a software system support that helps produce models or different elements needed within the project. It helps create models and components required in the project. The tools that were used for analysis and style during this project were:

Frontend (in the Client Side)

HTML: was chosen because it could easily work along with cascading style sheets, hypertext preprocessor, while it's flexible and can be opened by any browser.

CSS: was designed primarily to enable the separation of document content from document presentation, including aspects such as the layout, colors, and fonts and basically designs, This separation can improve content accessibility, provide more flexibility and control of the system.

PHP: this code was used because it could be embedded into HTML and it uses as link to connect the html with the database. It could be opened with any browser and it could easily be connected to most databases including MySQL.

Backend (in the server side) MySQL database server was used because it is an open source easily accessible and compatible with the above applications. The applications used to design the system were:

- ✓ Adobe Dreamweaver was used for the designing of the prototype.
- ✓ Microsoft Visio and Edraw Max for drawing various modeling diagrams
- ✓ Xampp server to access the MYSQL Database
- ✓ Microsoft office for documentation purpose
- ✓ Google chrome, Opera 44 and other browser for viewing the web pages.

3.12. System Testing Phase

I used formative usability testing to maximize the usability of the prototype WBEBMIS developed. The prototype WBEBMIS is tested against the requirements to make sure that the system developed is actually solving the needs gathered during the requirement phase.

3.13. Ethical Considerations

Prior to data collection, ethical clearance will obtain from school of public health and school of information science of Addis Ababa University. In addition concerned bodies will inform about the study. And interviewees will ask permission to go on with the interview.

3.14. Method of Dissemination of Results

Being an academic project, at the end of the project the investigator will deliver the design system documentation to AAU in partial fulfillment of MSc in health informatics. Furthermore the result of this project will be disseminated to Federal Ministry of Health (FMoH) and Eye Bank of Ethiopia.

3.15. Operational Definition

Consent: A process where approval for donation is obtained from the donor (called “First Person consent” or “FP”) or the donor’s next of kin or other legally recognized representative.

Cornea: It is a transparent tissue without any blood vessels. A clear cornea enables one to have a good vision

Donor: A deceased individual who provides the source of tissue for transplantation, education, or research.

Expiration Date: The date after which instruments, supplies or tissues are deemed no longer suitable for use.

Eye Bank: It is the link between donor and recipient/eye surgeon. It is an organization recognized by the government to collect and distribute human eyes to those requiring corneal transplantation.

Identification Number: An unique numeric or alphanumeric designation assigned to, and thus associated with, a donor or recipient, a specific establishment (or facility) and tissues for the purpose of tracking and confidentiality. If donated ocular tissue is divided, an unique donor identification number is distinctly assigned to each part.

Next Of Kin: The person(s) most closely related to a deceased individual as designated by applicable law such as the Uniform Anatomical Gift Act.

Patient: a person who receives medical attention, care, or treatment. A patient can be a recipient as well as a potential donor.

Preservation: The use of chemical agents, alterations in environmental conditions or other means to prevent or retard biological or physical deterioration of ocular tissues

Procedure: A series of steps, which when followed, are designed to result in a specific outcome.

Recipient: a patient/ an individual who is waiting /receiving an ocular tissue transplant. A recipient is registered in one or more waiting lists in the WBEBMI system within a given transplant health institution.

Time of Death: For purposes of eye donation, the time of death is the cessation of heartbeat, cardiac death, a systole, cross-clamp, last known alive (LKA), or it can be the time of death established by core temperature, when applicable and with appropriate documentation from a medical professional

Tissue collected: Tissue is retrieved either through enucleation (whole eye ball removal) or corneal excision. Presently Ethiopia eye banks, retrieve cornea by in situ corneal excision procedure. This procedure involves removing just the cornea from the whole eye of the deceased/donor. The procedure takes 20 to 30 minutes. The excised cornea is introduced into a preservative medium. It is a surgical procedure whereby an impaired cornea of the patient is replaced by a healthy cornea from a donor for gaining the lost vision.

Tissue Identification Number: Any unique combination of letters, numbers, and/or symbols assigned to ocular tissue and linked to a donor, from which the complete history of the collection, processing, packaging, quarantine, labeling, storage, and distribution of ocular tissue can be traced

Transplantation: The transfer of tissue to a recipient.

CHAPTER FOUR

BUSINESS AREA ANALYSIS AND REQUIREMENT DEFINITION OF THE SYSTEM

4.1 Introduction

As investigator mentioned in the previous chapter, an object oriented modeling methodology with an iterative process model is used to analyze the project. To obtain all the required information for the system design, in-depth interview, document review and inventory were conducted. In addition, the UML modeling technique was used to model the analysis of the system. In this chapter the key findings, the requirement analysis and definition of the system are discussed

It gives a detail description of the existing system all the way through various mechanisms in which it improves our understanding much better about the current system. There are several issues that will be undertaken in this chapter. Initially we will be a little more precise about major function of existing system than we will identify the actor. Furthermore this chapter will demonstrate the job done by the system with clear input, process and output. The problem will be identified by using PIECES frame work than we will identify the business rule of the existing system that will be illustrated in detail and then we will try to show the forms used as well as the report generating by the existing system, finally by placing alternate option the proposed new system is discussed and gives it functional and non-functional and business rules.

4.2 Major Function of the Existing System

The in-depth interview and the documents reviews done at the eye bank helped the investigator to acquire the required information for the EBIMS. The key findings both from the in-depth interview and document review are described in the following basic function (business activities) in the existing system are maintain details of the Register Donor, Donor call initial, Donor medical particulars, Screen donor selection, Donor information detail, Tissue collection detail, Serological test, Store cornea, Tissue evaluation, Discard cornea, Tissue Request, Tissue distribution, fill recipient data, Adverse report detail, Follow up transplanted patient, and Generate Report. Each of the above describe function in the existing system has input, process and output.

i. Register Donor

Description: It is to be filled with the correct contact details, signed by 1/2 witness/es (can be your relative/friend) and given back to the eye bank. The eye bank will issue a donor card that has contact details of the eye bank.

Input	Process	Output
✓ Eye Pledge form	✓ Any people who are willing to pledge their tissues	✓ issue a donor card
✓ Physical presentation of the donor	✓ Fill the form with the correct contact details,	that has contact details of the eye bank
✓ Physical presentation of the witness	✓ Signed the one or two witness/es (can be your relative/friend).	
✓ Unique registration id		

ii. Donor Call Initial

Description: An eye bank receptionist receives a call from a hospital or Transplant Coordination/ Procurement Unit or another “officially designated” third party that an individual has died and has met preliminary criteria for donation.

Input	Process	Output
✓ eye bank receives a call	✓ Try to contact the next of kin,	✓ Get initial information about the donor
✓ donor(name ,age, time of death, cause of death, placed at)	✓ Try to obtain consent and	
✓ caller(name, address, relation of donor)	✓ Try to recover the tissue to happen within 8 hours after the time of death	
✓ time taken donor to Eye Bank		

iii. Donor medical particulars

Description :At the time of any person’s death, his/her relative/friend, who was a witness for the pledge form or any other family member/friend who had the knowledge that the person who passed away intended to donate the eyes, should call to the eye bank.

Input	Process	Output
✓ Call from witness	<ul style="list-style-type: none"> ✓ Family consent is given, ✓ the eye bank obtains copies of relevant medical records for review from the hospital, ✓ Creating a complete donor profile. ✓ Eye banks pay close attention to the cause of death, any medications that were administered to the individual and if there was any blood loss. 	<ul style="list-style-type: none"> ✓ Death certificate of the donor ✓ Medical history had finished

iv. Screen Donor Selection

Description: is important to determine if the potential donor has an infection that could be transmitted to recipients through the transplanted organs and/or tissues.

Input	Process	Output
✓ Donor (Age, medical history, legal consent, serological test)	<ul style="list-style-type: none"> ✓ donor has limited upper and lower age ✓ Donor face cleaning ✓ Legal consent (consented donor meets medical and social history, physical assessment reveal on contraindication to donation and acquisition of donor tissue can be carried out) ✓ review of the donor's medical records ✓ performs several tests on the donor's blood ✓ evaluate suitability of donated corneas using powerful microscopes 	<ul style="list-style-type: none"> ✓ Screens out potentially harmful diseases.

v. Donor information detail

Description: After a collection of tissue, must take care the donor detail because it review and evaluate so many times

Input	Process	Output
✓ Donor (Name, EB no, tissue type, attending physician, type of preservation, lot no, immediate cause of death, case history...)	<ul style="list-style-type: none"> ✓ Review donor evaluation 	<ul style="list-style-type: none"> ✓ Know overall donor information ✓ Decide do/do not/ use for surgery

vi. Tissue collection detail

Description: It is harvested and transported to the eye bank for further processing, evaluation, storage and distribution.

Input	Process	Output
✓ Motivator to give the tissue	✓ Motivate donor family/ next-of-kin,	✓ Collect the tissue
✓ Consent taker	✓ The user fills harvested donor eye date,	
✓ Blood sample of the donor	✓ Procedure is done , and	
✓ Transport donor site to Eye Bank	✓ Ready mode of transport Eye Bank to donor site and vise verse	
✓ Lab technician		

vii. Serological test

Description: before release of tissue for transplantation, the donor blood sample test decide whether suitable or not to recipients.

Input	Process	Output
✓ Appropriate form	✓ blood sample test	✓ Result of test
✓ blood sample with recording the date and time of sampling within 24 hours	✓ serological results shall be received and assessed	
✓ serology testing laboratory or test kits approved for use by the appropriate authority		

viii. Store cornea

Description: After removing the cornea, the tissue is placed in a storage medium. This medium keeps the tissue viable and helps to reduce bacterial growth. The technician then transports the cornea to the eye bank’s laboratory for refrigeration.

Input	Process	Output
✓ cornea tissue,	✓ Label cornea tissue	✓ Store tissue in sustainable way
✓ Eye bank identification number	✓ keeps storage medium the tissue viable and helps to reduce bacterial growth	
✓ storage medium		

ix. Tissue evaluation :

Description: Specially trained technicians evaluate the cornea through evaluating materials like microscopes to ensure that it meets the eye bank’s strict criteria before release for transplantation.

Input	Process	Output
✓ Cornea tissue	✓ Infectious disease testing	✓ Suitability for
✓ Eye bank identification number	result evaluation	Surgical Use
✓ Blood sample result	✓ Physical assessment of the donor evaluation	cornea tissue
✓ Donor history information	✓ Tissue evaluation	
✓ Martial for evaluate the donor tissue	✓ Donor history evaluation	

x. Discard cornea

Description: Any tissue in stock from donors with conflicting serology results or reach expires date will be quarantined and discarded

Input	Process	Output
✓ Tissue in stock from donors	✓ Review storage conditions,	✓ Discard the tissue
✓ EB identification no	✓ recovery records,	
	✓ processing records, and	
	✓ mate status	

xi. Tissue Request

Description: the surgeon fill form to ask the eye bank wants to transplant to the recipient

Input	Process	Output
✓ Tissue in stock from donors	✓ Review storage conditions,	✓ Discard the tissue
✓ EB identification no	✓ recovery records,	
	✓ processing records, and	
	✓ mate status	

xii. Tissue distribution

Description: The designee authorizes release of the tissue, the cornea is then sealed and packed in a container in wet ice (to ensure it remains between 2-8 degrees and does not freeze)

Input	Process	Output
<ul style="list-style-type: none"> ✓ Reviewed of Donor Medical Information detail ✓ Receivers of Tissue ✓ Donor information detail ✓ Means of transportation 	<ul style="list-style-type: none"> ✓ Release of tissue ✓ sealed and packed in a container in wet ice 	<ul style="list-style-type: none"> ✓ Distribute tissue in Fair and Equitable ways

xiii. Fill recipient data:

Description- fill recipient data at the time of surgery

Input	Process	Output
<ul style="list-style-type: none"> ✓ Fill tissue record ✓ recipient ✓ Surgeon 	<ul style="list-style-type: none"> ✓ fill the form 	<ul style="list-style-type: none"> ✓ Capture Recipient date.

xiv. Adverse reaction detail

Description: adverse reaction is any communicable or other disease transmissible by, and attributable to, transplantation of donor eye tissue, including infection and biologic dysfunction

Input	Process	Output
<ul style="list-style-type: none"> ✓ Patient with infection and biologic dysfunction ✓ Surgeon ✓ The donor Transmit disease to the patient 	<ul style="list-style-type: none"> ✓ Report to the Eye Bank 	<ul style="list-style-type: none"> ✓ Review by the accreditation team at the time of inspection ✓ To ensure safe and efficacious donor corneal tissue, ✓ Monitoring trends and practice patterns.

xv. Follow up transplanted patient

Description: The eye bank must obtain recipient information from the transplanting surgeon on each eye tissue used for human transplantation distributed to the surgeon by the bank.

Input	Process	Output
<ul style="list-style-type: none"> ✓ Transplanted Patient ✓ Surgeon 	<ul style="list-style-type: none"> ✓ Updated Patient history 	<ul style="list-style-type: none"> ✓ obtain follow-up information from surgeon

4.3 Report generated and Forms in the existing system

The investigator has learned that, every document in the Eye bank is kept in a manual paper based filing system. It is challenging to find a document of exact data in a given time. To get exact information of pervious data's on an exact procedure one has to go through each and every document one by one serially. The chance of getting the required information is low; sometimes there is a possibility of being unable to get the required information. In Eye Bank prepares different types of reports that reported to different managerial level. The report is generated daily, monthly, quarterly and annually.

- ✓ Describe the number of persons registered/pledges for eye donations.
- ✓ Describe the number of eyes Collected/ Utilized
- ✓ Describe the number of eyes distributed (S.No., Name of organization, No. of eyes etc....)
- ✓ Immunology laboratory serology report: (Name ,Date ,MR. No , Serology No ,Age & Sex , Category , Eye Bank, Nature of specimen, Blood, Referring Eye Bank ,Reference No, Tests Done Report (HIV , HBs Ag ,DRL ,Date ,Technician ,Microbiologist) It describe conflicting serologic and positive non-required test results that may be indicative of risk for HIV or viral hepatitis will be reported to the eye bank managerial.
- ✓ **Adverse report** describes request that all surgeons who receive ocular tissue report any cases of postoperative infection with a positive cornea scleral rim culture.
- ✓ **Tissue report** describes record the method and date of storage.

The Eye bank Uses different kinds of forms are required to capture information. All the formats are in paper based form:

I. Pledge Form

This form is used to register all necessary information about donor and 1or 2 witness/es (can be your relative/friend) needs to be filled with the correct contact details.

II. Donor call form

This form is used to record all necessary information about receives a call from a hospital or Transplant Coordination/ Procurement Unit or another “officially designated” third party that an individual has died and has met preliminary criteria for donation.

III. Donor medical particulars form

This form is used to record all necessary information about at the time of any person’s death, his/her relative/friend, who was a witness for the pledge form or any other family member/friend who had the knowledge that the person who passed away intended to donate the eyes, should call to the eye bank.

IV. Donor screening forms

This form is used to record all necessary information about the information regarding the circumstances surrounding the death of a donor and adequate medical history so that the suitability of the tissue for transplantation may be judged.

V. Donor information detail

This form is used to record all necessary information about take care donor detail after a collection of tissue, because it review and evaluate so many times.

VI. Harvested/collected Donor tissue form

This form is used to record all necessary information about harvested and transported to the eye bank for further processing, evaluation, storage and distribution (eye donation Motivated , Motivated by, Designation, Consent taken at ,Consent given by, Position of body, # of tissues, sample obtained , During the procedure Problems / Solutions ,Procedure done by, Time, Procedure done at, Assisted by, Team members, Mode of transport Eye Bank to donor site, Donor site to Eye Bank, Case #, Month ,and Year)

VII. Serological test form

This form is used to record all necessary information about before release of tissue for transplantation, the donor blood sample test decide whether suitable or not to recipients.

VIII. Store cornea form

This form is used to record all necessary information about after removing the cornea, the tissue is placed in a storage medium.

IX. Tissue evaluation form

This form is used to record all necessary information about evaluate the cornea through evaluating materials like microscopes to ensure that it meets the eye bank’s strict criteria before release for transplantation.

X. Discard cornea form

This form is used to record all necessary information about any tissue in stock from donors with conflicting serology results or reach expires date will be quarantined and discarded

This form is used to record all necessary information about

XI. Cornea tissue request form

This form is used to record all necessary information about

XII. Tissue distribution form

This form is used to record all necessary information about the designee authorizes release of the tissue, the cornea is then sealed and packed in a container in wet ice (to ensure it remains between 2-8 degrees and does not freeze)

XIII. Recipient fill form

This form is used to record all necessary information about recipient at the time of surgery.

XIV. Adverse reaction form

This form is used to record all necessary information about adverse reaction of any communicable or other disease that is reasonably likely or proven to have been transmitted by transplantation of donor eye tissue including infection and biologic dysfunction.

XV. Follow up Recipient form

This form is used to record all necessary information about recipient follow up how many of them to be successful or not. If they are not successful, the bank should identify the problem and to be train their expertise.

4.4 Business Rule of Existing System

A business rule describes a standard business practice that constrains the design of the solution. Business rules define acceptable corporate behavior in response to business events. They grant authority to act while imposing limits and conditions on how users interact within their business environment. From an information system perspective, the rules define which processes, data,

constraints and performance criteria are acceptable. Properly expressed, they are a set of formal business requirements (20).

Table 1. Business Rules of the Eye Bank

Rule ID #	Rule Type	Statement	Source Date	Priority	Use Case Source
BR1	Operative	The donor must always treat with dignity and respect	Interview	high	EBUC-01,03,04&05
BR2	Operative	Eyes must only be pledged by alive person and pledge once in his/her life	Interview	high	EBUC-01`
BR3	Operative	The Eye Pledge form must to be filled with the correct contact details, signed by 1/2 witness/es (can be your relative/friend).	Interview	high	EBUC-01
BR4	Operative	The donors have to the lower and upper age of 2 -75 years limit.	Interview	high	EBUC-05
BR5	Operative	Cornea must donates only at the time of death and removed only after death	Interview	high	EBUC-04
BR6	Operative	Removal of corneas must be done with the written consent of the donor family (next of kin) after the donor's death. Even in pledged donor, consent should be taken from close relatives Eyes should not be harvested unless the donor family give consent	Interview	high	EBUC-04
BR7	Operative	Cornea tissue enucleation should be done within 8 hours of demise	Interview	high	EBUC-06
BR8	Operative	Donor blood sample must be taken within 24 hours of death and a blood sample from the donor must be tested.	Interview	high	EBUC-07
BR9	Operative	Any tissue in stock from donors with conflicting serology results and reach expire date must be quarantined and discarded immediately.	Interview	high	EBUC-10 & 11
BR10	Operative	Access to tissue must be provided without regard to recipient sex, age, religion, race, creed, and color.	Interview	high	EBUC-13
BR11	Operative	Surgeons should report to the eye bank all serious adverse reactions	Interview	high	EBUC- 15

4.5. Problems of the Existing System

The existing system that is currently running has the following difficulties however it is running smoothly. And from these, I have identified and list them out using PIECES framework (21).

A. Performance Related Problems

Performance related problems can be identified by checking the outputs against performance criteria and observing the behavior of workers in the Eye Bank. These problems generally described in terms of thought put and response time.

Throughput

Throughput describes the amount of resource put through each process with in my system.

- ✓ Lack of integration among the already stored file which decreases the overall performance of the system.
- ✓ Difficulties of identifying the donors or poor searching mechanism.
- ✓ Checking the availability of donor pledge and store tissue needed requires remembering the location that is the shelf and refrigerator number of the item.

Response time

Response time describes the time required to get a response from the system for each request comes from users.

- ✓ The existing system consumes much time to give response for requests that came from user of the system.

B. Information Related Problems

Input

- ✓ Data is not accurately captured.

Because of the current system is manual; it does not have any data validation mechanism. So people may register data, which is not valid. Which means all data is inputted to the system is subject to human errors.

- ✓ Data is captured redundantly.

In the current system the same data is recorded again and again which is unnecessary.

Output

- ✓ Lack of information - Lack of keeping full information about the whole donor, recipient
- ✓ Inaccurate information

Because of the system is manual and in doing some tasks the donors make many inaccurate

information's. Man-made error such as forget to record the usage or input of the donor information can cause the inaccuracy.

- ✓Difficulty of producing information

There are difficulties to produce information on related to reports in the current system this is due to that reports are generated from number of records, like from donor pledge, donor information, serology test...

- ✓Difficulty of getting timely information

In the current system it is time taking to search and check availability of register donor.

Stored data

Data is stored redundantly in multiple files.

C. Economic

- ✓Difficult of generating report to the concerned user of the system within a short period of time and minimal cost.
- ✓Difficulties in controlling the due date for borrowed book.

D. Control and Security

- ✓ Poor donor, recipient/patient security mechanism.
- ✓ Poor error control mechanism.
- ✓ Data stored are inconsistent because it is kept redundantly.

E. Efficiency

- ✓ Problem on preparing timely report because we exhaust sometimes taking manual work.
- ✓ Every task performed manually so that overall efficacy is affected will have negative impact on the system.

F. Service to the customer

- ✓ Poor customer satisfaction in deliver information about donor pledge and recipient when the donors register and the surgeon requests tissue.
- ✓ The system is inflexible to change.

4.6. Practices to be preserved from the existing system

From the major functions of the existing system all operations of the system are done manually. But some of these functions are still necessary and need to be exercising some of are:-

- a. **Consent form** is a form consent signed by the legal next-of-kin must be in order of priority in accordance with state law. The consent shall include, but not be limited to, the following information: Name of donor, relationship of the donor to the person signing the permission, signature of next-of-kin, witness (es), and the type of tissue donated. This process will continue in the manual system.

All cleaning and maintenance procedures must be recorded for each piece of equipment used. All cleaning procedures should clearly define the type of cleaning solution used and the frequency of cleaning. All cleaning and maintenance records must be kept for three years and must be available for inspection purpose. So these records remain as it is.

- b. **Instrument cleaning log:** (date, instrument set, number of batches, instrument cleaned by, instrument packed by, and initials) the outside and inside of the equipment is wiped with 70% alcohol once daily. When there is a spill of infected material on any of the equipment, the surfaces are wiped with absorbent cotton or gauze piece soaked in 70% alcohol or sodium hypochlorite solution.
- c. **Instrument sterilization log:** sterilization run contents and biological indicator testing performed. A label giving the item number, contents, mode of sterilization, date and time of packing, signature of the technician, along with another indicators stuck on the outside of the wrapped instrument tray before sending for sterilization to the Operation Theatre.
- d. **Laboratory cleaning log:** The room including walls, floor and sink must be kept clean at all times. Appropriate documentation of regular laboratory cleaning schedules must be maintained and kept on file for a minimum of three years.
- e. **Temperature record refrigerator log:** Each eye bank laboratory must have a refrigerator with a device, internal or external for recording temperature variations. Temperature variations must be recorded twice daily and should remain within the range of 2° – 8° C. Document any deviations and corrective action taken.

4.7. Alternative option to address problems of the existing system and option analysis

As the aim of the project is to identify the problem of the existing system and to a better solution, the investigator has identified the following three system solutions. The database approach emphasizes the integration and shared of data throughout the organization.

I. Stand-alone application

A standalone computer is exactly what its name implies: a computer that stands on its own. Any tasks or data associated with that computer stay inside it and are not accessible from anywhere else. Any peripherals, such as printers, must be directly connected to it in order to work (22).

Advantages of Stand-alone application

- ✓ Never lose access to your data
- ✓ No internet required
- ✓ Faster in access, data entry, reporting, etc...
- ✓ Can be customized to meet your specific needs
- ✓ You own and control your own data
- ✓ Less expensive over time
- ✓ **Damage control:** If something goes wrong, only the standalone will be affected.
- ✓ **Simplicity:** it takes a lot less expertise to manage one computer than it does to setup or troubleshoot several.
- ✓ Secured from Data hacking and virus.

Disadvantages Stand-alone application

- ✓ Single user access at a time.
- ✓ Installation is required.
- ✓ End user system resources utilized.
- ✓ No data sharing
- ✓ Maintenance is hard with respect to both user and Eye Bank

II. Web based database approach

The web as a platform for database system can deliver innovative solutions for both inter- and intra-Eye bank issues. Unfortunately, there are advantage and disadvantages associated with this approach (23).

Advantages of the Web-based database

- ✓ No installation required
- ✓ Vendor responsible for backups
- ✓ Simplicity: In its original form, HTML as a markup language was easy for both developer and naïve end-users to learn.
- ✓ Platform Independence
- ✓ Graphical User Interface
- ✓ Standardization - HTML is a de facto standard to which all web browsers
- ✓ Transparent network access
- ✓ We can access wherever

Disadvantages of the Web Based Database

- ✓ **Reliability** - The internet is currently an unreliable and slow communication medium-when a request is carried across the internet, there is no real guarantee of delivery.
- ✓ **Security** - Security is of great concern for the Eye Bank that makes its database accessible on the web. User authentication and secure data transmission are critical because of the large number of potentially anonymous users.
- ✓ **Cost** - Cost of maintenance is very expensive.
- ✓ **Scalability** - Web application can face unpredictable and potentially enormous peak loads.

There are two types web based approach

A. Distributed Database approach

A distributed database management system (DDBMS) is a centralized software system that manages a distributed database in a manner as if it were all stored in a single location. Distributed databases are databases which are usually located on more than one server, but communicate with each other to fulfill a mutual goal. A distributed database is a system which consists of two or more database located at the same physical location or distributed over a network of connected computers. The distributed database system started to appear when companies and business get larger and operation spread out to different geographical locations (24).

Advantages of Distributed Database

- ✓ Increased reliability and availability – A distributed database system is robust to failure to some extent. Hence, it is reliable when compared to centralized database system.

- ✓ Local control – The data is distributed in such a way that every portion of it is local to some sites (servers). The site in which the portion of data is stored is the owner of the data.
- ✓ Modular growth (resilient) – Growth is easier. We do not need to interrupt any of the functioning sites to introduce (add) a new site. Hence, the expansion of the whole system is easier. Removal of site is also does not cause much problems.
- ✓ Lower communication costs (More Economical) – Data are distributed in such a way that they are available near to the location where they are needed more. This reduces the communication cost much more compared to a centralized system.
- ✓ Faster response – Most of the data are local and in close proximity to where they are needed. Hence, the requests can be answered quickly compared to a centralized system.
- ✓ Reflects the organizational structure – Normally, database is fragmented into various locations wherever we have controls.
- ✓ Secured management of distributed data – Various transparencies like network transparency, fragmentation transparency, and replication transparency are implemented to hide the actual implementation details of the whole distributed system. In such way, Distributed database provides security for data.
- ✓ Robust – The system is continued to work in case of failures.
- ✓ Properties – Distributed transactions demands Atomicity, Consistency, Isolation, and Reliability.
- ✓ Improved performance and Parallelism in executing transactions can be achieved.

Disadvantages of Distributed Database Systems

- ✓ Security - remote database fragment must be secured, and they are not centralized so the remote site must be secured as well. The infrastructure must be secured.
- ✓ Complex Software – Complex implementation. Costs more in terms of software cost compared to a centralized system. Additional software might be needed in most of the cases over a centralized system.
- ✓ Increased Processing overhead – It costs many messages to be shared between sites to complete a distributed transaction.

- ✓ Data integrity – Data integrity becomes complex. Too much network resources may be used.
- ✓ Different data formats might be used – This may cost time.
- ✓ Deadlock is difficult to handle compared to a centralized system.
- ✓ May cause much more network traffic in case of write operation in a replicated form of distributed database.
- ✓ Distributed System supported Operating System is required to implement distributed database system.
- ✓ The data shared between sites over networks are vulnerable to attack. Hence, network oriented security protocols to be used based on the sensitivity of data shared.
- ✓ More complex in terms database design – According to various applications, we may need to fragment a database, or replicate a database or both.
- ✓ Handling failures is a difficult task. In some cases, we may not distinguish site failure, network partition, and link failure.

B. Central database approach

A centralized database is physically confined to a single location, controlled by a single computer. Most functions for the databases are created are accomplished more easily if the database is centralized. That is, it is easier to update, back up, query and control access to a database if we know exactly where it is and what software controls it. A centralized database consists of a single data server into which all data are stored and from which all data are retrieved. All the data reside at a single location and all applications must retrieve all data from that location. The centralized approach consists of a central server into which all forecast data are stored. At some predefined time, software on this central server requests data from each of the local data servers scattered throughout the country. These data are received, processed and stored, possibly at lower spatial and temporal resolution than the data from which it was derived (25).

Advantages of Centralized Approach

- ✓ **Decreased Risk:** With Centralized data management, all edits and manipulation to core data are housed and stored centrally.

- ✓ **Data security:** Data is stored securely with documentation and administration of access authorization such that it cannot be accessed unless someone is given centrally direct privileges through a tightly controlled process.
- ✓ **Data Consistency:** When data feeds are managed in a central repository, the Eye Bank can achieve consistent data management and distribution throughout the country.
- ✓ **Data Quality:** A data-centric approach enables the establishment of a data standard across the Eye Bank
- ✓ **Operational Efficiency:** When one operation unit controls the Eye Bank data centrally, the resources previously devoted to data management can be redirected back to core operation needs.
- ✓ **Single Point of Entry:** By introducing single point of entry for data, this allows changes from data vendors to be implemented once, rather than in multiple instances.
- ✓ **Cost Saving:** With data management centralized, costs attributed to vendor relationships are better controlled, minimizing any redundancy costs.
- ✓ **Disaster recovery:** Compass data repositories are backed up on a regular basis and can be restored in case of server failure or occurrence of natural disasters.

Disadvantage of Centralized Approach

- ✓ **Response Time:** The size of a centralized database could cause data retrieval delays.
- ✓ **Single Point of Failure:** Entire data is sorted at a single point (central server), if the data failed or corrupted then all the data will be lose.

4.8. The proposed New System

Based on options and analysis presented above we prefer web-based centralized database approach to solve the problem of the existing system because of the following reasons. The web enables the eye bank to provide immediate services and reach new customers through globally accessible applications. Such benefits were not available with standalone based. Data can be organized in single point, by introducing single point of entry for data Database Administrator can implement the data only once instead of in multiple sites. Data consistency can achieve by introducing data-centric approach. It is suitable for establishment of data standards across an

enterprise; For better security purpose Centralized database approach is suitable, For quick efficient searching Centralized approach is good one, and For controlled access to the database repository.

4.9. Stakeholders

Stakeholders are any individual, group, or institution who has a vested interest in the natural resources of the project area and/or who potentially will be affected by project activities and have something to gain or lose if conditions change or stay the same. Stakeholders are all those who need to be considered in achieving project goals and whose participation and support are crucial to its success (26) Stakeholders identified according to their roles and concerns from the existing system in the following table 2.

Table 2 List of stakeholders and their responsibilities for the web based EBIMS of Ethiopia, Addis Ababa, 2017

S.No	Stakeholders	Role and Responsibility
1.	Board of Trust	<ul style="list-style-type: none"> ✓ Responsible for overseeing the financial security of the eye bank, helping us to ensure that we can continue to provide ocular tissue to the community. ✓ Composed of medical professionals and other professionals who could contribute to the smooth functioning of the organization.
2.	Executive Committee:	<ul style="list-style-type: none"> ✓ responsibility of the medical director to follow the policies of the Board or committee and wherever necessary to consult the Medical director/Eye Bank in charge or other specialists for discharging the responsibilities
3.	System Administrator	<ul style="list-style-type: none"> ✓ Responsible for maintaining accounts. ✓ Responsible for creating organizational setup. ✓ Responsible for updating the portal. ✓ Responsible for generating different reports. ✓ Responsible for managing and controlling the accuracy of data entry. ✓ Responsible for conducting provide supportive supervision and feedbacks.
4.	Medical Director	<ul style="list-style-type: none"> ✓ responsible for managing the entire operations of the eye bank ,responsible for establishing the eye bank’s procedures for recovery, processing, and preservation of tissue. ✓ Responsible to provide advice for all medical aspects of the eye bank operations. ✓ Responsible to ensure that the medical issues are in compliance with the existing Medical standards. ✓ The final responsibility for determination of suitability of each tissue

		<p>for transplantation is with the corneal transplant surgeon. In cases of discrepancies, the Medical Director responsible to be consults them.</p> <ul style="list-style-type: none"> ✓ Responsible for monitoring the Cornea Retrieval programs in various hospitals. ✓ Responsible for give fairly distribute cornea for patients. ✓ Responsible for assuring that eye bank personnel comply with all applicable procedures for the recovery, processing, and preservation of tissue.
5.	Eye Bank Manager	<ul style="list-style-type: none"> ✓ Responsible for awareness campaigns both within the Eye Bank and outside the Eye Bank and Responsible to work in close association with the all staff of the eye bank in all administrative, financial concerning eye banking.
6.	Deputy Eye Bank Manager	<ul style="list-style-type: none"> ✓ Responsibility like that of eye bank manager. ✓ Responsible for awareness campaigns both within the Eye Bank and outside the Eye Bank and Responsible to work in close association with the all staff of the eye bank in all administrative, financial concerning eye banking.
7.	Lab technician supervisor	<ul style="list-style-type: none"> ✓ Responsible for the day to day administrative, medical and scientific operations of the eye bank under the supervision of the Medical Director ✓ Responsible supervise technical staff in operations related to donor cornea procurement, tissue storage and distribution. ✓ Responsible for conducting the annual appraisals of the technical staff of the eye bank. ✓ Responsible for organizing the accreditation procedures as per requirements.
8.	Laboratory Technician	<ul style="list-style-type: none"> ✓ responsible for the entire activities of eye banking like retrieval, processing, evaluation, and documentation, distribution of tissue and maintenance of the laboratory and instruments and equipment. ✓ Responsible for screen, store, evaluate, discarded cornea information. ✓ Responsible for generating report to the supervisor of lab technician daily and weekly.
9.	All public	<ul style="list-style-type: none"> ✓ Responsible for register to promise pledge cornea at the time of death. ✓ Responsible to inform in the occurrence of death
10.	Receptionist	<ul style="list-style-type: none"> ✓ Responsible for registering donor. ✓ Responsible for giving proper pre donation information to donor. ✓ Responsible to handle work related to donor call, pledge cards, providing certificate of appreciation to donor families, all correspondence, reports, documentation of donor data entry in the system. ✓ Responsible to report to the Medical Director or Designate of Eye

		Bank in all matters.
11.	Eye Donation Counselor	<ul style="list-style-type: none"> ✓ Responsible for counseling families at Hospitals and coordinate with eye bank and hospital for retrieval of cornea. ✓ Responsible for awareness campaigns within the hospital. ✓ Responsible to report to the medical director in all matters related to HCRP.
12.	Health Institution (surgeon)	<ul style="list-style-type: none"> ✓ Responsible for requesting cornea from Eye banks ✓ Responsible for give fairly distribute cornea for patients.
13.	Federal Minster of Health	<ul style="list-style-type: none"> ✓ Responsible for using the reports for planning and decision making.

4.10. System Requirements

The formal definition of software requirements proposed by the IBM Rational Unified Process (RUP) is: "A requirement describes a condition or capability to which a system must conform; either derived directly from user needs, or stated in a contract, standard, specification, or other formally imposed document."(27). Requirements engineering is the most important area of Software engineering and possibly of the entire software life cycle. Because errors produced at this stage, if undetected until a later stage of software development, can be very costly. If it can specify the requirement specification correctly, errors of later stages will be less. Hence software developments and maintenance cost will be less moreover customer will get their desire system (28).

4.10.1. Functional Requirements

Functional or behavioral requirements are a sub-set of the overall system requirements. These requirements are used to consider trade-offs, system behavior, redundancy and human aspects. Trade-offs may be between hardware and software issues, weighing up the benefits of each. Behavioral requirements, as well as describing how the system will operate under normal operation should also consider the consequences and response due to software failure or invalid inputs to the system (29). Functional requirements explain what has to be done by identifying the necessary task, action or activity that must be accomplished (30).

This web based eye bank management information system is designed is a way that enables the stakeholder. The high level functional requirements identified in the system are presented in following below.

- ✓ The system should enable to the receptionist to record donor call.
- ✓ The system should enable to the lab technician to record donor medical particular
- ✓ The system should enable the lab technician to screen cornea details
- ✓ The system should enable the lab technician to collect cornea details
- ✓ The system should enable the lab technician to test serology details
- ✓ The system should enable the lab technician to store cornea details
- ✓ The system should enable the lab technician to record donor information details
- ✓ The system should enable the users to evaluate cornea details
- ✓ The system should enable the user to record discarded cornea details
- ✓ The system should allow a surgeon to request cornea tissue
- ✓ The system should enable the user to distribute cornea to provide request from surgeon
- ✓ The system should allow a surgeon to fill recipient data at the time of surgery.
- ✓ The system should allow a surgeon to send adverse report detail to the Eye Bank.
- ✓ The system should allow a surgeon to send follow up detail of a patient.
- ✓ The system should generate standard reports

4.10.1.1. Use Cases

Uses cases are widely accepted as the best approach to capturing system requirements, in particular, functional requirements. However, an extremely important step towards a final implementation is how use an object oriented analysis method to translate the customers' needs into system software (31). Use case defines a goal-oriented set of interactions between external actors and the system under consideration. Actors are parties outside the system that interact with the system. An actor may be a class of users, roles users can play, or other systems. A primary actor is one having a goal requiring the assistance of the system. A secondary actor is one from which the system needs assistance. A use case is initiated by a user with a particular goal in mind, and completes successfully when that goal is satisfied. It describes the sequence of interactions between actors and the system necessary to deliver the service that satisfies the goal.

4.10.1.1.1. Essential Use Case diagram

An essential use case, sometimes called a business use case, is a simplified, abstract, generalized use case that captures the intentions of a user in a technology and implementation independent manner. A fully documented essential use case is a structured narrative, expressed in the

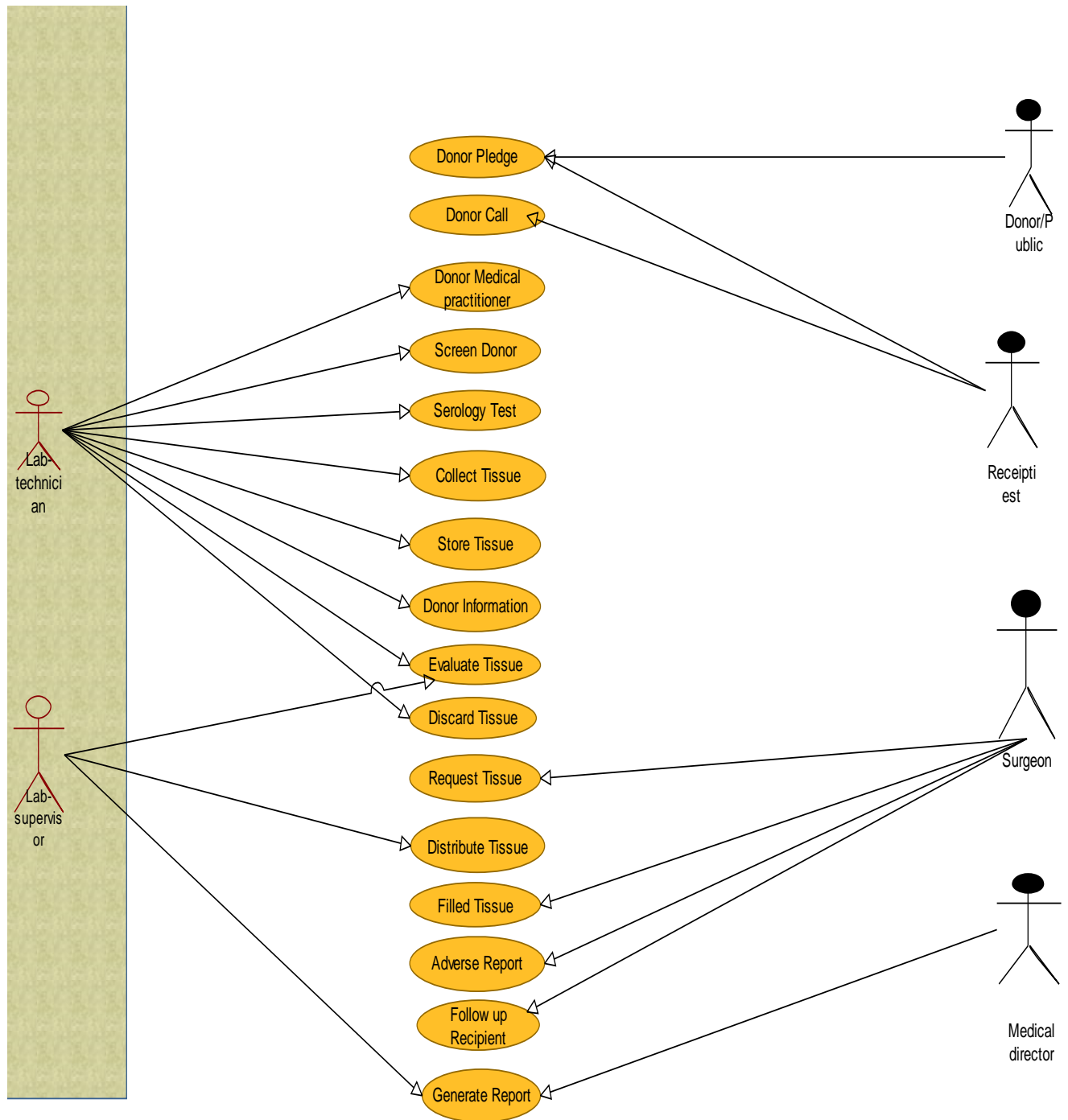
language of the application domain and of users, comprising a simplified, abstract, technology-free and implementation-independent description of one task or interaction. An essential use case is complete, meaningful, and well designed from the point-of-view of users in some role or roles in relation to a system and that embodies the purpose or intentions underlying the interaction. The following use cases have been identified for the proposed system specification (32)

- | | |
|------------------------------|------------------------------------|
| 1) Register Donor | 9) Store cornea |
| 2) Search from list of donor | 10) Tissue evaluation |
| 3) Donor call | 11) Discard cornea |
| 4) Donor medical particulars | 12) Tissue Request |
| 5) Screen donor selection | 13) Tissue distribution |
| 6) Donor information detail | 14) Tissue fill detail |
| 7) Tissue collection detail | 15) Adverse reaction detail |
| 8) Serological test | 16) Follow up transplanted patient |
| | 17) Generate Report |

ACTORS

A use case is the interactions between external actors and the system under consideration to accomplish a goal. Actors must be able to make decisions, but need not be human. An actor might be a person, a company or organization, a computer program, or a computer system—hardware, software, or both (33). Actors are always stakeholders, but not all stakeholders are actors, since they "never interact directly with the system, even though they have the right to care how the system behaves. (34). similarly, a person using a system may be represented as different actors because he is playing different roles. The actors that will participate only in the system are:

- | | |
|-------------------------|--|
| 1) System Administrator | 5) Laboratory technician supervisor |
| 2) Receptionist | 6) Eye surgeon physician in health Institution |
| 3) Donor/public | 7) Medical director |
| 4) Lab Technician | |



Use Case Diagram of WBEBIMS Figure 2 Essential use case diagram for Eye bank information management System

4.10.1.1.2. Essential Use Case Narrations

Use case narration is a textual representation of the course of events encountered when an actor is interacting with the system. Use case narrations help clear possible misunderstandings during the early stages of development. The sample of the use case narration is presented below.

1. Donor Pledge

Use Case ID	EBUC-01
Use Case Name	Donor Pledge
Description	Describes the donor promise to Pledge to donate tissue at the time of death.
Actor	Receptionist
Pre-Conditions	Public motivation and awareness.
Post-Conditions	Donor registered
Main-Success Scenario	<ol style="list-style-type: none">1. The donor want to reach at the eye bank of Ethiopia2. The Receptionist register the donor with correct necessary detail such as, Name, Gender, Donation Date, Email etc.;3. The Receptionist give to donor pledge card that have a necessary detail4. Use case ends
Alternative Scenario	-

2. Donor Call

Use Case ID	EBUC_02
Use case Name	Donor call
Primary actor	Receptionist
Summary description	This use case describes the process used to receive call from willing to donate next-of-kin.
Precondition	Receive a call from willing to donate next-of-kin.
Post condition	The Donor initial information will get.
Main success scenario	<ol style="list-style-type: none">1. The Receptionist want to document donor information at the time of received call;2. The Receptionist capture the donor call necessary information;3. The Receptionist give the donor call information to lab technician immediately.4. ready for the next Donor call initial information;5. Use case ends.
Alternative path	

3. Donor Medical Particular

Use Case ID	EBUC_03
Use case Name	Donor medical particular
Primary actor	Lab technician
Summary description	This use case describes the process used to actually know donor deceased approved
Precondition	May Donor registered and must call information received to receptionist
Post condition	The Donor may be screen detail.
Main success scenario	<ol style="list-style-type: none"> 1. The Lab technician arrives to suspected deceased donor place. 2. The Lab technician check donor deceased or deceased certificate availability; 3. The Lab technician capture Donor Medical Particular information detail; 4. Use case ends
Alternative path	--

4. Screen Donor selection

Use Case ID	EBUC_04
Use case Name	Screen donor selection
Primary actor	Lab technician
Summary description	This use case describes the process used to screen donor selection means that suitable by age, cause of death, medical history and the family must approach fill the consent form.
Precondition	Assure death of donor
Post condition	Get Screened donor information
Main success scenario	<ol style="list-style-type: none"> 1. The lab technician want to screen donor selection 2. The lab technician check donor suitable age, facial expression, medical history, cause of death etc.; 3. The lab technician take consent to next-of-kin of the donor ; 4. The lab-technician record screen donor selection detail by using the screening form. 5. Use case ends
Alternative path	

5. Tissue Collection Detail

Use Case ID	EBUC_05
Use case Name	Tissue collection detail.
Primary actor	Lab technician
Summary description	This use case describes the process used to tissue is collected from home, hospital, mortuary etc. from deceased donor by the consent given family.
Precondition	The donor must be screened
Post condition	Collected tissue information
Main success scenario	<ol style="list-style-type: none"> 1. The Lab technician want to collect the donor cornea from anywhere to have a diseased information 2. The Lab technician assure to give consent from next-of-kin and to take blood sample 3. The Lab technician inculcate tissue and record tissue collected form and transported to the eye bank. 4. Use case ends;
Alternative path	--

6. Serological Test

Use Case ID	EBUC_6
Use case Name	Serological Test
Primary actor	Lab technician
Summary description	This use case describes the process used to describe the procedure for obtaining a blood sample from a donor for the purpose of serologic testing. It required before ocular tissue can be released for surgical use.
Precondition	Tissue must be collected
Post condition	Serological test information
Main success scenario	<ol style="list-style-type: none"> 1. The Lab technician want to test sample blood take from the donor; 2. The Lab technician test blood sample; 3. The Lab technician record serological test information detail. 4. Use case ends.
Alternative path	---

7. Store cornea tissue

Use Case ID	EBUC-07
Use Case Name	Store cornea tissue
Description	Describes the process of storing cornea information that allocate the conditions under which donor eye tissue is to be maintained and stored free from bacterial contamination and potentially hazardous biological material to isolate tissue until infectious disease screening is completed in Laboratory tests, which rule out disease such as HIV, Hepatitis B and Hepatitis C in sterile container, preservation or storage solutions for the particular type of tissue, refrigerator with temperature recording device, backup power supply.
Actor	Lab technician
Pre-Conditions	Blood sample test
Post-Conditions	Tissue Store detail
Main-Success Scenario	<ol style="list-style-type: none"> 1. The Lab technician want to store cornea in appropriate location; 2. The Lab technician store in refrigerator in appropriate temperature; 3. The Lab technician capture store tissue information detail; 4. Use case ends.
Alternative Scenario	---

8. Donor Information Detail

Use Case ID	EBU-08
Use Case Name	donor information detail
Description	Describes the process of all donor information listed for different purpose After preserving ocular tissue, the initial evaluation may differ from, To avoid inaccurate or erroneous assumptions based on illegible record entries; to avoid confusion and misunderstanding and avoid transmission of any infections or disease from donor to recipient
Actor	Lab technician, supervisor
Pre-Conditions	Approved quality store cornea tissue
Post-Conditions	All donor information detail is an input of final evaluation cornea tissue
Main-Success Scenario	<ol style="list-style-type: none"> 1. The user want to capture donor information detail; 2. The Lab technician capture all available donor information detail; 3. Use case ends.
Alternative Scenario	.----

9. Tissue Evaluating

Use Case ID	EBUC-09
Use Case Name	Tissue evaluating
Description	Describes the process of cornea tissue evaluation that are gross examine, slit lamp examination, endothelial cell density suitable for surgery use.
Actor	Lab Technician , Lab Technician supervisor
Pre-Conditions	The users is logged into the system , the users is authenticated
Post-Conditions	Tissue evaluating information is recorded in the system database
Main-Success Scenario	<ol style="list-style-type: none"> 1. The user want to evaluate Cornea tissue from the stoke; 2. The Lab technician evaluate cornea tissue in different microscope; 3. The Lab technician record evaluate tissue information detail; 4. Use case ends.
Alternative Scenario	----

10. Tissue Discard

Use Case ID	EBUC-10
Use Case Name	Tissue discard
Description	Describes the process of registering discarded cornea tissue in stock from donors with conflicting serology results, expire and by any other means not fit will be quarantined and discarded
Actor	Lab Technician
Pre-Conditions	The user is logged into the system , the lab technician is authenticated
Post-Conditions	Discarded cornea information is recorded in the system database
Main-Success Scenario	<ol style="list-style-type: none"> 1. The user want to discard cornea tissue from the stoke; 2. The Lab technician discard cornea tissue reach expire date and donor conflict serological test result ; 3. The Lab technician capture discard tissue information detail; 4. Use case ends.
Alternative Scenario	-----.

11. Cornea tissue request

Use Case ID	EBUC-11
Use Case Name	Cornea tissue request
Description	Describes the process of cornea tissue request from eye bank that transplant to cornea's problem in the health institutions.
Actor	Surgeon
Pre-Conditions	The surgeon is logged into the system , the surgeon is authenticated
Post-Conditions	The system displays cornea requested from the eye bank.
Main-Success Scenario	<ol style="list-style-type: none"> 1. The Surgeon want to request Cornea tissue transplant to the cornea patient ; 2. The Surgeon request Cornea tissue transplant to the cornea patient ; 3. The Surgeon capture request tissue information detail; 4. The use case ends.
Alternative Scenario	-----

12. Cornea tissue distribution

Use Case ID	EBUC-12
Use Case Name	Cornea Tissue distribution.
Description	A process of allocation of tissue for transplant, research or educational use. This process includes receipt of request, selection, checkup and release of tissue, to a consignee such as a surgeon, surgical center or educational research center. Only 9 surgeons we have in our country carrying out distribution of eye tissue.
Actor	Lab technician and lab technician supervisor
Pre-Conditions	The users are logged into the system , the users are authenticated
Post-Conditions	The system displays cornea tissue distribution from the eye bank.
Main-Success Scenario	<ol style="list-style-type: none"> 1. The user want to distribute cornea tissue to dedicated surgeon; 2. The user distribute cornea tissue transplant to the recipient; 3. The user capture distribute tissue information detail; 4. The use case ends.
Alternative Scenario	---

13. Fill Recipient Data

Use Case ID	EBUC-13
Use Case Name	fill recipient data
Description	Describes the process of fill recipient data at the time surgery.
Actor	Surgeon
Pre-Conditions	The users are logged into the system , the users are authenticated
Post-Conditions	The system displays Cornea tissue fill from the eye bank.
Main-Success Scenario	<ol style="list-style-type: none"> 1. The Surgeon want to fill recipient data at the time of surgery; 2. The Surgeon fill recipient data at the time of surgery; 3. The Surgeon record recipient information detail 4. The use case ends.
Alternative Scenario	-----

14. Adverse Reaction Detail

Use Case ID	EBUC-14
Use Case Name	adverse Reaction detail
Description	Describes the process any communicable or other disease that is reasonably likely or proven to have been transmitted by transplantation of donor eye tissue including infection and biologic dysfunction.
Actor	Surgeon
Pre-Conditions	The users are logged into the system , the users are authenticated
Post-Conditions	The system displays Cornea tissue fill from the eye bank.
Main-Success Scenario	<ol style="list-style-type: none"> 1. The Surgeon want to send adverse detail of recipient problem transmitted by transplantation; 2. The Surgeon send adverse detail of recipient problem transmitted by transplantation to the Eye Bank; 3. The Surgeon capture adverse recipient information detail 4. The use case ends.
Alternative Scenario	

15. Follow up recipient

Use case ID	EBUC-15
Use Case name	follow up
Use case Description	Describes the eye bank must obtain recipient information from the transplanting surgeon on each eye tissue used for human transplantation distributed to the surgeon by the bank.
Primary Actor	Surgeon
Pre-Conditions	The surgeon should be logged in to the system, the users are authenticated
Post-Conditions	The system stored completed patient follow up information to the database.
process of main success scenario	<ol style="list-style-type: none"> 1. The Surgeon want to follow a recipients; 2. The Surgeon follow up the transplanted recipients ; 3. The Surgeon record follow up recipients ; 4. The use case ends.
Alternative Course	

16. Report

Use Case ID	EBUC-16
Use Case Name	Generate Report
Description	Describes the process of generating different reports
Actor	System administrator, eye bank manager, lab technician supervisor
Pre-Conditions	The user is logged into the system
Post-Conditions	The system generates reports
Main-Success Scenario	<ol style="list-style-type: none"> 1. The users wants to generate a report 2. The users collect and count from file data of the form. 3. The users submit the generated report to concerned manager 4. use case ends
Alternative Scenario	-----

4.10.1.2. Essential user interface prototyping

Prototyping is a means of exploring ideas before you invest in them. All experienced craftspeople and engineers create prototypes of their work before they build anything: Architects create models out of paper or cardboard, or with virtual reality tools. Aeronautic engineers use wind tunnels. Bridge builders create stress models. Software and Web designers create mock-ups of how users will interact with their designs. The best reason to prototype is to save time and resources. The value of a prototype is that it is a façade relative to the real product; prototypes are easy and inexpensive to create. So, for a minimal investment, usability and design problems can be found and the UI adjusted before substantial investment is made in the final design and technologies. On examining the needs of a particular project, reasons for creating a prototype other than saving money might be found. Is the goal to explore a new interface model? Make modifications to one part of the existing design? Investigate a new technology? Before starting, it's important to be clear about why you're building what you're building. Beginning with clear goals helps make effort direct and effective (35).Interface requirements describe interaction of the system with users, hardware, software, and communications (36).

2. HOME PAGE

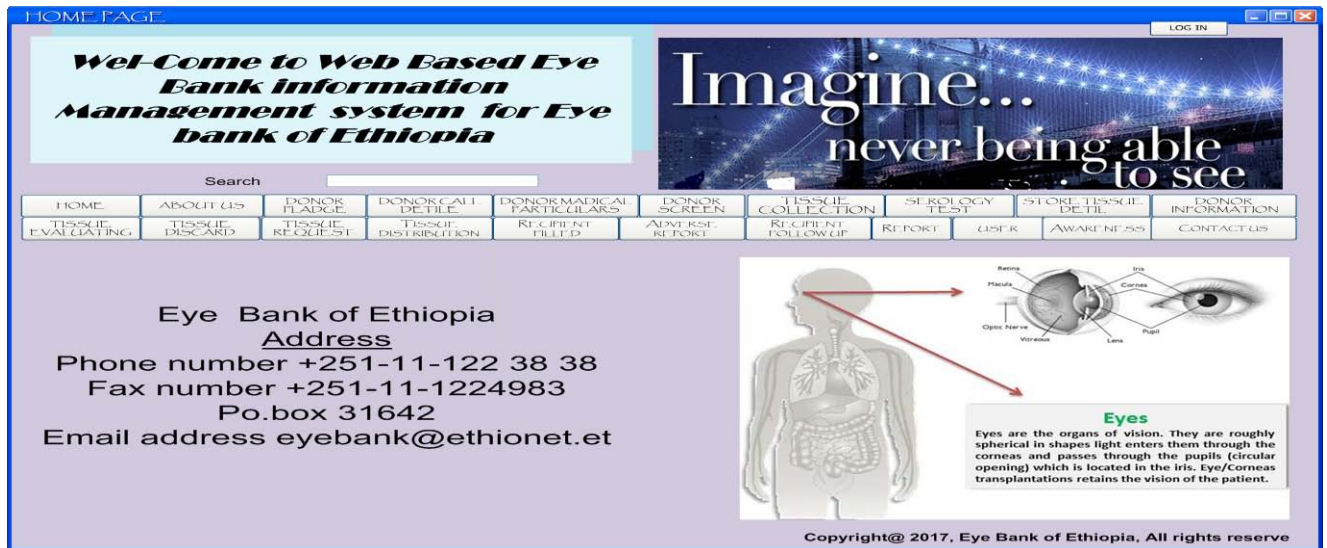


Fig.3 home page Essential user interface prototyping

LOGIN FORM

Wel-come to Log in form of WEBBIMS

username: Betre

password: 1234mfgd#

Login cancel

Forgot password?

Fig.4 login page Essential user interface prototyping

3. DONER PLADGE FORM

DONER PLEDGE DETAIL FORM

Wel-Come to Web Based Eye Bank information Management system for Eye bank of Ethiopia

Imagine... never being able to see

Search

HOME ABOUT US DONOR PLEDGE DONOR CALL DETILE DONOR/MADICAL PARTICULARS DONOR SCREEN TISSUE COLLECTION SEROLOGY TEST STORE TISSUE DETIL DONOR INFORMATION

TISSUE EVALUATING TISSUE DISCARD TISSUE REQUEST TISSUE DISTRIBUTION RECIPIENT FILLED ADVERSE REPORT RECIPIENT FOLLOW UP REPORT USER AWARENESS CONTACT US

PERSONAL DETAIL

Full name: _____

DOB: _____

Age: _____

Body Mass Index: _____

weight: _____

Blood group: _____

Religion: _____

Sex: Male Female

Email address: _____

Mobile number: _____

Mobile number if any more: _____

IDENTIFICATION DETAIL

ID No: _____

Emp. ID no: _____

ADDRESS

Country: _____

State: _____

City/ town: _____

Zone/sub-city: _____

Wereda: _____

Kebela: _____

Special place: _____

House #: _____

Emergency contact detail

Full name: _____

Relation: _____

Country: _____

State: _____

Zone/sub-city: _____

Witness detail

Full name: _____

Relation: _____

DOB: _____

Country: _____

State: _____

Zone/sub-city: _____

City /town: _____

Email address: _____

Phone #: _____

I have informed my near relatives or family members to donate my cornea tissue after being declared my brain steam death

Submit Reset Cancel

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Fig. 5 donor pledge page Essential user interface prototyping

4. DONOR CALL - INITIAL INFORMATION FORM

WELCOME TO Web Based Eye Bank Information Management system for Eye bank of Ethiopia

Search: _____

Navigation: HOME, ABOUT US, DONOR PLADGE, DONOR CALL DETILE, DONOR MEDICAL PARTICULARS, DONOR SCREEN, TISSUE COLLECTION, SEROLOGY TEST, STORE TISSUE DETIL, DONOR INFORMATION, TISSUE EVALUATING, TISSUE DISCARD, TISSUE REQUEST, TISSUE DISTRIBUTION, RECIPIENT FILLED, ADVERSE REPORT, RECIPIENT FOLLOWUP, REPORT, USER, AWARENESS, CONTACT US

DONOR CALL - INITIAL INFORMATION

Name of the donor: _____
 Sex of the donor: Male Female
 Age of the donor: _____
 Time of death: _____
 Cause of death: _____
 Name of the caller: _____
 Relationship with the donor: _____
 Contact phone: _____

BODY AVAILABILITY
 Placed at: home
 Time taken house from hospital about: _____
 Sub -city: _____
 Kebele: _____
 Special place: _____
 House no: _____
 Other detail: _____
 Death certificate: Available Note available

Comment & additional remarks: _____
 Receiver Name: _____
 Designation: _____
 Case #: _____
 Date: _____

Submit Reset Cancel

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Fig. 6 donor call page Essential user interface prototyping

2. EYE DONOR MEDICAL PARTICULARS form

WELCOME TO Web Based Eye Bank Information Management system for Eye bank of Ethiopia

Search: _____

Navigation: HOME, ABOUT US, DONOR PLADGE, DONOR CALL DETILE, DONOR MEDICAL PARTICULARS, DONOR SCREEN, TISSUE COLLECTION, SEROLOGY TEST, STORE TISSUE DETIL, DONOR INFORMATION, TISSUE EVALUATING, TISSUE DISCARD, TISSUE REQUEST, TISSUE DISTRIBUTION, RECIPIENT FILLED, ADVERSE REPORT, RECIPIENT FOLLOWUP, REPORT, USER, AWARENESS, CONTACT US

EYE DONOR MEDICAL PARTICULARS

Name of the deceased: _____
 Sex: Male Female
 Age: _____
 Time of death: _____
 Name of the caller: _____
 Permanent Address: _____
 Manner of death: accident
 Contact phone: _____

Cause of death: _____
 Secondary cause: _____
 Visible identification no: _____
 Information given: _____
 Next-of-kin name: _____
 Relationship: _____
 Death certificate: Available Note available

Reason for not available: _____
Doctor attending eye donation call
 Name: _____
 Date: _____
 Place: _____
 Registration number: _____

Submit Reset Cancel

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Fig.7 donor medical particular page Essential user interface prototyping

3. DONOR SCREEN DETILE FORM

Donor Screen Detail Form

Search

HOME ABOUT US DONOR FLAGGE DONOR CALL DETILE DONOR MEDICAL PARTICULARS DONOR SCREENIN TISSUE COLLECTION SEROLOGY TEST STORE TISSUE DETIL DONOR INFORMATION

TISSUE EVALUATING TISSUE DISCARD TISSUE REQUEST TISSUE DISTRIBUTION RECIPIENT FILLED ADVERSE REPORT RECIPIENT FOLLOWUP REPORT USER AWARENESS CONTACT US

DONOR SCREEN DETAIL

Name of recorder _____ Cause of death _____ Transfusion history _____

Date of referral _____ Name of next-of-kin _____ Record Date _____

Origin of referral _____ Relation _____ Family physician name _____

Name of hospital _____ Country _____ Phone # _____

Info provider name _____ State _____ Donor medical history _____

Phone no _____ Zone/sub-city _____ Social history _____

Name of donor _____ City /town _____ Current history any contraindication list _____

Age _____ Wereda _____ Enter Text _____

weight _____ Kebela _____

Height _____ House # _____

Sex Male Female Phone # _____

Unique ID no _____ Consent Accept Reject _____

Date of admission _____ Time of ventilator support _____

Time declaration death _____ Pervious ocular history _____

Time of asystole _____ Surgery _____

Save Reset Cancel

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Fig.8 donor screen page Essential user interface prototyping

4. TISSUE COLLECTION FORM

TISSUE COLLECTION DETAIL FORM

Search

HOME ABOUT US DONOR FLAGGE DONOR CALL DETILE DONOR MEDICAL PARTICULARS DONOR SCREENIN TISSUE COLLECTION SEROLOGY TEST STORE TISSUE DETIL DONOR INFORMATION

TISSUE EVALUATING TISSUE DISCARD TISSUE REQUEST TISSUE DISTRIBUTION RECIPIENT FILLED ADVERSE REPORT RECIPIENT FOLLOWUP REPORT USER AWARENESS CONTACT US

TISSUE COLLECTION DETAIL

Eye donation voluntary motivated

Motivated by _____

Designation _____

DONOR DATA

Consent taken at _____

Consent given by _____

Position of body phakic Aphakic

of tissue _____

Blood sample obtain Yes No

During the procedure problem & solution _____

Procedure done by _____

Procedure done at _____

Assisted by _____

MODE OF TRANSPORT

EB to donor site _____

Donor site to EB _____

Team members _____

Case # _____

Date received _____

Time received _____

Save Reset Cancel

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Fig.9 tissue collection page Essential user interface prototyping

5. SEROLOGICAL TEST FORM

Fig.10 door serology test page Essential user interface prototyping

6. TISSUE STORAGE DETIL FORM

Fig.11 Tissue storage page Essential user interface prototyping

7. Donor Information detail

Fig.12 donor information page Essential user interface prototyping

8. Tissue Evaluation Detail

Fig.13 Tissue Evaluation page Essential user interface prototyping

9. TISSUE DISCARD FORM

TISSUE DISCARD DETAIL FORM

LOG IN

Wel-Come to Web Based Eye Bank information Management system for Eye bank of Ethiopia

Search

HOME	ABOUT US	DONOR FLADGE	DONOR CALL DETILE	DONOR MEDICAL PARTICULARS	DONOR SCREEN	TISSUE COLLECTION	SEROLOGY TEST	STORE TISSUE DETIL	DONOR INFORMATION
TISSUE EVALUATING	TISSUE DISCARD	TISSUE REQUEST	TISSUE DISTRIBUTION	RECIPIENT FILLED	ADVERSE REPORT	RECIPIENT FOLLOWUP	REPORT	USER AWARENESS	CONTACT US

TISSUE DISCARD DETAIL

SOURCE OF EYE BANK

EB ID No

OCULAR TISSUE TYPE

STATUS OF TISSUE

FIN

PRODUCT CODE

EXPIRE DATE OF TISSUE

REASON FOR DISCARD

DISCARDED BY

DISCARDED DATE OF TISSUE

Save Reset Cancel

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Fig.14 Tissue Discard page Essential user interface prototyping

10. TISSUE REQUEST FORM

TISSUE REQUEST FORM

LOG IN

Wel-Come to Web Based Eye Bank information Management system for Eye bank of Ethiopia

Search

HOME	ABOUT US	DONOR FLADGE	DONOR CALL DETILE	DONOR MEDICAL PARTICULARS	DONOR SCREEN	TISSUE COLLECTION	SEROLOGY TEST	STORE TISSUE DETIL	DONOR INFORMATION
TISSUE EVALUATING	TISSUE DISCARD	TISSUE REQUEST	TISSUE DISTRIBUTION	RECIPIENT FILLED	ADVERSE REPORT	RECIPIENT FOLLOWUP	REPORT	USER AWARENESS	CONTACT US

TISSUE REQUEST

SURGEON

Surgeon Name

phone

Email

Fax

HOSPITAL

Hospital name

Country

City

Sub-city

Werda

Phone

P.O.Box

PATIENT

Patient Name

Country

City

Sub-city

Werda

MRN

Diagnosis

Surgery date

Surgery Time

Tissue Donor #

Type of surgery

Comment

Request Reset Cancel

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Fig.15 Tissue Request page Essential user interface prototyping

11. TISSUE DISTRUBATION

TISSUE DISTRIBUTION

SURGEON

Surgeon Name _____
 phone _____
 Email _____
 Fax _____
 Eye position Right Left
 Age _____
 Religion _____
 Sex Male Female
 Injury/Admittance _____
 Death time _____
 Preservation Date _____
 Preservation Hrs _____
 Preservation Mins _____

TISSUE DISTRIBUTION

Enucleation / excision time _____
 Cause of Death _____
 Medical history _____
 Ocular history _____
 Medication _____

Tissue Type _____
 Storge method _____
 Lot Number _____
 Status _____
 Count Cells/mm _____
 HIV Ag Result Negative Positive
 Hepatitis B Ag Result Negative Positive
 HCV Result _____
 Syphilis Result _____
 G/comment _____
 Name of EB tech supervisor _____

Submit Reset Cancel

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Fig.16 Tissue distribution page Essential user interface prototyping

12. RECIPIENT DATA

RECIPIENT DATA
 (to be filled at the time of surgery)

RECIPIENT DATA
 (to be filled at the time of surgery)

MRN _____
 Name of patient _____
 Age _____
 Eye/ Diagnosis _____
 Time lapse between Enucleation and utilization _____ hours
 Date of surgery _____
 Operating Surgen name _____
 Surgical procedure _____
 Name of surgeon _____

Send Reset Cancel

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Fig.17 recipient data page Essential user interface prototyping

13. ADVERSE REACTION FORM

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Search

HOME ABOUT US DONOR FLADGE DONOR CALL OF FILE DONOR MEDICAL PART CLARS DONOR SCREEN TISSUE COLLECTION SEROLOGY TEST STORE TISSUE DETE DONOR INFORMATION

TISSUE EVALUATING TISSUE DISCARD TISSUE REQUEST TISSUE DISTRIBUTION RECIPIENT FILLED ADVERSE REPORT RECIPIENT FOLLOWUP REPORT USER AWARENESS CONTACT US

DONOR TISSUE TENTATIVE DATA & ADVERSE REPORT FORM

ID NO _____ Date of surgery _____

Age _____ Counselor's name _____

Sex male female Date _____

Death date _____

Death time _____

Preservation date _____

Preservation time _____

Received date _____

Received time _____

Tissue sent by _____

Proposed date to use the tissue _____

Name of surgeon _____

MRN _____

ADVERSE REPORT

Details of aduers findings _____

Likely reason for adverse findings _____

Suggestions _____

Operating surgeon /team name _____

Save Reset Cancel

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Fig.18 Adverse Reaction page Essential user interface prototyping

14. RECIPIENT FOLLOW UP DETAIL

WELCOME TO Web Based Eye Bank Information Management system for Eye bank of Ethiopia

Imagine... never being able to see

Search

HOME ABOUT US DONOR FLADGE DONOR CALL OF FILE DONOR MEDICAL PART CLARS DONOR SCREEN TISSUE COLLECTION SEROLOGY TEST STORE TISSUE DETE DONOR INFORMATION

TISSUE EVALUATING TISSUE DISCARD TISSUE REQUEST TISSUE DISTRIBUTION RECIPIENT FILLED ADVERSE REPORT RECIPIENT FOLLOWUP REPORT USER AWARENESS CONTACT US

RECIPIENT FOLLOW UP DETAIL

Patient name _____

MRN _____

DOB _____

Diagnosis _____

Name of surgeon _____

Receiving transplanting tissue _____

Date of surgery _____

Placed at surgery _____

Post-operative complication _____

Tissue related _____

Types of surgery _____

Date _____

Submit Reset Cancel

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Fig.19 recipient follow up page Essential user interface prototyping

15. Generate Report



Fig.21 Report page Essential user interface prototyping

4.10.2. Non-functional Requirements

Non-functional requirements are requirements that specify criteria that can be used to judge the operation of a system, rather than specific behaviors (25). Non-functional requirements typically specify properties of the system considered as a whole. This category of requirements includes such aspects as, performance, security policies, system availability, and backup and restores strategies, portability, scalability, reliability, efficiency, testability, understandability, interface etc. (37). Thus focus majorly on the visible quality aspects of the system and the overall attributes of the system, including.

- ✓ The system should be easy is to use, the health professionals, other staff members as well as other users of the systems should easily understand. Usability is a crucial point in the system. As most users don't have experience of system like this, users are expecting to use the system in a way like a traditional word processor.
- ✓ The user interfaces should look satisfying or even attractive, often promoting confidence in its use.

- ✓ The system needs to be portable on all major platforms. This system should not be restricted by any specific technology such as database, web server, and operating system. There should always be alternative environment.
- ✓ The system should respond to the request within a reasonable period of time. The system should support concurrent access, in which multiple users can access it simultaneously. The system should be capable of processing queries quickly. Beside the software, hardware is also a great factor in its efficiency.
- ✓ The system should provide appropriate error message when the user enters unexpected/wrong data.
- ✓ The system should be protected, provided that traceability is ensured from donors and recipients of the data.
- ✓ The system should be available for 24 hours a day and 7 days a week
- ✓ The system should at least use English language for all interfaces.

CHAPTER FIVE

OBJECT ORIENTED ANALYSIS MODELS

5.1. Introduction

Object-Oriented Analysis (OOA) is to fully understand the problem and all its implications for its potential users. The investigator wants to find/identify all things and concepts, i.e. objects, in the application domain, that are relevant for solving this particular problem. Using these objects, their properties and interrelationships, the investigator then builds an object-oriented model of the problem domain. This abstract and simplified model of the problem domain will help us to better understand the actual problem and find an appropriate solution (38).

Analysis is independent of actual programming languages and user interfaces. This independence has several advantages. It is not necessary to know a specific programming language and/or user interface software to do analysis. This is particularly important, since analysis must be performed in close collaboration with the clients/users. The clients/users are the domain experts and cannot be expected to have a background in computer science. Decisions about actual implementation details should be deferred as long as possible. In the analysis phase, the investigator should not need to worry about such details. They might block our minds and prevent us from finding an Elegant "out of the box" solution. The investigator can think of the analysis model as an idealized and general object model, which is not corrupted by implementation issues. How do I find/identify the relevant objects in this problem? What are their properties and behavior in this particular context? How do they interact to accomplish the necessary tasks? We want to find out what each object knows and does and how objects collaborate.

5.2. UML Analysis Modeling

The Unified Modeling Language, or UML, is the de facto standard for building Object-Oriented software. It is a general modeling language to describe software both structurally and behaviorally. It has a graphical notation and allow for extension with a Profile. The Unified Modeling Language (UML) is a graphical language for visualizing, specifying, constructing, and documenting the artifacts of a software-intensive system. The UML offers a standard way to write a system's blueprints, including conceptual things such as business processes and system

functions as well as concrete things such as programming language statements, database schemas, and reusable software components.). UML defines 13 basic diagram types but the most useful, standard UML diagrams are: use case diagram, class diagram, sequence diagram, state chart diagram, activity diagram, component diagram, and deployment diagram. When using multiple models diagrams to represent a system is important because it allows a team to break up the huge problem of developing a system into smaller, digestible pieces that can be solved one at a time (39, 40).

5.3. Use Case Modeling

In the early stages of a development project, use case diagrams (use case: In a use case diagram, a representation of a set of events that occurs when an actor uses a system to complete a process. Normally, a use case is a relatively large process, not an individual step or transaction.) are used to describe real-world activities and motivations. We can refine the diagrams in later stages to reflect user interface and design details. It also describes, in the form of action and reaction, the system's behavior from the user's point of view. They allow defining the system's limits and the relationships between the system and the environment. It represents use cases, actors and the relationships between the use cases and the actors. The use case diagram shows the boundary of the system and it is a representation of a user's interaction with the system and depicting the specification of a use case.

Based on the existing system assessment findings, the system process is modeled. As part of the analysis, the investigator identified the use cases and the primary and secondary actors and relates them with the corresponding use cases. Figure 1 shows the use cases identified for the EBIMS process and also shows the actors of the system

5.3.1. System Use Case

System use case describes the interaction between the user and system in a more detailed way than an essential use case. While still trying to avoid referencing any UI specific features when possible, usually certain aspects of the technology to be used can be assumed. For instance, when writing a system use case, it is usually known whether the user will interact with a telephonic system, an internet application, or a piece of manufacturing equipment. Similarly, system use cases provide more detailed description of the steps that the system will perform to fulfill the

need of the user. In order to avoid committing to a specific UI design, this detail should still be expressed in logical terms. However, it paints a clearer picture of the requirements that the GUI must satisfy (41).

5.3.1.1. System Use Case Diagram

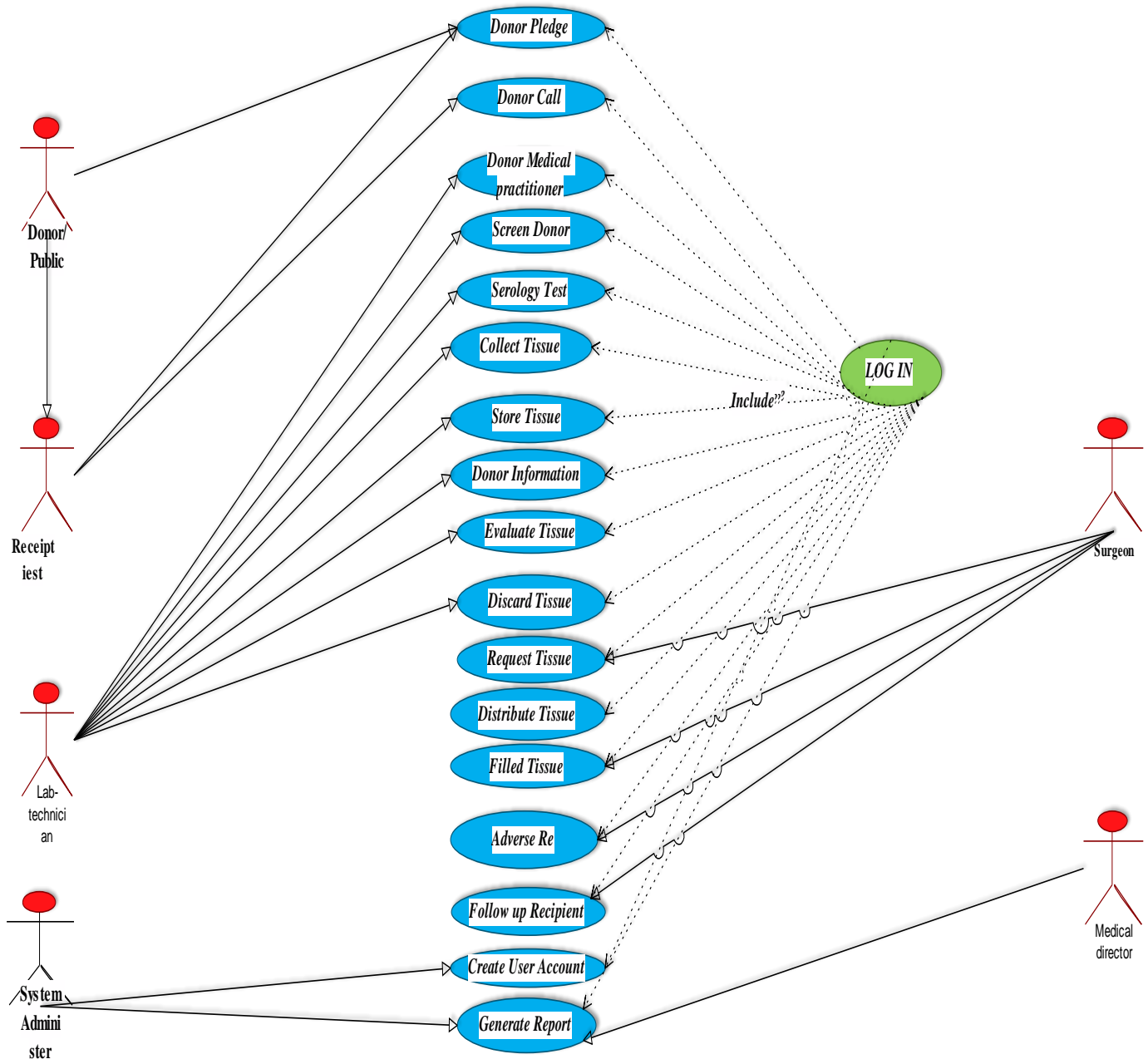


Fig.21 system use case of Eye Bank

5.3.1.2. System Use Case Narration

1. Manage user account

Use Case ID	EBUC-01
Use Case Name	Manage user account
Description	The use case describes how the system administrator Activates, inactivates and provides privilege to the users of the system
Actor	System administrator
Pre-Conditions	The System administrator must be logged into the system, authenticated and authorized by its own assigned privilege and registered user.
Post-Conditions	Different user account information are managed
Extends	None
Includes	EBUC-001
Main-Success Scenario	<ol style="list-style-type: none"> 1. The System administrator want to manage the user account 2. The logs into the system using “EBUC-02: Login”; 3. The system displays the main Window “EBUI-01: Main Menu”; 4. The user select “Manage account” from the Main Menu; 5. The System administrator selects system administration page. 6. The System presents the different users of the system. 7. The system displays a new account creation form 8. The System administrator checks staffs have a user account from the list of Identification numbers 9. The System administrator fills the required forms[Alt1] 10. Click submit button to save the data 11. The system creates account that is the system provides privilege to use the system [Alt2]. 12. The system validates and confirms the inserted data 13. The use case ends
Alternative Scenario1	<ol style="list-style-type: none"> A) if the system administrator wants to update system user data B) selects the identification number of the user C) The system administrator changes the information of the user D) the system administrator updates the needed data E) the system administrator clicks update F) the data will be saved onto the database G)The use case ends

Alternative Scenario2	A) if the system administrator wants to deactivate the user B) click on the identification number of that user C) The system displays the information of the user D)The use case ends
------------------------------	--

2. Log in

Use Case ID	EBUC-02
Use Case Name	Login
Description	Describes how the user is authenticated by the system.
Actor	Receptionist Nurse, System Administrator, Lab Technician.
Pre-Conditions	The user has authorized user name and password.
Post-Conditions	The user logs into the system and the system displays system main page.
Extends	None
Includes	None
Main-Success Scenario	<ol style="list-style-type: none"> 1. This use case starts when the user wishes to log into the eye bank management information system; 2. The system displays login form; 3. The user enters user name and password and press login button; 4. The system displays main page based on the user privilege [Alt1]. 5. The use case ends
Alternative Scenario 1	<p>G. If the user enters wrong user name and password</p> <p>B. The system notifies the user that he/she entered wrong user name and password;</p> <p>C. The system let the user to please try again.</p> <p>D. The use case ends</p>

3. Donor Pledge

Use Case ID	EBUC-03
Use Case Name	Donor Pledge
Description	Describes Donor Pledge to donate at the time death.
Actor	Donor ,Receptionist
Pre-Conditions	The donor access the Eye Bank portal by entering the URL.
Post-Conditions	The system register donation after the time death.
Extends	None
Includes	EBUC-001
Main-Success Scenario	<ol style="list-style-type: none"> 1. The user want to register as a donor after death 2. The logs into the system using “EBUC-02: Login”;

	<ol style="list-style-type: none"> 3. The system displays the main Window “EBUI-01: Main Menu”; 4. The user select “Donor Pledge” from the Main Menu; 5. The system displays the Screen donor selection interface “EBUI-03: Donor Pledge”; 6. The donor enters the necessary information such as, Name, Gender, Donation Date, Email etc..; 7. The donor clicks “Register” button; [Alt1] [Alt 2] 8. The system check the validity according to the business rule “BR-002: check donor alive & register once” 9. The system sends confirmation number to the donor’s email. 10. The system lets the donor to enter confirmation number; 11. The donor enters confirmation number; 12. The donor clicks “Submit” button; 13. The system register the donor donate at the time death 14. Use case ends
Alternative Scenario 1	<ol style="list-style-type: none"> A. If the lab technician clicks on Reset button; B. The system donor pledge information missed or clear the input box; C. Use case ends
Alternative Scenario 2	<ol style="list-style-type: none"> A. lab technician clicks on Cancel button; B. The system return to main manu“EBUI-01: Main Menu”; C. Use case ends

4. Search Donors

Use Case ID	EBUC-04
Use Case Name	<i>Search Donors</i>
Description	Describes how search Registered Donors list at eye bank.
Actor	Receptionist , lab technician, supervisor,
Pre-Conditions	The user is logged into the system.
Post-Conditions	The system displays Registered Donors requested from the list.
Extends	None
Includes	EBUC-001

Main-Success Scenario	<ol style="list-style-type: none"> 1. The user want to search registered donor 2. The log into the system using “<i>EBUC-02: Login</i>”; 3. The system displays the main Window “<i>EBUI-01: Main Menu</i>”; 4. The users select “Search” from the Main Menu; 5. The system displays the Search interface “<i>EBUI-01: Home Page</i>”; 6. User enters the keywords they are searching on.[Alt 1] 7. System searches all the donor registered libraries for registered matching the given keywords and displays a list of the matching registered and the library they belong in. 8. User reviews the available registered donors and selects the one they would like to do based on their privileges. 9. Use case ends
Alternative Scenario1	<ol style="list-style-type: none"> A. If the user makes error while enters the input, the system displays error message. B. The user clicks ok button. C. The system inform the user to re-enter the information D. Use case ends

6. Donor call initial

Use Case ID	EBUC_05
Use case Name	Donor call initial
Primary actor	Receptionist
Summary description	This use case describes the process used to receive call from willing to donate next-of-kin.
Precondition	Log to system and the receptionist are authenticated.
Post condition	The Donor initial information will get.
Extends	None
Includes	EBUC-001
Main scenario	<ol style="list-style-type: none"> 1. The Receptionist want to register Donor call initial at the time of received call; 2. The logs into the system using “<i>EBUC-02: Login</i>”; 3. The system displays the main Window “<i>EBUI-01: Main Menu</i>”; 4. The Receptionist selects “<i>Donor Call Initial</i>” from the Main Menu; 5. The system displays the Donor call initial interface “<i>EBUI-05: Donor Call Initial</i>”; 6. The receptionist enters donor calls initial detail; 7. Receptionist clicks on <i>Save</i> button [Alt1] [Alt2]; 8. The system save donor calls initial information on the database and make the form ready for the next Donor call initial information;

	9. Use case ends.
Alternative Scenario1	A. If the lab technician clicks on <i>Reset</i> button; B. The system donor calls information missed or clear the input box;
Alternative Scenario1	H. lab technician clicks on <i>Cancel</i> button; I. The system return to main manu“ <i>EBUI-01: Main Menu</i> ”; J. Use case ends.

7. Donor medical particular

Use Case ID	EBUC_06
Use case Name	Donor medical particular
Primary actor	Lab technician
Summary description	This use case describes the process used to actually know donor deceased approved
Precondition	May Donor registered , must call information received to receptionist , the user is logged into the system, lab technician are authenticated
Post condition	Get Donor medical particular detail
Extends	None
Includes	EBUC-001
Main success scenario	<ol style="list-style-type: none"> 1. The Lab technician want to register Donor medical particular 2. The logs into the system using “<i>EBUC-02: Login</i>”; 3. The system displays the main Window “<i>EBUI-01: Main Menu</i>”; 4. The Lab technician selects “<i>Donor Medical Particular</i>” from the Main Menu; 5. The system displays the Donor medical particular interface “<i>EBUI-06: Donor Medical Particular</i>”; 6. Lab technician enters Donor medical particular detail; 7. lab technician clicks on Save button [Alt1] [Alt2]; 8. The system check the donor death and take consent next-of-kin according to the business rule “<i>BR-005and 006: check donor death and take consent</i>” 9. The system save Donor medical particular information on the database and make the form ready for the next Donor medical particular information; 10. Use case ends.
Alternative Scenario1	A. If the lab technician clicks on <i>Reset</i> button; B. The system Donor medical particular information missed or clear the input box; C. The use case ends

Alternative Scenario2	<p>A. lab technician clicks on <i>Cancel</i> button;</p> <p>B. The system return to main manu“<i>EBUI-01: Main Menu</i>”;</p> <p>C. Use case ends.</p>
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8. Screen Donor Selection

Use Case ID	EBUC_07
Use case Name	<i>Screen donor selection</i>
Primary actor	Lab technician
Summary description	This use case describes the process used to screen donor selection means that suitable by age, cause of death, medical history and the family must approach fill the consent form.
Precondition	May Donor registered , must call information received to receptionist , the user is logged into the system, lab technician are authenticated
Post condition	The Donor tissue may be collect.
Extends	None
Includes	EBUC-001
Main success scenario	<ol style="list-style-type: none"> 1. The Lab technician want to Screen donor selection 2. The logs into the system using “<i>EBUC-02: Login</i>”; 3. The system displays the main Window “<i>EBUI-01: Main Menu</i>”; 4. The Lab technician selects “<i>Screen Donor Selection</i>” from the Main Menu; 5. The system displays the Screen donor selection interface “<i>EBUI-07: Screen Donor Selection</i>”; 6. Lab technician enters screen donor selection detail 7. Lab technician clicks on save button[Alt1],[Alt2] 8. The system check the donor age according to the business rule “<i>BR-004: check donor age limit</i> ” 9. The system save Screen donor selection information on the database and make the form ready for the next Screen donor selection information; 10. Use case ends.
Alternative Scenario1	<p>A. If the lab technician clicks on <i>Reset</i> button;</p> <p>B. The system Screen donor selection missed or clear the input box;</p> <p>C. Use case ends.</p>

Alternative Scenario2	<p>A. lab technician clicks on <i>Cancel</i> button;</p> <p>B. The system return to main manu“<i>EBUI-01: Main Menu</i>”;</p> <p>C. Use case ends.</p>
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9. Tissue collection detail

Use Case ID	EBUC_8
Use case Name	<i>Tissue collection detail.</i>
Primary actor	Lab technician
Summary description	This use case describes the process used to tissue is collected from home, hospital, mortuary etc. from deceased donor by the consent given family.
Precondition	May Donor registered , must call information received to receptionist , the user is logged into the system, lab technician are authenticated
Post condition	The Lab technician may be get tissue collection detail.
Extends	None
Includes	EBUC-001
Main scenario success	<ol style="list-style-type: none"> 1. The Lab technician want to collect the donor cornea from anywhere to have a diseased information; 2. The logs into the system using “<i>EBUC-02: Login</i>”; 3. The system displays the main Window “<i>EBUI-01: Main Menu</i>”; 4. The Lab technician selects “<i>Tissue collection detail</i>” from the Main Menu; 5. The system displays the Tissue collection detail interface “<i>EBUI-08: Tissue Collection Detail</i>”; 6. Lab technician enters tissue collection detail; 7. lab technician clicks on <i>Save</i> button [Alt1] [Alt2]; 8. The system check the tissue enucleation not exceed eight hours according to the business rule “<i>BR-007: check donor cornea tissue</i>” 9. The system save Tissue collection detail information on the database and make the form ready for the next Tissue collection detail information; 10. Use case ends.
Alternative Scenario 1	<p>A. If the lab technician clicks on <i>Reset</i> button;</p> <p>B. The system Tissue collection detail information missed or clear the input box;</p> <p>C. Use case ends.</p>

Alternative Scenario 2	<p>A. lab technician clicks on <i>Cancel</i> button;</p> <p>B. The system return to main manu“<i>EBUI-01: Main Menu</i>”;</p> <p>C. Use case ends.</p>
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10. Serological Test

Use Case ID	EBUC_9
Use case Name	Serological Test
Primary actor	Lab technician
Summary description	This use case describes the process used to describe the procedure for obtaining a blood sample from a donor for the purpose of serologic testing. It required before ocular tissue can be released for surgical use.
Precondition	Donor may register, tissue must be collected and the user is logged into the system and the lab technician is authenticated.
Post condition	The Donor tissue may store or discard.
Extends	None
Includes	EBUC-001
Main success scenario	<ol style="list-style-type: none"> 1. The Lab technician want to test sample blood take from the donor; 2. The logs into the system using “<i>EBUC-02: Login</i>”; 3. The system displays the main Window “<i>EBUI-01: Main Menu</i>”; 4. The Lab technician selects “ <i>Serological Test</i> ” from the Main Menu; 5. The system displays the Serological Test interface “<i>EBUI-09: Serological Test</i>”; 6. Lab technician enters serological test result; 7. Lab technician clicks on <i>Submit</i> button [Alt1] [Alt2]; 8. The system check the blood sample taken hours after death according to the business rule “<i>BR-008: check donor sample taken hours</i>” 9. The system save sample test information on the database and make the form ready for the next sample test information; 10. Use case ends.
Alternative Scenario 1	<p>A. If the lab technician clicks on <i>Reset</i> button;</p> <p>B. The system sample test information missed or clear the input box;</p> <p>C. . Use case ends</p>
Alternative Scenario 2	<p>A. lab technician clicks on <i>Cancel</i> button;</p> <p>B. The system return to main manu“<i>EBUI-01: Main Menu</i>”;</p> <p>C. Use case ends.</p>

11. Store cornea tissue

Use Case ID	EBUC-10
Use Case Name	<i>Store cornea tissue</i>
Description	Describes the process of storing cornea information that allocate the conditions under which donor eye tissue is to be maintained and stored free from bacterial contamination and potentially hazardous biological material to isolate tissue until infectious disease screening is completed in Laboratory tests, which rule out disease such as HIV, Hepatitis B and Hepatitis C in sterile container, preservation or storage solutions for the particular type of tissue, refrigerator with temperature recording device, backup power supply.
Actor	Lab technician
Pre-Conditions	The user is logged into the system , the lab technician is authenticated Serological test must perform.
Post-Conditions	All donor information detail is available donated cornea information recorded in the system database
Extends	None
Includes	EBUC-001
Main-Success Scenario	<ol style="list-style-type: none"> 1. The Lab technician want to store Cornea in appropriate location 2. The logs into the system using “<i>EBUI-02: Login</i>”; 3. The system displays the main Window “<i>EBUI-01: Main Menu</i>”; 4. The Lab technician selects “ <i>Cornea Store</i> ” from the Main Menu; 5. The system displays the Cornea Tissue Store interface “<i>EBUI-10: Cornea Store</i>”; 6. The Lab technician enters cornea store details; 7. The user click <i>Save</i> button [Alt1] [Alt2]; 8. The system save stored cornea information on the database and make the form ready for the next cornea information; 9. The use case ends.

Alternative Scenario 1	<p>A. If the lab technician clicks on Reset button;</p> <p>B. The system Store information missed or clear the input box;</p> <p>C. The use case ends</p>
Alternative Scenario 2	<p>A. lab technician clicks on Cancel button;</p> <p>B. The system return to main manu“EBUI-01: Main Menu”;</p> <p>C. Use case ends</p>

12. Donor Information Detail

Use Case ID	EBUC-11
Use Case Name	<i>Donor Information Detail</i>
Description	Describes the process of all donor information listed for different purpose After preserving ocular tissue, the initial evaluation may differ from, To avoid inaccurate or erroneous assumptions based on illegible record entries; to avoid confusion and misunderstanding and avoid transmission of any infections or disease from donor to recipient
Actor	Lab technician
Pre-Conditions	Approved quality store cornea tissue The user is logged into the system , the lab technician is authenticated
Post-Conditions	All donor information detail is an input of final evaluation cornea tissue
Extends	None
Includes	EBUC-001
Main-Success Scenario	<ol style="list-style-type: none"> 1. The user want to record donor information from the stoke; 2. The logs into the system using “EBUI-02: Login”; 3. The system displays the main Window “EBUI-01: Main Menu”; 4. The user selects “Donor Information Detail” from the Main Menu; 5. The system displays the Cornea Tissue Discard interface “EBUI-11: Donor Information Detail”; 6. The user enters all available donor information details; 7. The user click Save button[Alt 1],[Alt 2] 8. The system save donor information detail on the database and make the form ready for the next donor information; 9. The use case ends.
Alternative Scenario1	<p>A. If the lab technician clicks on Reset button;</p> <p>B. The system donor calls information missed or clear the input box;</p> <p>C. Use case ends</p>

Alternative Scenario2	A. lab technician clicks on <i>Cancel</i> button; B. The system return to main manu“ <i>EBUI-01: Main Menu</i> ”; C. Use case ends.
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13. Tissue evaluating

Use Case ID	EBUC-12
Use Case Name	Tissue evaluating
Description	Describes the process of cornea tissue evaluation that are gross examine, slit lamp examination, endothelial cell density suitable for surgery use.
Actor	Lab Technician , Lab Technician supervisor
Pre-Conditions	The users is logged into the system , the users is authenticated
Post-Conditions	Tissue evaluating information is recorded in the system database
Extends	None
Includes	EBUC-001
Main-Success Scenario	<ol style="list-style-type: none"> 1. The user want to evaluate Cornea tissue from the stoke; 2. The logs into the system using “<i>EBUC-02: Login</i>”; 3. The system displays the main Window “<i>EBUI-01: Main Menu</i>”; 4. The user selects “ <i>Cornea Evaluating</i>” from the Main Menu; 5. The system displays the Tissue Evaluating interface “<i>EBUI-12: Cornea Evaluating</i>”; 6. The users enters Tissue evaluating details; 7. The users click <i>Save Button</i> [Alt 1] [Alt 2] 8. The system save Tissue evaluating details on the database and make the form ready for the next record; 9. Use case ends.
Alternative Scenario 1	A. If the users click on <i>Reset</i> button; B. The system Tissue evaluating info missed or clear the input box; C. Use case ends.
Alternative Scenario2	A. users click on <i>Cancel</i> button; B. The system return to main menu “ <i>EBUI-01: Main Menu</i> ”; C. Use case ends.

14. Tissue Discard

Use Case ID	EBUC-13
Use Case Name	Tissue discard
Description	Describes the process of registering discarded cornea tissue in stock from donors with conflicting serology results, expire and by any other means not fit will be quarantined and discarded
Actor	Lab Technician
Pre-Conditions	The user is logged into the system , the lab technician is authenticated
Post-Conditions	Discarded cornea information is recorded in the system database
Extends	None
Includes	EBUC-001
Main-Success Scenario	<ol style="list-style-type: none"> 1. The user want to discard Cornea tissue from the stoke; 2. The logs into the system using “<i>EBUI-02: Login</i>”; 3. The system displays the main Window “<i>EBUI-01: Main Menu</i>”; 4. The user selects “ <i>Cornea Tissue Discard</i>” from the Main Menu; 5. The system displays the Cornea Tissue Discard interface “<i>EBUI-13: Cornea Tissue discard</i>”; 6. The users enters discarded cornea details; 7. The users click <i>Save</i> button [Alt 1], [Alt 2]; 8. The system check the conflict serology result and reach expire date of cornea according to the business rule “<i>BR-008: check conflict serology result</i>” 9. The system save discarded cornea details on the database and make the form ready for the next record; 10. Use case ends.
Alternative Scenario1	<ol style="list-style-type: none"> A. If the users click on <i>Reset</i> button; B. The system donor calls information missed or clear the input box; C. Use case ends.
Alternative Scenario2	<ol style="list-style-type: none"> A. users click on cancel button; B. The system return to main manu“<i>EBUI-01: Main Menu</i>”; C. Use case ends.

15. Cornea tissue request

Use Case ID	EBUC-14
Use Case Name	<i>Cornea tissue request</i>
Description	Describes the process of cornea tissue request from eye bank that transplant to cornea’s problem in the health institutions.
Actor	surgeon

Pre-Conditions	The surgeon is logged into the system , the surgeon is authenticated
Post-Conditions	The system displays cornea requested from the eye bank.
Extends	None
Includes	EBUC-001
Main-Success Scenario	<ol style="list-style-type: none"> 1. The Surgeon want to request Cornea tissue to the cornea patient ; 2. The logs into the system using “<i>EBUC-02: Login</i>”; 3. The system displays the main Window “<i>EBUI-01: Main Menu</i>”; 4. The Surgeon selects “ <i>Cornea Tissue Request</i> ” from the Main Menu; 5. The system displays the Cornea Tissue request interface “<i>EBUI-14: Cornea Tissue request</i>”; 6. The surgeon enters Cornea request details; 7. The surgeon clicks send button[Alt1], [Alt]; 8. The system saves cornea request information on the database; 9. The use case ends.
Alternative Scenario 2	<ol style="list-style-type: none"> A. If the surgeon clicks on <i>Reset</i> button; B. The system donor calls information missed or clear the input box; C. Use case ends.
Alternative Scenario 2	<ol style="list-style-type: none"> A. Surgeon clicks on <i>Cancel</i> button; B. The system returns to home page; C. Use case ends.

16. Cornea tissue distribution

Use Case ID	EBUC-15
Use Case Name	<i>Cornea Tissue distribution.</i>
Description	A process of allocation of tissue for transplant, research or educational use. This process includes receipt of request, selection, checkup and release of tissue, to a consignee such as a surgeon, surgical center or educational research center. Only 9 surgeons we have in our country carrying out distribution of eye tissue.
Actor	Lab technician and lab technician supervisor
Pre-Conditions	The users are logged into the system , the users are authenticated
Post-Conditions	The user may be get cornea tissue distribution information
Extends	None
Includes	EBUC-001
Main-Success Scenario	<ol style="list-style-type: none"> 1. The user want to distribute cornea tissue to dedicated surgeon; 2. The logs into the system using “<i>EBUC-02: Login</i>”; 3. The system displays the main Window “<i>EBUI-01: Main Menu</i>”; 4. The user selects “<i>Cornea Tissue Distribution</i>” from the Main Menu;

	<ol style="list-style-type: none"> 5. The system displays the follow up interface “EBUI-15: Cornea Tissue Distribution”; 6. The users enter cornea tissue distribution details; 7. The users click save button [Alt 1],[Alt2]; 8. The system saves cornea tissue distribution information on the database; 9. The use case ends.
Alternative Scenario	<ol style="list-style-type: none"> A. If the users clicks on Reset button; B. The system Cornea Tissue distribution detail missed or clear the input box; C. Use case ends.
Alternative Scenario	<ol style="list-style-type: none"> A. The users click on Cancel button; B. The system returns to Main manu“EBUI-01: Main Menu”; C. Use case ends.

17. Fill Recipient Data

Use Case ID	EBUC-16
Use Case Name	<i>Fill Recipient Data</i>
Description	Describes the process of cornea tissue fail at the time surgery or another the surgeon as soon as possible inform to eye bank.
Actor	Surgeon
Pre-Conditions	The users are logged into the system , the users are authenticated
Post-Conditions	The system displays Cornea tissue fail from the eye bank.
Extends	None
Includes	EBUC-001
Main-Success Scenario	<ol style="list-style-type: none"> 1. The Surgeon want to send fail Cornea tissue at the time of surgery; 2. The logs into the system using “EBUI-02: Login”; 3. The system displays the main Window “EBUI-01: Main Menu”; 4. The Surgeon selects “Fill Recipient Data” from the Main Menu; 5. The system displays the Fill Cornea Tissue interface “EBUI-16: Fill Recipient Data”; 6. The users enter fill recipient data details; 7. The users click save button [Alt 1],[Alt 2]; 8. The system saves fill recipient data information on the database; 9. The use case ends.
Alternative Scenario 1	<ol style="list-style-type: none"> 7. A If the users clicks on Reset button; 8. A The system fill recipient data detail missed or clear the input box;

Alternative Scenario 2	7. B The users click on <i>Cancel</i> button; 8 B The system returns to main menu " <i>EBUI-01: Main Menu</i> "; 9. Use case ends.
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18. Adverse report detail

Use Case ID	EBUC-17
Use Case Name	<i>adverse reaction detail</i>
Description	Describes the process of adverse reaction detail at the time surgery or another the surgeon as soon as possible inform to eye bank.
Actor	Surgeon
Pre-Conditions	The users are logged into the system , the users are authenticated
Post-Conditions	The system displays adverse reaction detail to the eye bank.
Main-Success Scenario	<ol style="list-style-type: none"> 1. The Surgeon want to send adverse reaction detail ; 2. The logs into the system using "<i>EBUI-02: Login</i>"; 3. The system displays the main Window "<i>EBUI-01: Main Menu</i>"; 4. The Surgeon selects "<i>Adverse Reaction Detail</i>" from the Main Menu; 5. The system displays the follow up interface "<i>EBUI-17: Adverse Reaction Detail</i>"; 6. The users enter adverse reaction details; 7. The users click Send button [Alt 1,] [Alt 2]; 8. The system saves adverse report detail information on the database; 9. The use case ends.
Alternative Scenario1	<ol style="list-style-type: none"> A. If the users clicks on reset button; B. A The system adverse reaction detail missed or clear the input box; C. Use case ends
Alternative Scenario 2	<ol style="list-style-type: none"> A. The users click on cancel button; B. The system returns to main menu "<i>EBUI-01: Main Menu</i>"; C. Use case ends.

19. Follow up transplanted patient

Use case ID	EBUC-18
Use Case name	<i>Follow up</i>
Use case Description	Describes follow up information of transplanted patient
Primary Actor	Surgeon
Pre-Conditions	The surgeon should be logged in to the system, the users are authenticated
Post-Conditions	The system stored completed patient follow up information to the database.

Extends	None
Includes	EBUC-001
process of main success scenario	<ol style="list-style-type: none"> 1. The Surgeon want to send follow up of a patient; 2. The logs into the system using “EBUC-02: Login”; 3. The system displays the main Window “EBUI-01: Main Menu”; 4. The Surgeon selects “Follow up” from the Main Menu; 5. The system displays the follow up interface “EBUI-18: follow up recipient”;<i>[Alt 1]</i> 6. The surgeon fills the transplanted patient follow up information ; 7. The surgeon clicks on Send button<i>[Alt 2] [Alt 3]</i>; 8. The System displays successfully submitted message; 9. Use case end.
Alternative Scenario 1	<ol style="list-style-type: none"> A. if the recipient is not new the surgeon enters the card number and click on Search button; B. The system displays previous follow up form; C. The surgeon updates the follow up information; D. Use case ends
Alternative Scenario 2	<ol style="list-style-type: none"> A. If the users clicks on Reset button; B. The system cornea tissue fill detail missed or clear the input box; C. Use case ends
Alternative Scenario 3	<ol style="list-style-type: none"> A. The users click on Cancel button; B. The system returns to main manu“EBUI-01: Main Menu”; C. Use case ends.

20. Report

Use Case ID	EBUC-19
Use Case Name	Generate Report
Description	Describes the process of generating different reports
Actor	System administrator, eye bank manager, lab head
Pre-Conditions	The user is logged into the system
Post-Conditions	The system generates reports
Extends	None
Includes	EBUC-001
Main-Success Scenario	<ol style="list-style-type: none"> 1. The user want to generate a report 2. The user logs into the system using “EBUI-02: Login” 3. The system displays the main Window “EBUI-01: Main Menu” 4. The user selects “report” from the Main Menu 5. The system displays the report interface “EBUI-19: report”

	6. The user selects option of the report to be generated and click on Generate report button; [Alt1], [Alt2], [Alt3] 7. The system generates report from the database. 8. use case ends
Alternative Scenario 1	A. If the user click on Export button; B. The system exports the report in different format. C. The use case ends
Alternative Scenario 2	A. If the user click on Print button; B. The system print out the report C. The use case ends
Alternative Scenario 3	A. If the system click on Cancel button; B. The system return to the main menu " EBUI-01: Main Menu " C. The use case ends

Tables 3 system use case documentation

5.4. Sequence diagram

Sequence diagrams show a detailed flow for a specific use case or even just part of a specific use case. They are almost self-explanatory; they show the calls between the different objects in their sequence and can show, at a detailed level, different calls to different objects. A sequence diagram has two dimensions: The vertical dimension shows the sequence of messages/calls in the time order that they occur; the horizontal dimension shows the object instances to which the messages are sent (42).

A sequence diagram is very simple to draw. Across the top of your diagram, identify the class instances (objects) by putting each class instance inside a box. In the box, put the class instance name and class name separated by a space/colon/space “: “. If a class instance sends a message to another class instance, draw a line with an open arrowhead pointing to the receiving class instance; place the name of the message/method above the line. Optionally, for important messages, you can draw a dotted line with an arrowhead pointing back to the originating class instance; label the return value above the dotted line. Personally, I always like to include the return value lines because I find the extra details make it easier to read (42).

A system sequence diagram (SSD) is a picture that shows, for a particular scenario of a use case, the events that external actors generate their order, and inter-system events. All systems are treated as a black box; the emphasis of the diagram is events that cross the system boundary from

actors to systems. An SSD should be done for the main success scenario of the use case, and frequent or complex alternative scenarios (43).

Manage account
Basic Course of Action
ABUC-02

1. The System administrator want to manage the user account
 2. The logs into the system using "EBUC-02: Login";
 3. The system displays the main Window "EBUI-01: Main Menu";
 4. The user select "Manage account" from the Main Menu;
 5. The System administrator selects system administration page.
 6. The System administrator presents the different users of the system,checks staffs have a user account from the list of Identification numbers fills the required forms
 7. The system displays a new account creation form
 10. Click submit button to save the data
 11. The system creates account that is the system provides privilege to use the system
 12. The system validates and confirms the inserted data
- The use case ends

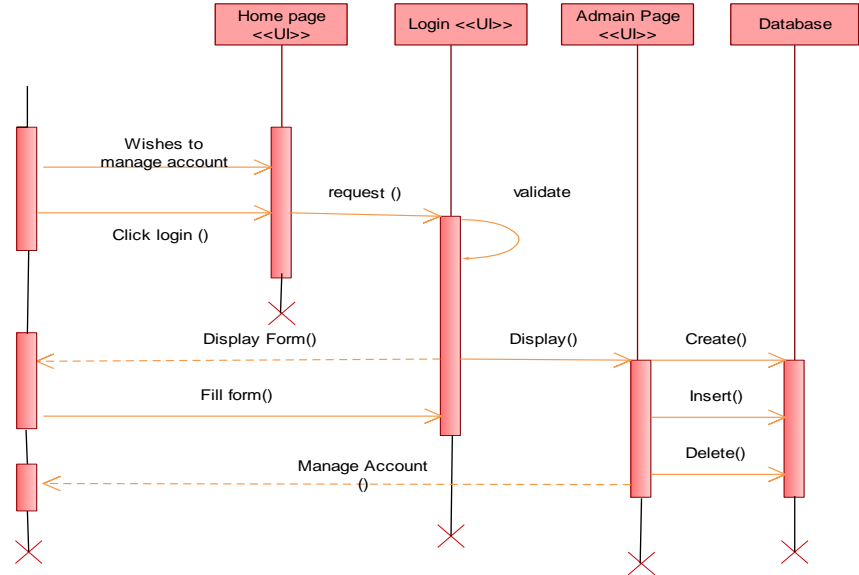


Fig.22 manage account sequence diagram

Validate System User
Basic Course of Action
ABUC-01

1. This use case starts when the user wishes to log into the eye bank management information system;
2. The system displays login form;
3. The user enters user name and password and press login button;
4. The system displays main page based on the user privilege.
5. The use case ends

Users/
Actor

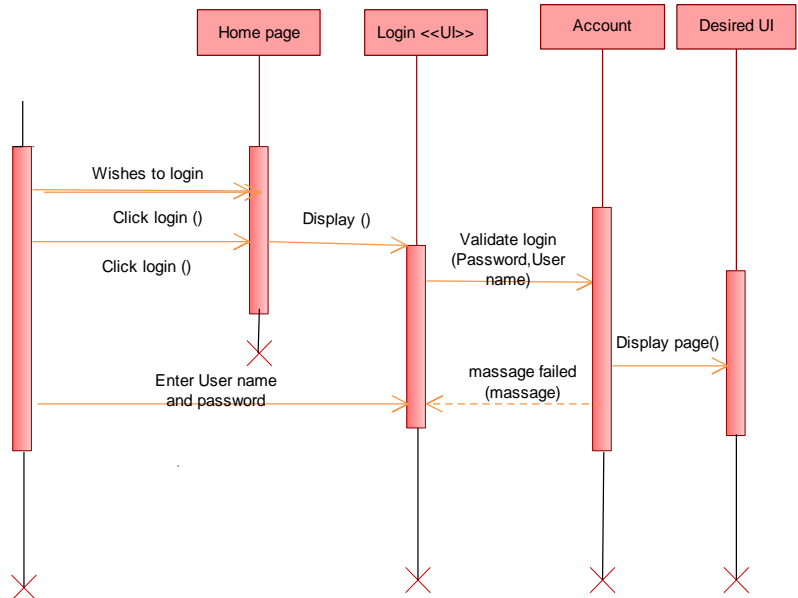


Fig.23 login sequence diagram

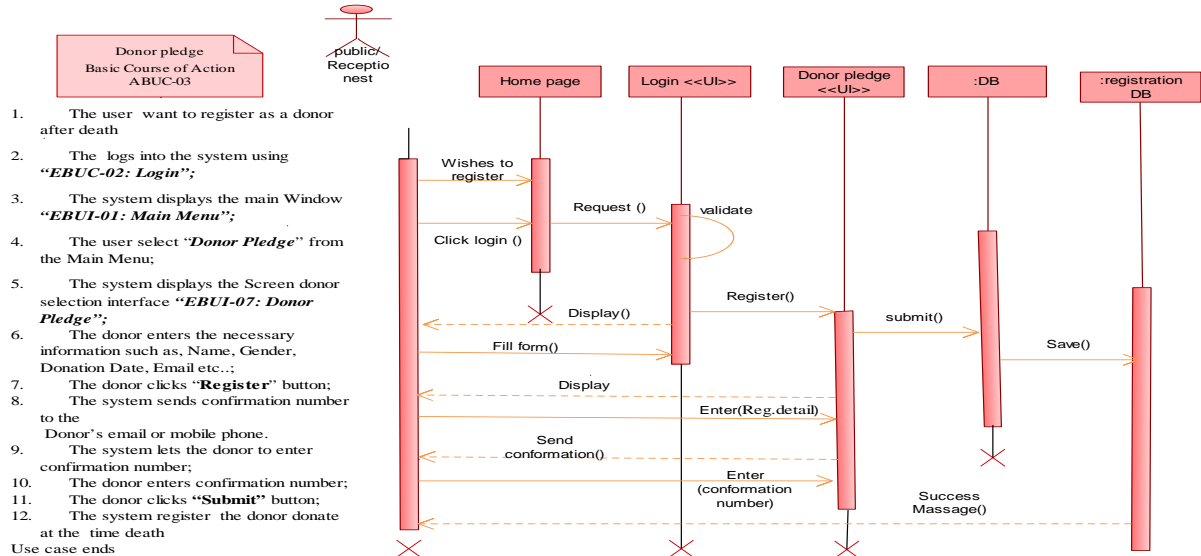


Fig.24 donor pledge sequence diagram

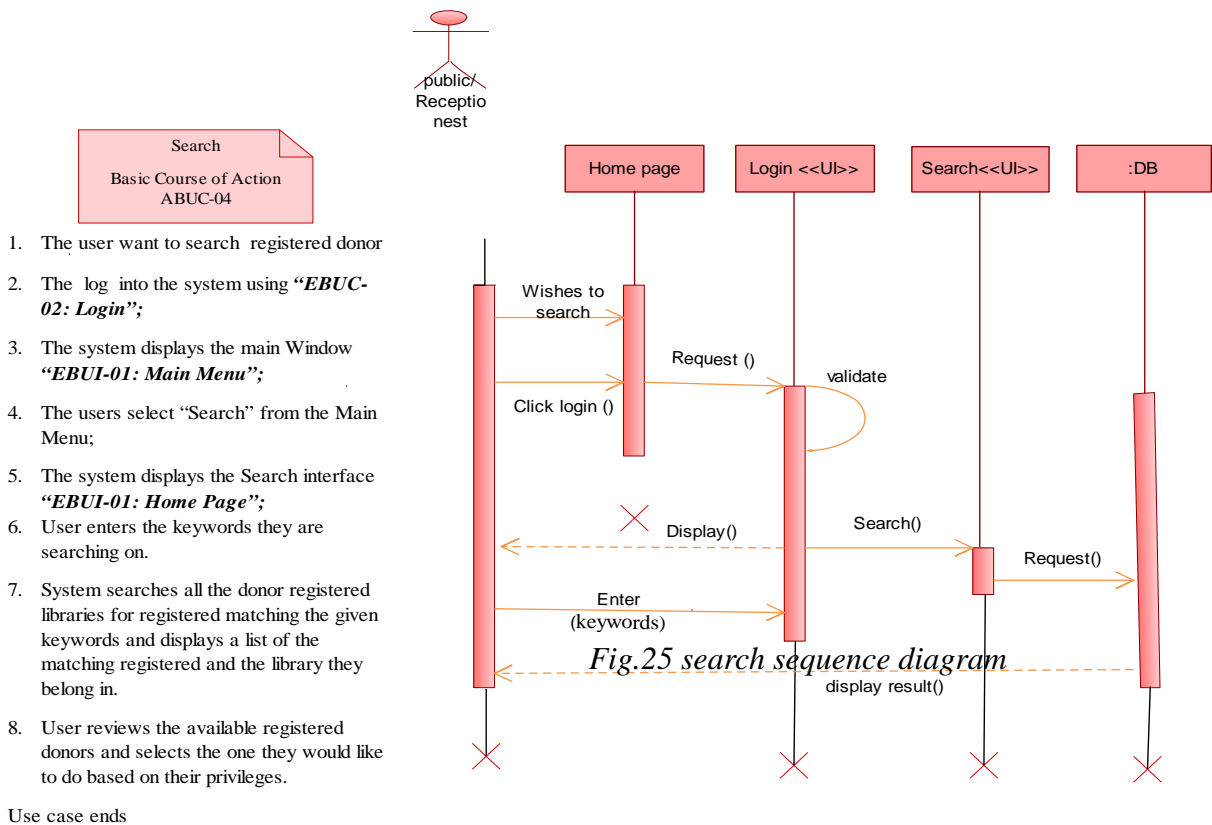


Fig.25 search sequence diagram



Donor call initial
Basic Course of Action
ABUC-03

1. The Receptionist want to record Donor call initial at the time of received call;
 2. The logs into the system using **"EBUC-02: Login"**;
 3. The system displays the main Window **"EBUI-01: Main Menu"**;
 4. The Receptionist selects **"Donor Call Initial"** from the Main Menu;
 5. The system displays the Donor call initial interface **"EBUI-05: Donor Call Initial"**;
 6. The receptionist enters donor calls initial de tail;
 7. Receptionist clicks on **Save** button;
 8. The system save don or calls initial information on the database and make the form ready for the next Donor call initial information;
- Use case ends

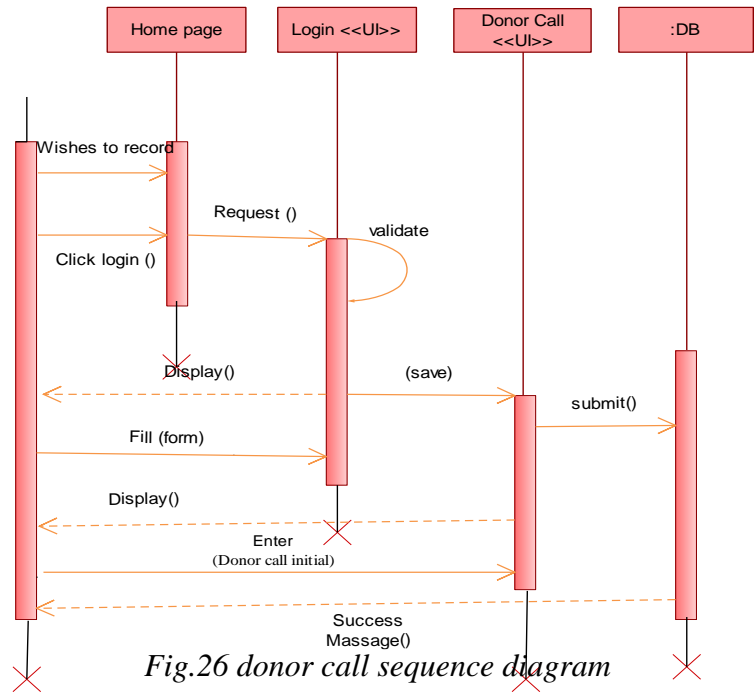


Fig.26 donor call sequence diagram

Donor medical particular
Basic Course of Action
ABUC-06

1. The Lab technician want to record Donor medical particular
2. The logs into the system using **"EBUC-02: Login"**;
3. The system displays the main Window **"EBUI-01: Main Menu"**;
4. The Lab technician selects **"Donor Medical Particular"** from the Main Menu;
5. The system displays the Donor medical particular interface **"EBUI-06: Donor Medical Particular"**;
6. Lab technician enters Donor medical particular detail;
7. lab technician clicks on **Save** button;
8. The system save Donor medical particular information on the database and make the form ready for the next Donor medical particular information;
9. Use case ends

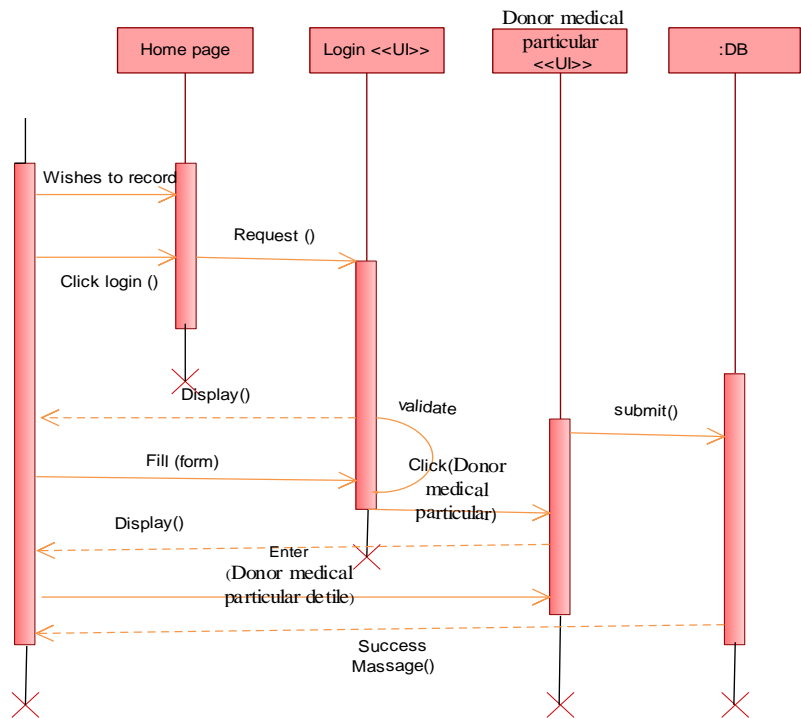


Fig. 27 donor medical particular sequence diagram

Screen donor selection
Basic Course of Action
ABUC-08

1. The Lab technician want to Screen donor selection
2. The logs into the system using "EBUC-02: Login";
3. The system displays the main Window "EBUI-01: Main Menu";
4. The Lab technician selects "Screen Donor Selection" from the Main Menu;
5. The system displays the Screen donor selection interface "EBUI-07: Screen Donor Selection";
6. Lab technician enters screen donor selection detail
7. lab technician clicks on **submit** button
8. The system save Screen donor selection information on the database and make the form ready for the next Screen donor selection information;

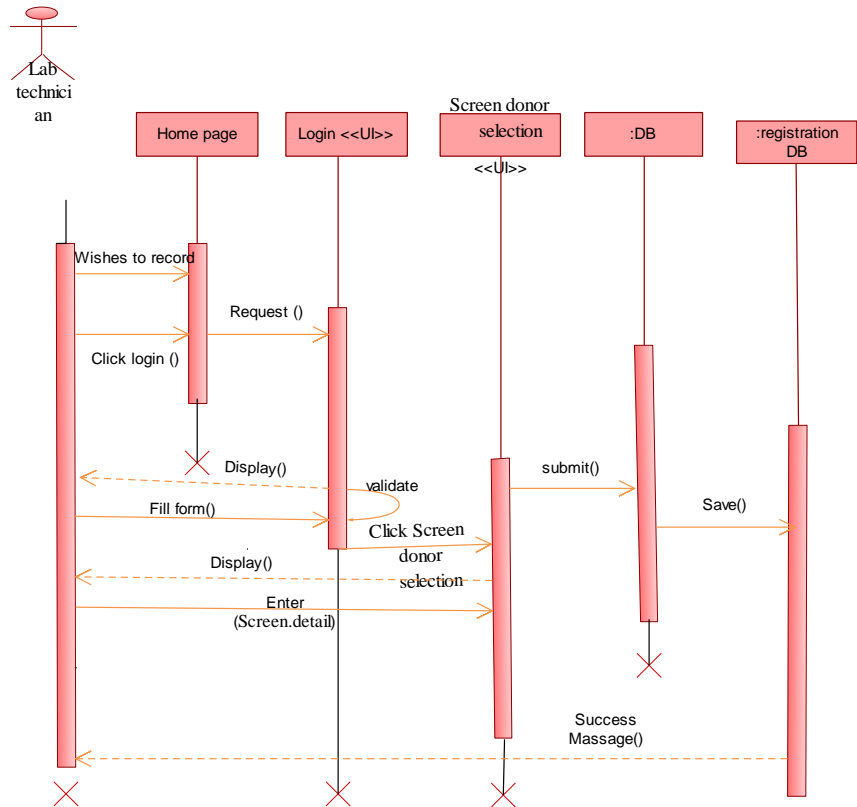


Fig.28 screen donor sequence diagram

Tissue collection detail
Basic Course of Action
ABUC-08

1. The Lab technician want to collect the donor cornea from anywhere to have a diseased information
 2. The logs into the system using "EBUC-02: Login";
 3. The system displays the main Window "EBUI-01: Main Menu";
 4. The Lab technician selects "Tissue collection detail" from the Main Menu;
 5. The system displays the Tissue collection detail interface "EBUI-08: Tissue Collection Detail";
 6. Lab technician enters tissue collection detail;
 7. lab technician clicks on **Save** button;
 8. The system save Tissue collection detail information on the database and make the form ready for the next Tissue collection detail information;
- Use case ends

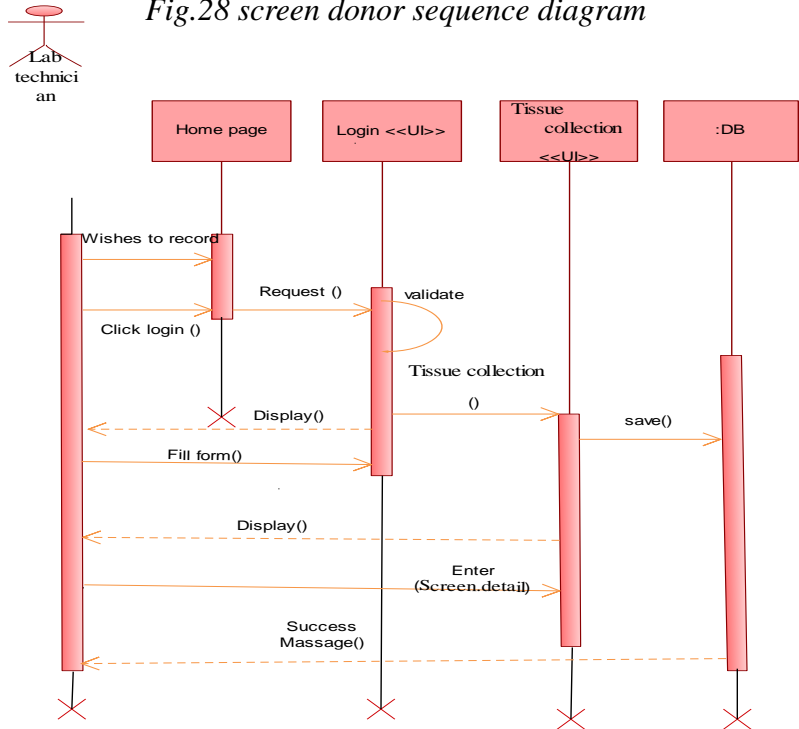


Fig.29 Tissue collection sequence diagram

Serological Test
Basic Course of Action
ABUC-09

1. The Lab technician want to test sample blood take from the donor;
2. The logs into the system using “EBUC-02: Login”;
3. The system displays the main Window “EBUI-01: Main Menu”;
4. The Lab technician selects “Serological Test” from the Main Menu;
5. The system displays the Serological Test interface “EBUI-09: Serological Test”;
6. Lab technician enters serological test result;
7. Lab technician clicks on **Submit** button;
8. The system save sample test information on the database and make the form ready for the next sample test information;
9. Use case ends.

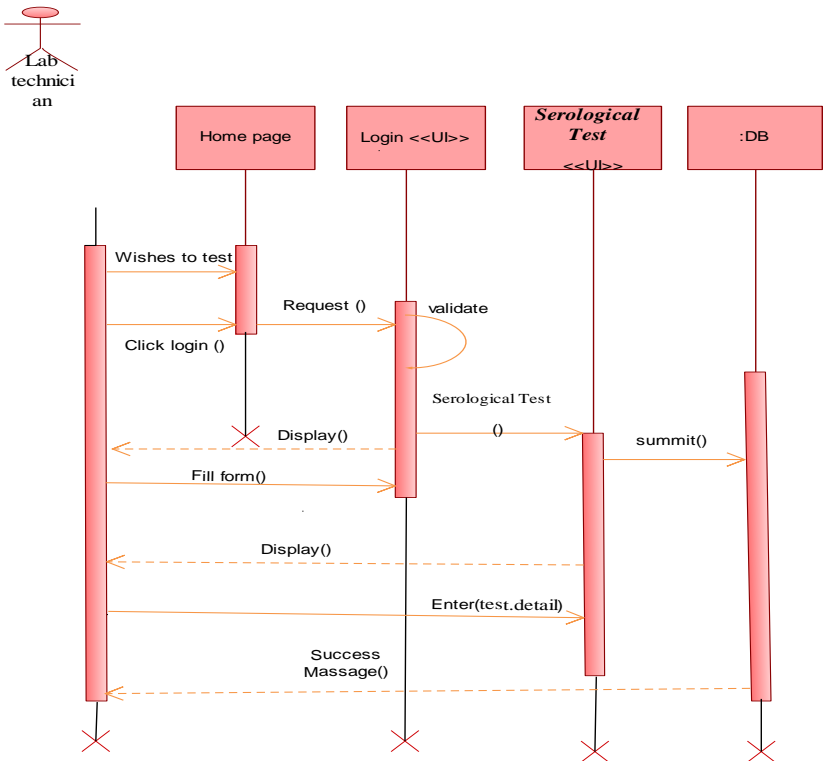


Fig.30 serology test sequence diagram

Evaluate Cornea Tissue
Basic Course of Action
ABUC-11

1. The user want to evaluate Cornea tissue from the stoke;
2. The logs into the system using “EBUC-02: Login”;
3. The system displays the main Window “EBUI-01: Main Menu”;
4. The user selects “Cornea Evaluating” from the Main Menu;
5. The system displays the Cornea Tissue Discard interface “EBUI-12: Cornea Evaluating”;
6. The user enters all available donor information details;
7. The user click **Save** button;
8. The system save don or information detail on the database and make the form ready for the next donor information;
9. The use case ends

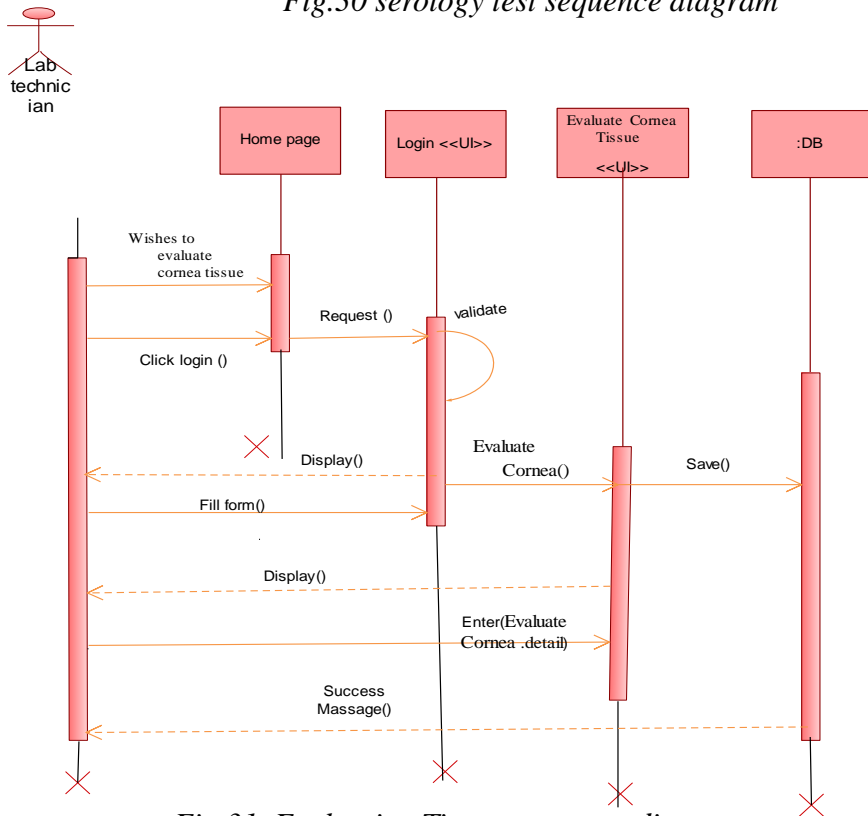


Fig.31 Evaluation Tissue sequence diagram

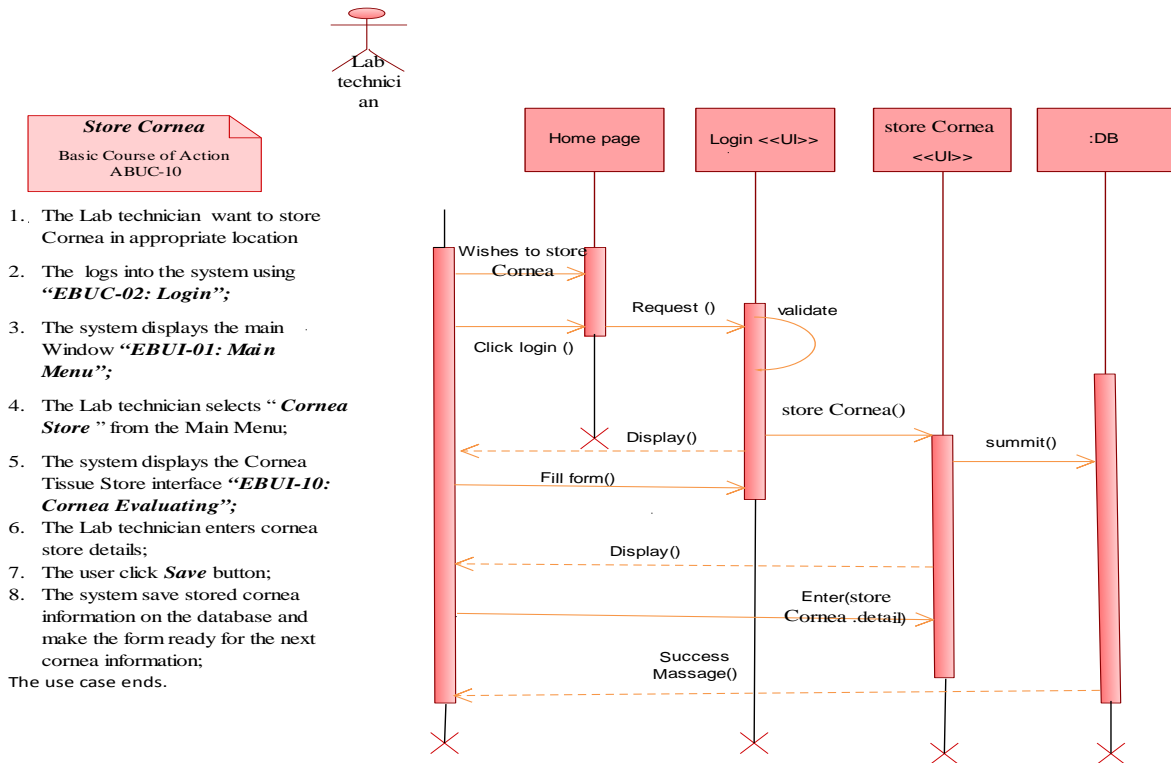


Fig.32 Store Tissue sequence diagram

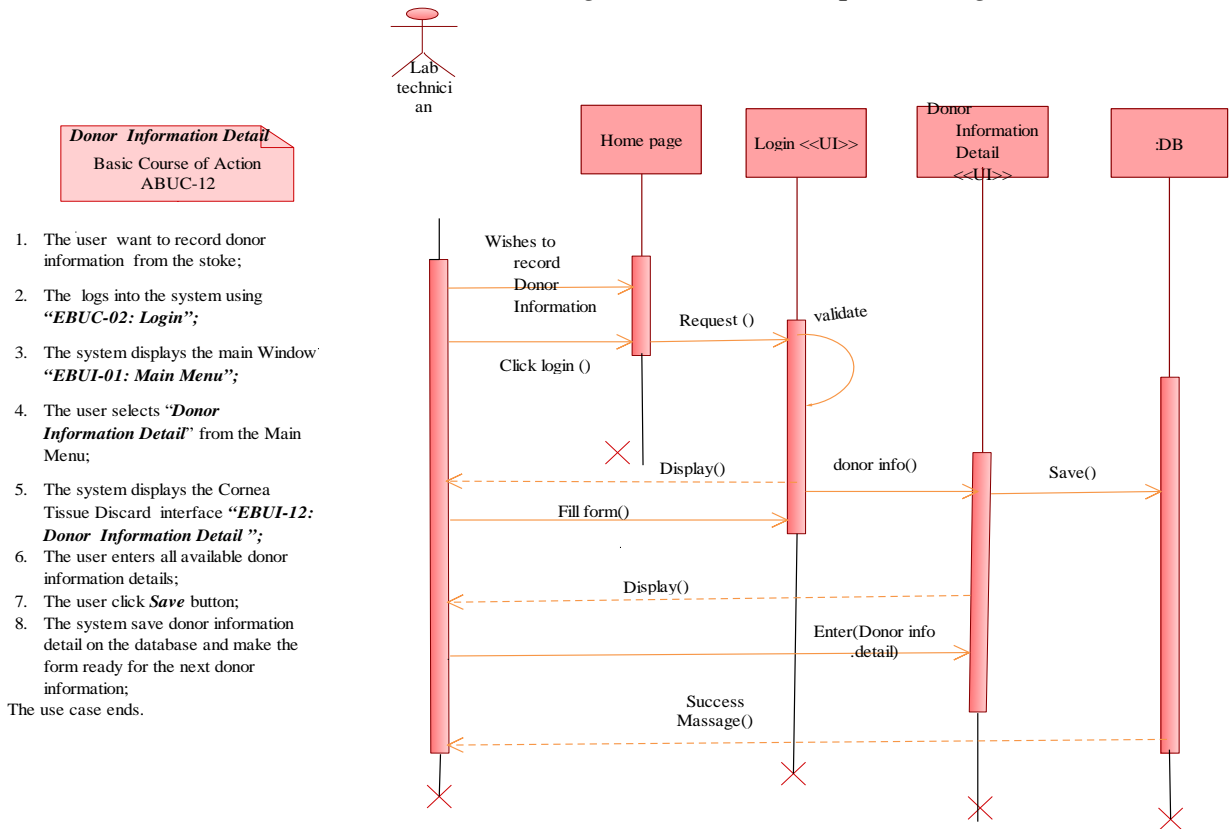


Fig.33 donor information sequence diagram

- Discard Cornea**
Basic Course of Action
ABUC-13
1. The user want to discard Cornea tissue from the stoke;
 2. The logs into the system using "EBUC-02: Login";
 3. The system displays the main Window "EBUI-01: Main Menu";
 4. The user selects "Cornea Tissue Discard" from the Main Menu;
 5. The system displays the Cornea Tissue Discard interface "EBUI-13: Cornea Tissue discard";
 6. The users enters discarded cornea details;
 7. The users click *Save* button;
 8. The system save discarded cornea details on the database and make the form ready for the next record;
 9. Use case ends.

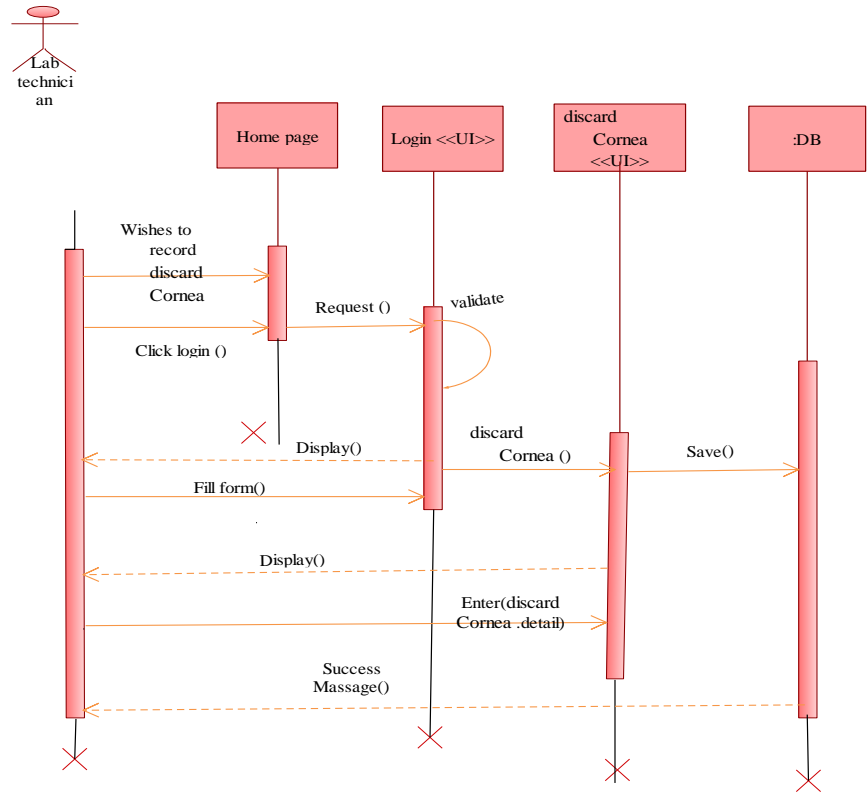


Fig.34 discard Tissue sequence diagram

- Cornea Tissue Request**
Basic Course of Action
ABUC-14
1. The Surgeon want to request Cornea tissue to the cornea patient ;
 2. The logs into the system using "EBUC-02: Login";
 3. The system displays the main Window "EBUI-01: Main Menu";
 4. The Surgeon selects "Cornea Tissue Request " from the Main Menu;
 5. The system displays the Cornea Tissue request interface "EBUI-14: Cornea Tissue request";
 6. The surgeon enters Cornea request details;
 7. The surgeon clicks send button;
 8. The system saves cornea request information on the database;
 9. The use case ends.

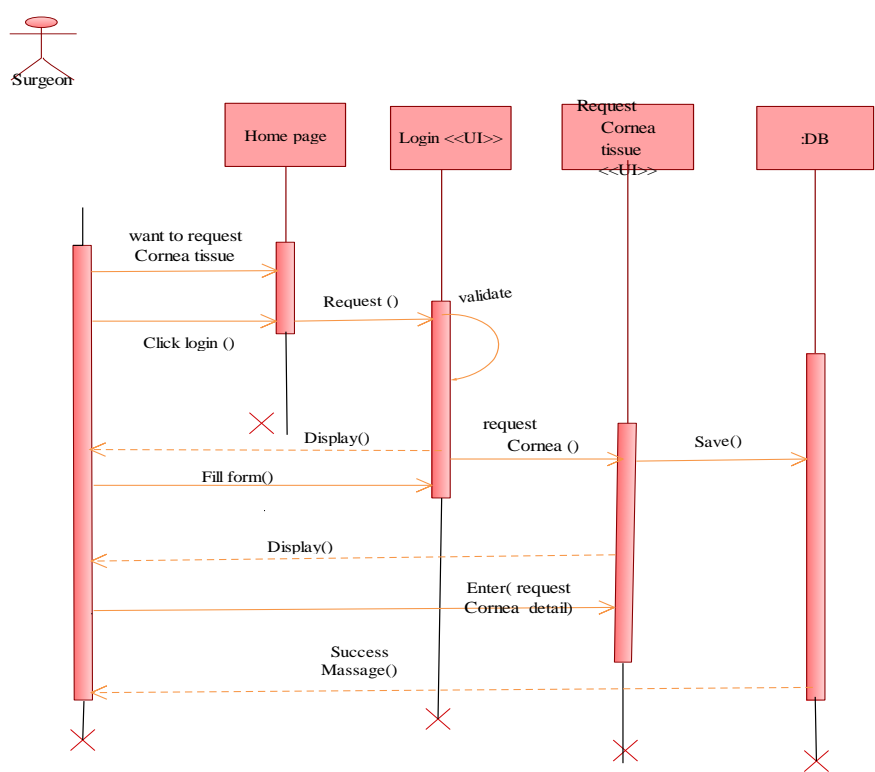


Fig.35 Request Tissue sequence diagram

Cornea Tissue Distribution
Basic Course of Action
ABUC-15

1. The user want to distribute cornea tissue to dedicated surgeon;
2. The logs into the system using "EBUC-02: Login";
3. The system displays the main Window "EBUI-01: Main Menu";
4. The user selects "Cornea Tissue Distribution" from the Main Menu;
5. The system displays the follow up interface "EBUI-15: Cornea Tissue Distribution";
6. The users enter cornea tissue distribution details;
7. The users click **save** button;
8. The system saves cornea tissue distribution information on the database;
9. The use case ends.

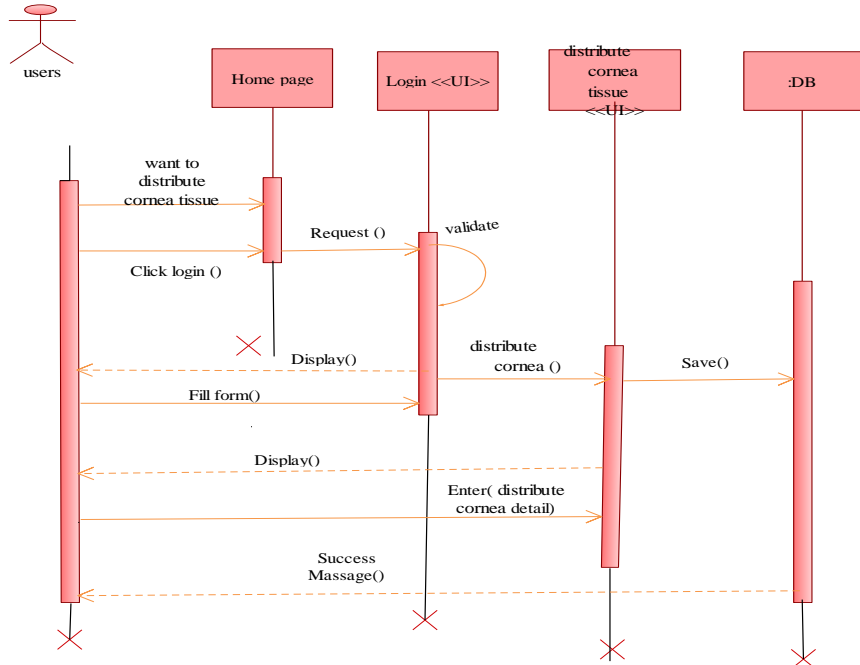


Fig.36 Distribution Tissue sequence diagram

Fail Cornea Tissue
Basic Course of Action
ABUC-16

1. The Surgeon want to send fail Cornea tissue at the time of surgery;
2. The logs into the system using "EBUI-02: Login";
3. The system displays the main Window "EBUI-01: Main Menu";
4. The Surgeon selects "Fail Cornea Tissue" from the Main Menu;
5. The system displays the fail Cornea Tissue interface "EBUI-16: Fail Cornea Tissue";
6. The users enter cornea tissue fail details;
7. The users click **save** button;
8. The system saves cornea tissue fail information on the database;
9. The use case ends.

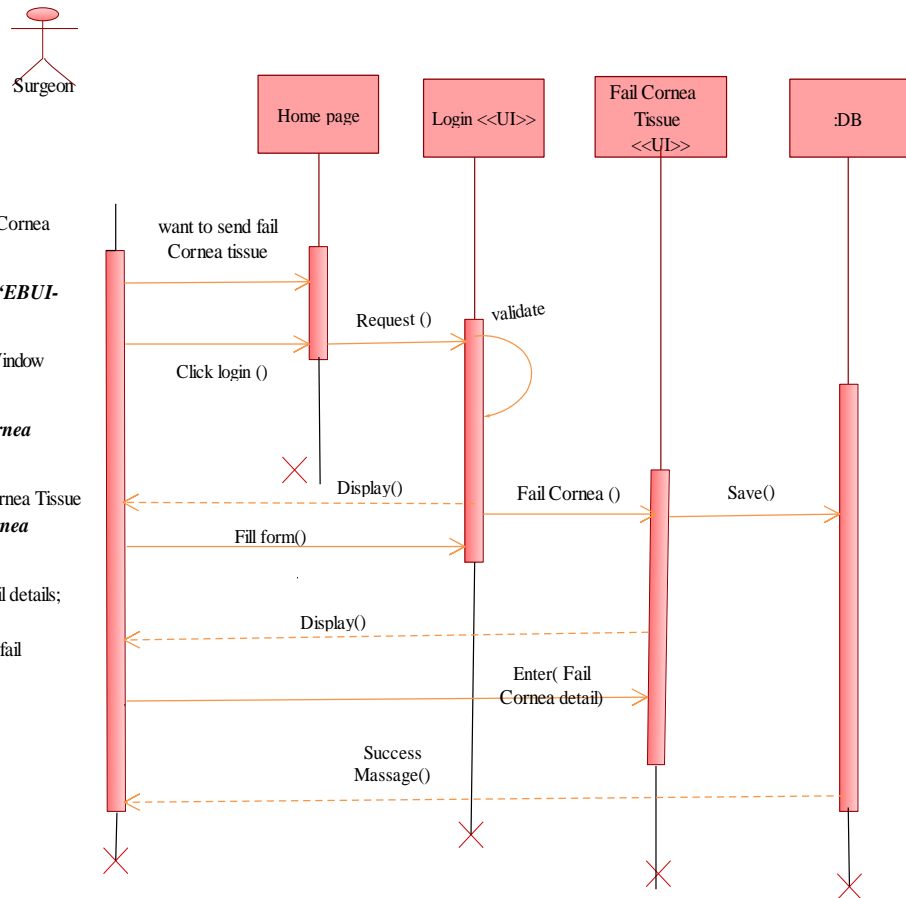


Fig.37 recipient data sequence diagram

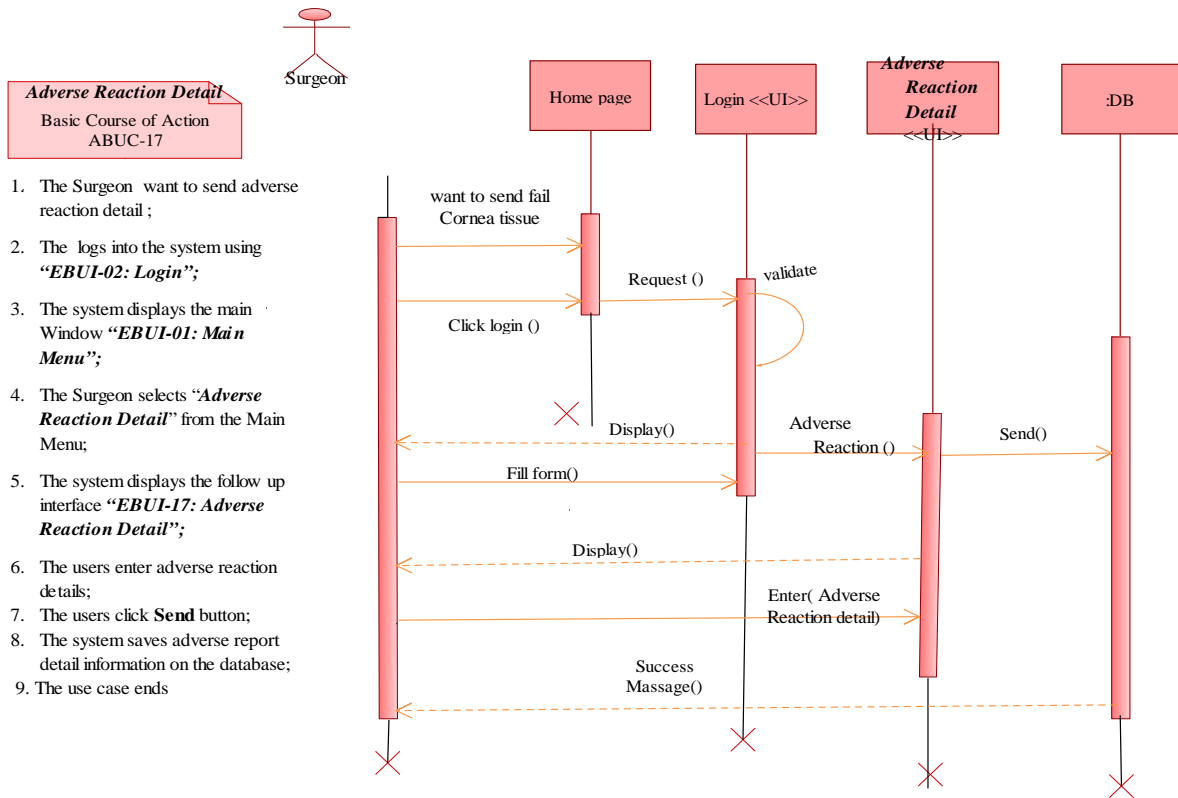


Fig.38 Adverse reaction sequence diagram

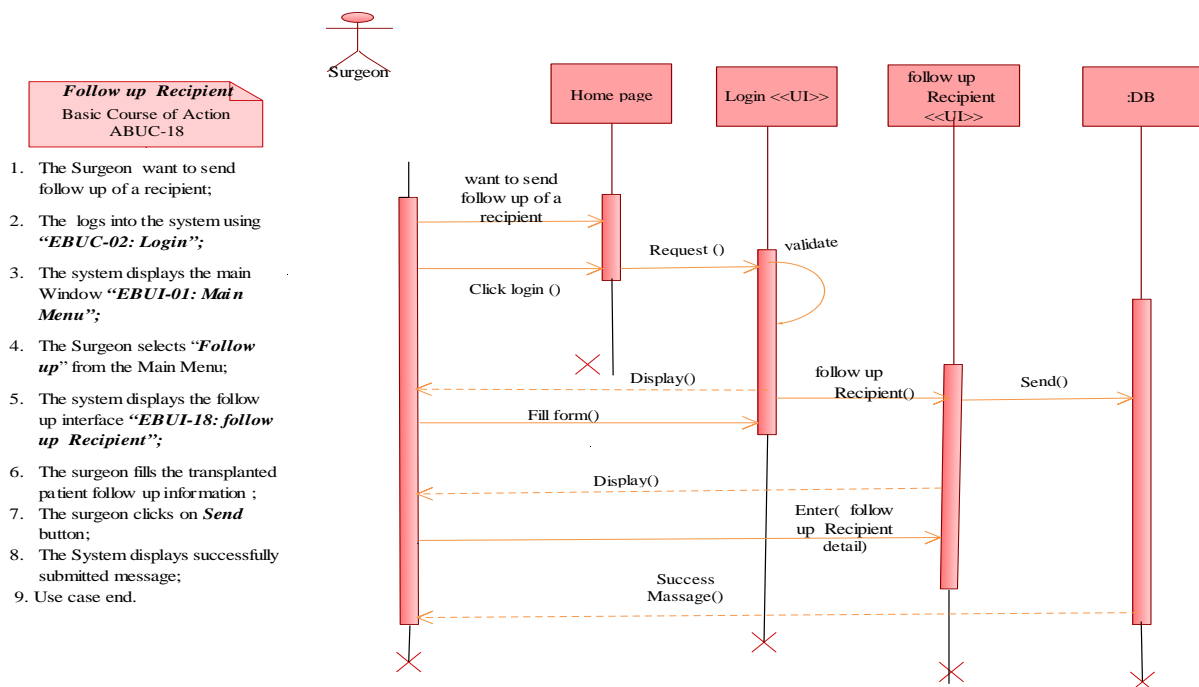


Fig.39 Follow up recipient data sequence

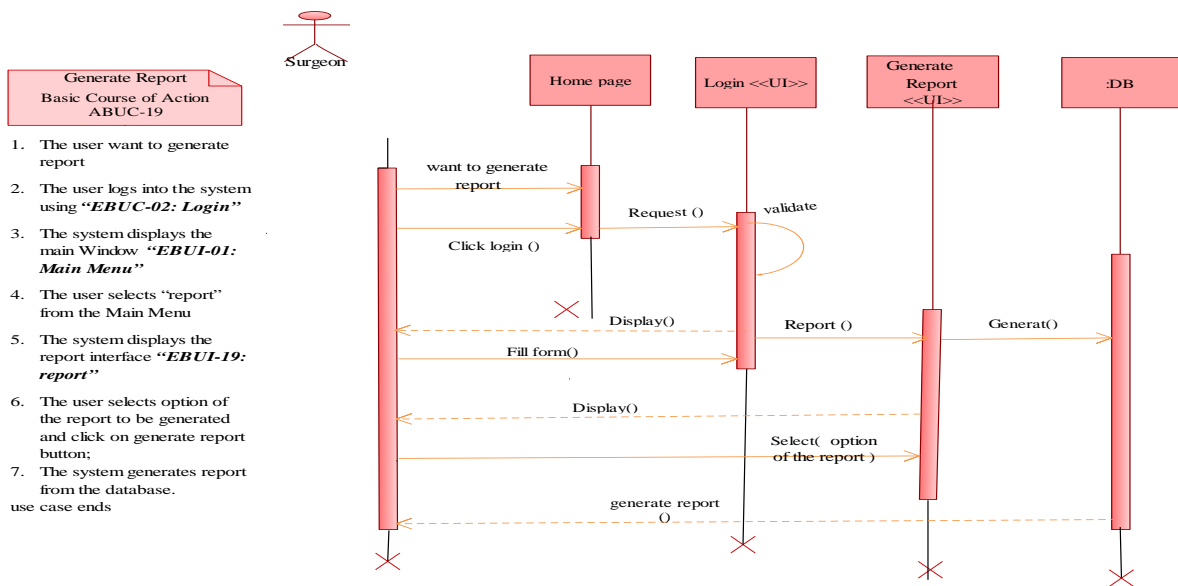


Fig.40 generate report sequence diagram

5.5. Class modeling

Object-oriented methodologies work to discover classes, attributes, methods, and relationships between classes. Because programming occurs at the class level, defining classes is one of the most important object-oriented analysis tasks. Class diagrams show the static features of the system and do not represent any particular processing. A class diagram also shows the nature of the relationships between classes. Classes are represented by a rectangle on a class diagram. In the simplest format, the rectangle may include only the class name, but may also include the attributes and methods. Attributes are what the class knows about characteristics of the objects, and methods (also called operations) are what the class knows about how to do things. Methods are small sections of code that work with the attributes (44).

Class model shows the classes of the system, their interrelationships (including, inheritance, aggregation and association), and the operation and attributes of the class. A class is a representation of an object. To describe a class we define its attributes and methods. Attributes are the information stored about an object while methods are what the object or the class does.

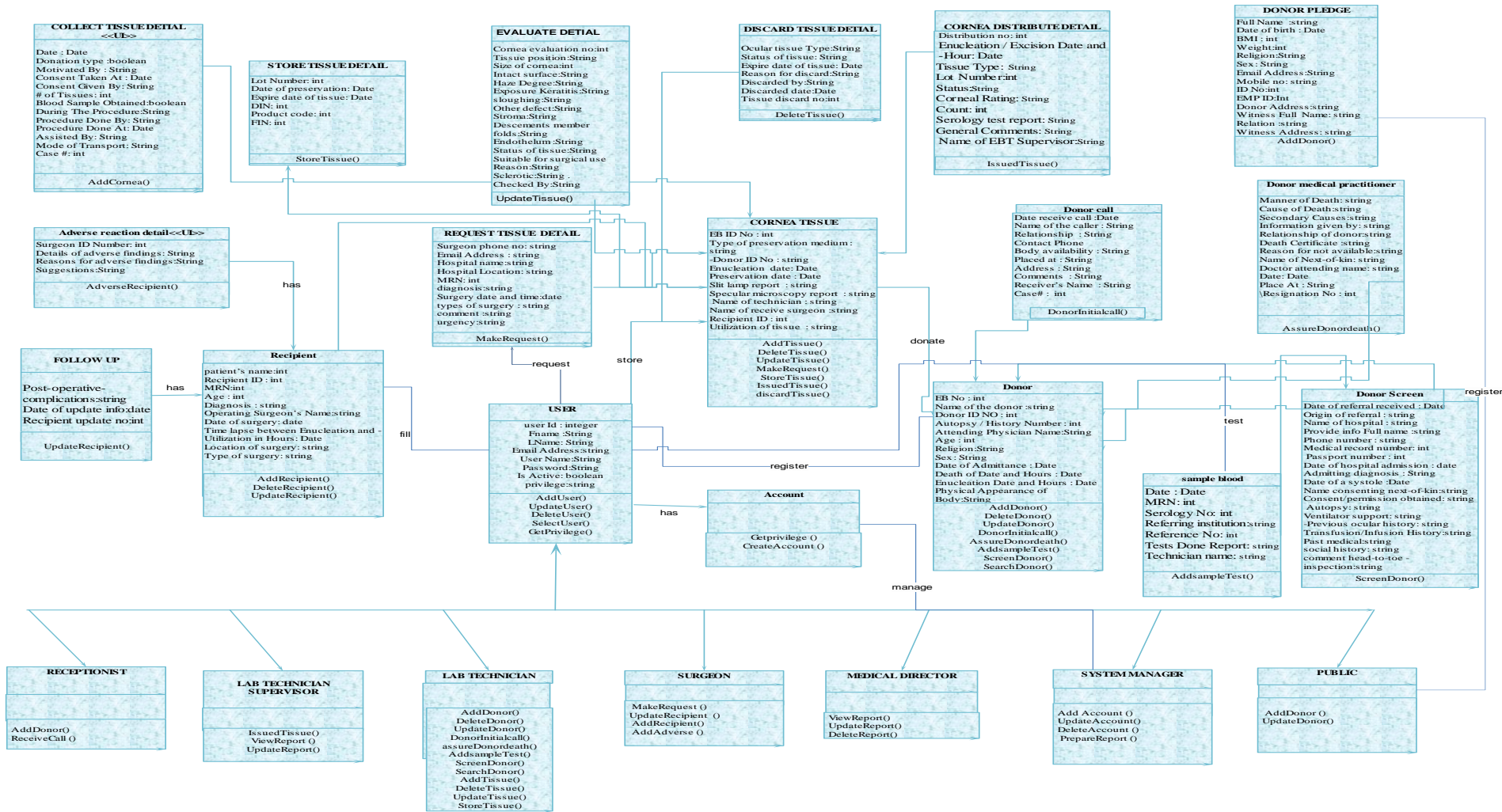
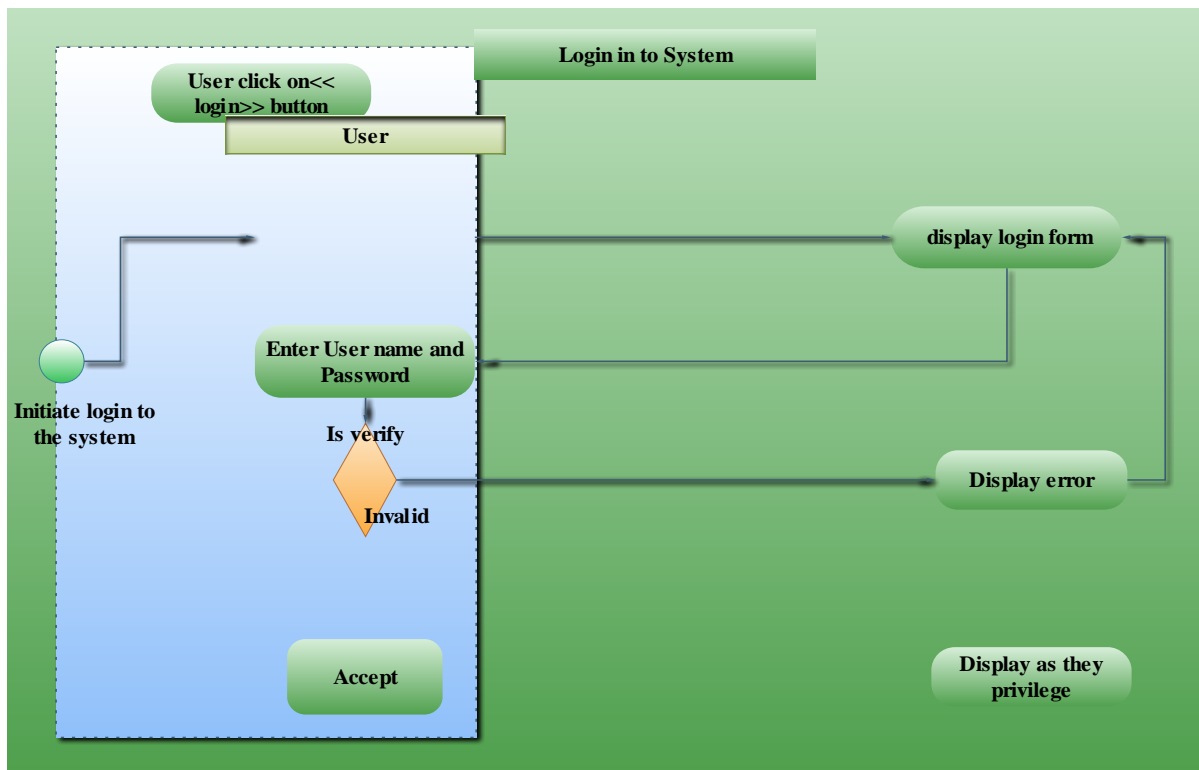
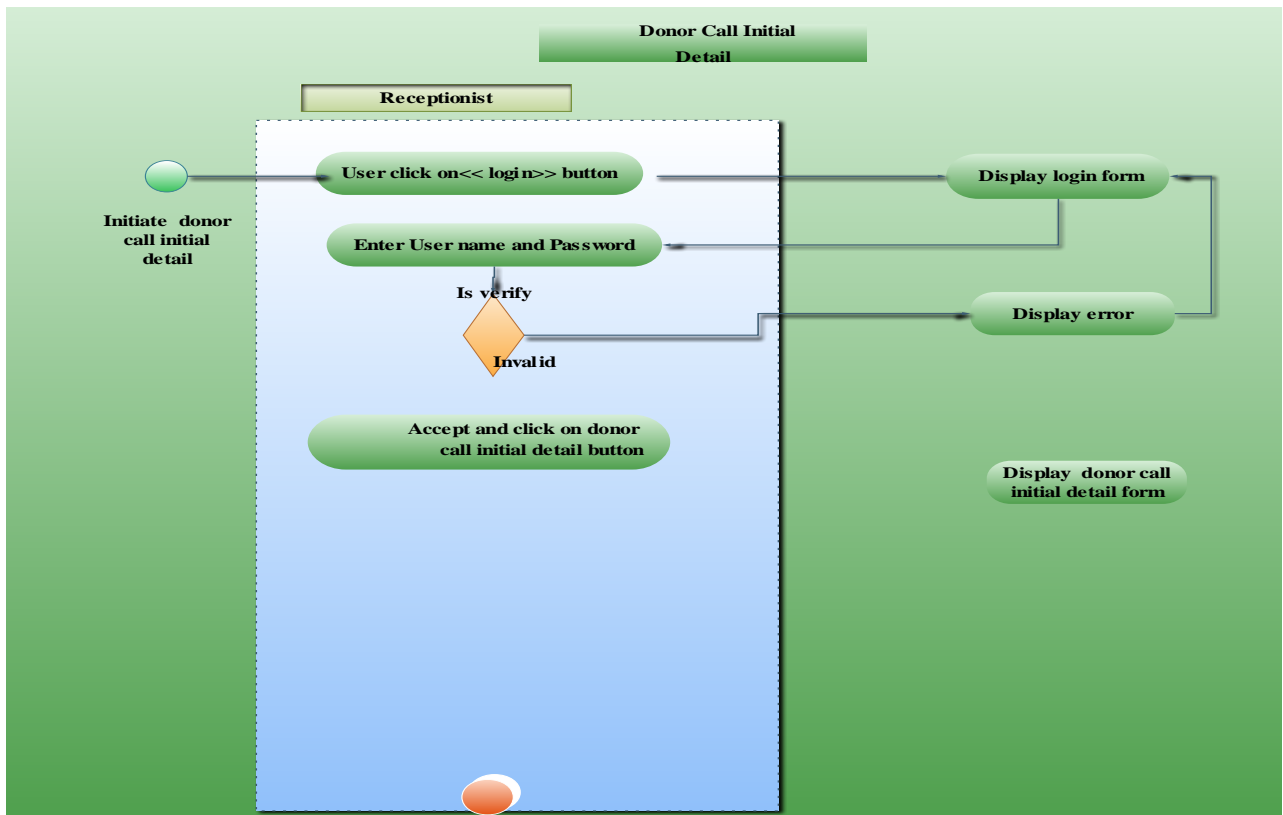
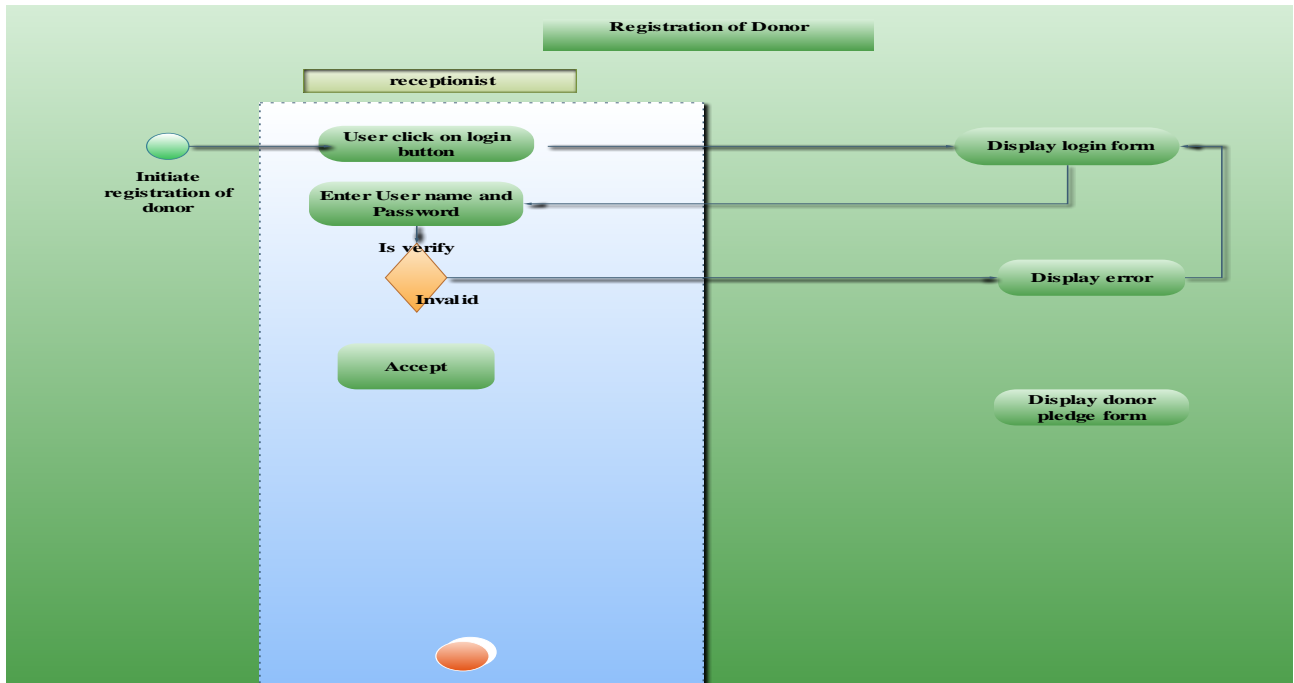


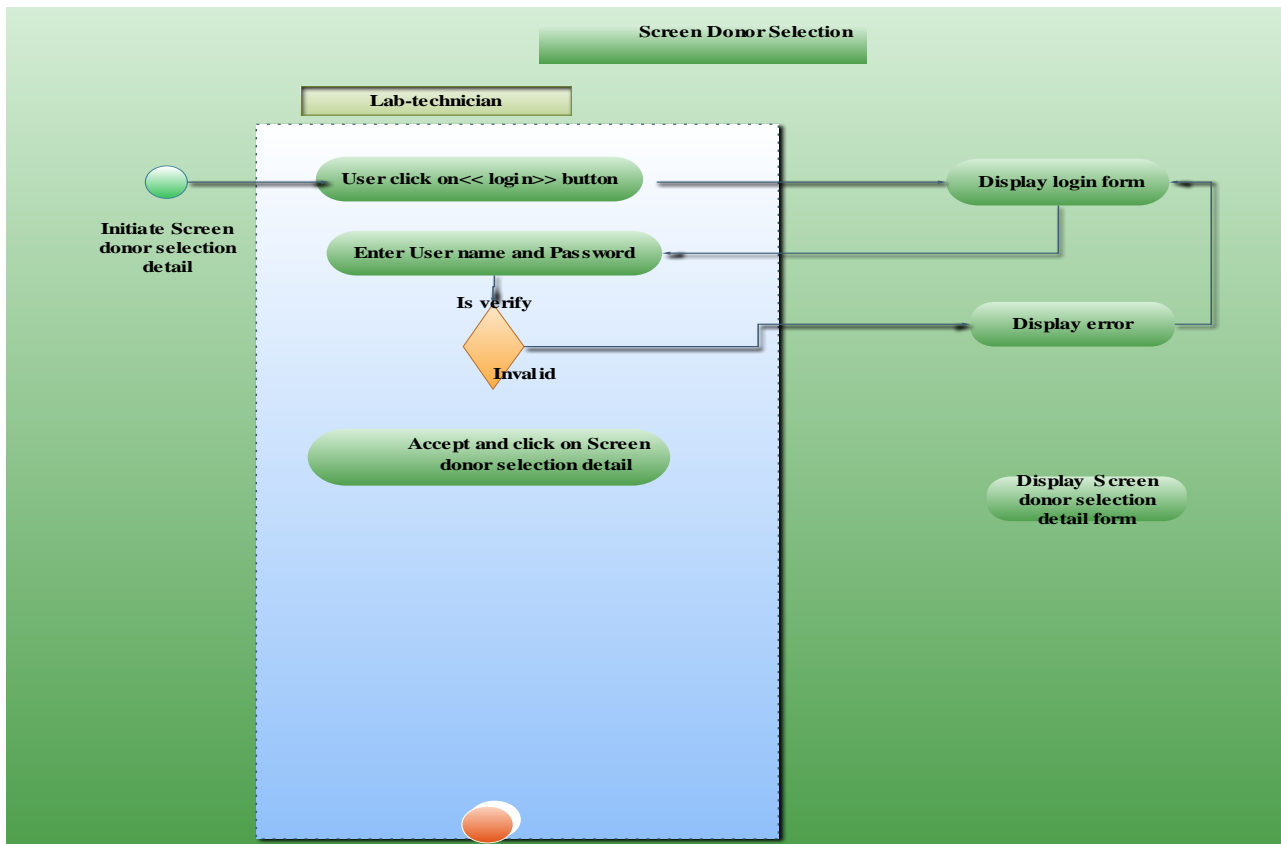
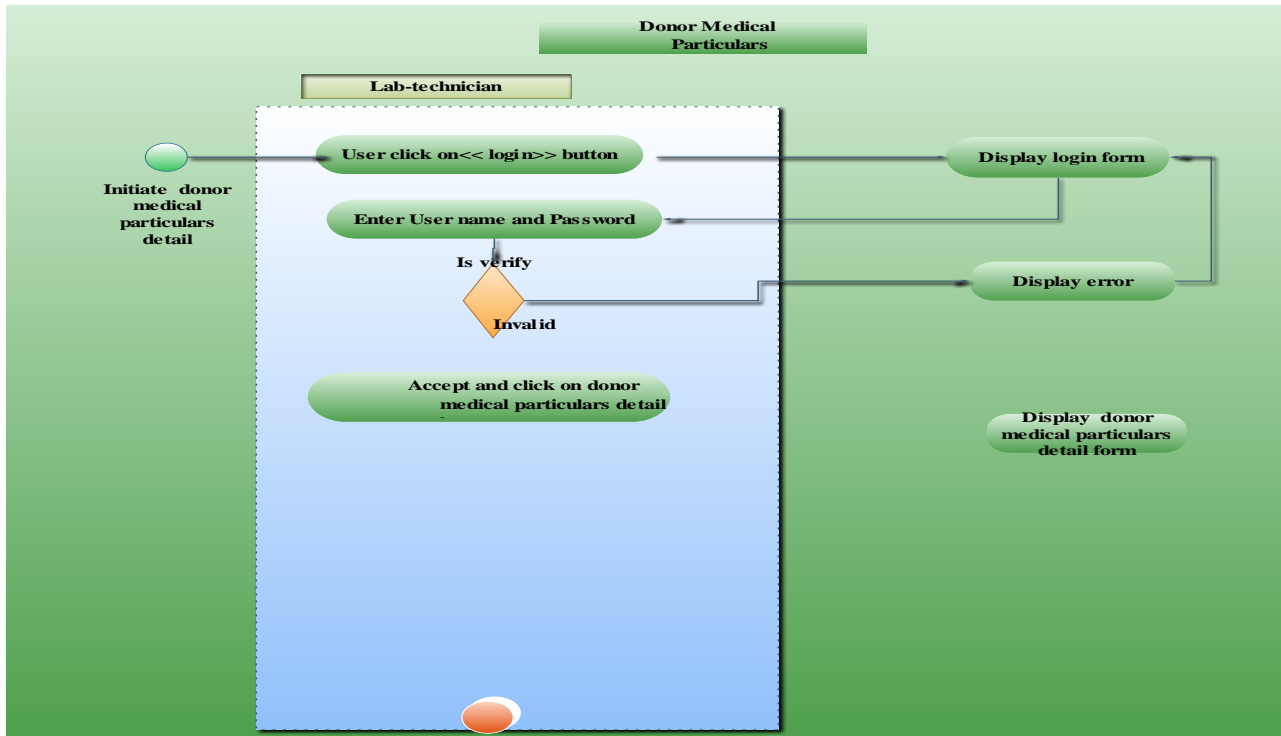
Fig.42 Refined level class diagram

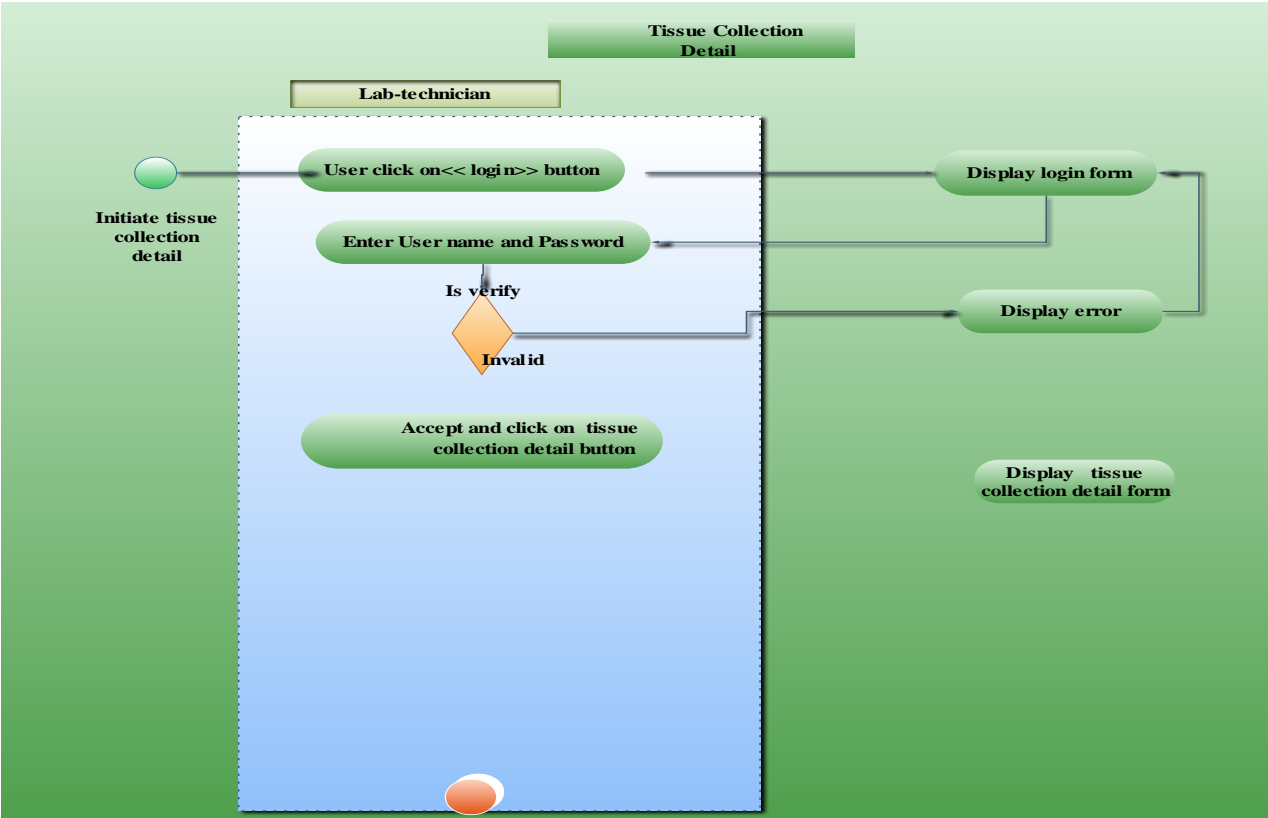
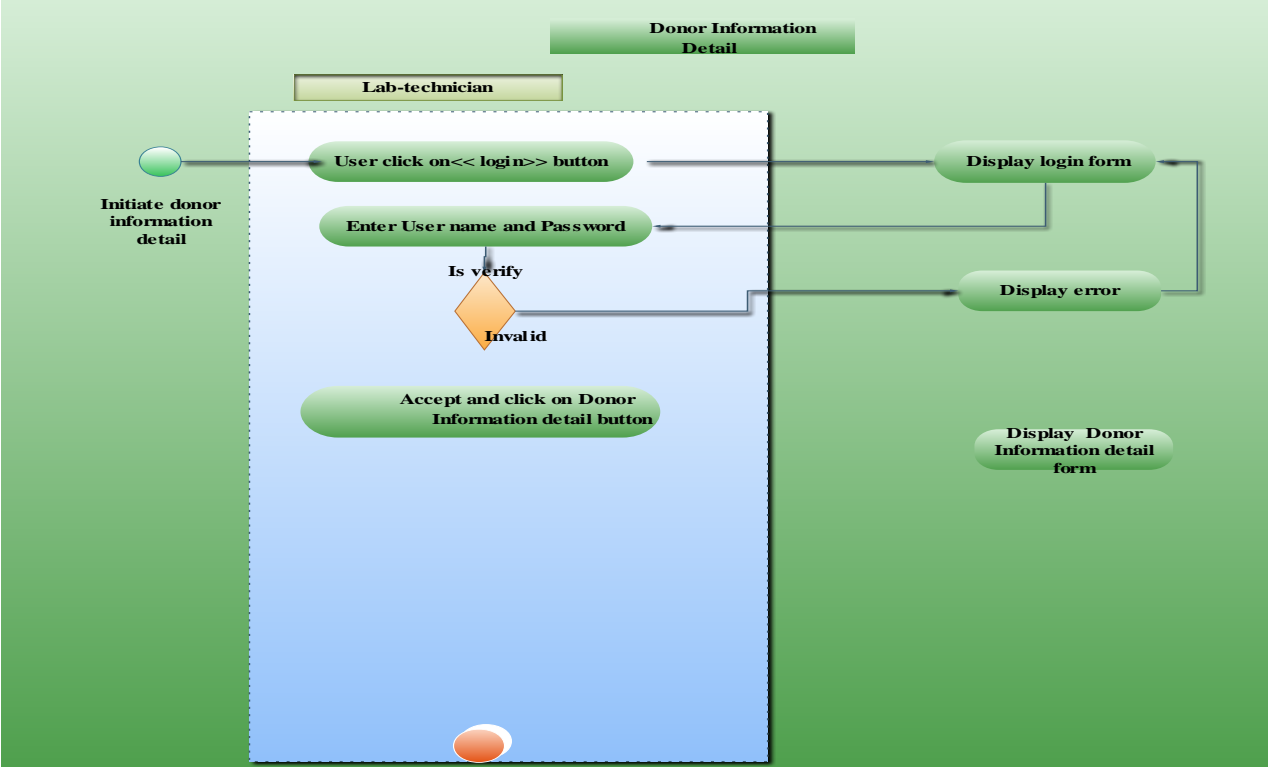
5.6. Activity Diagram

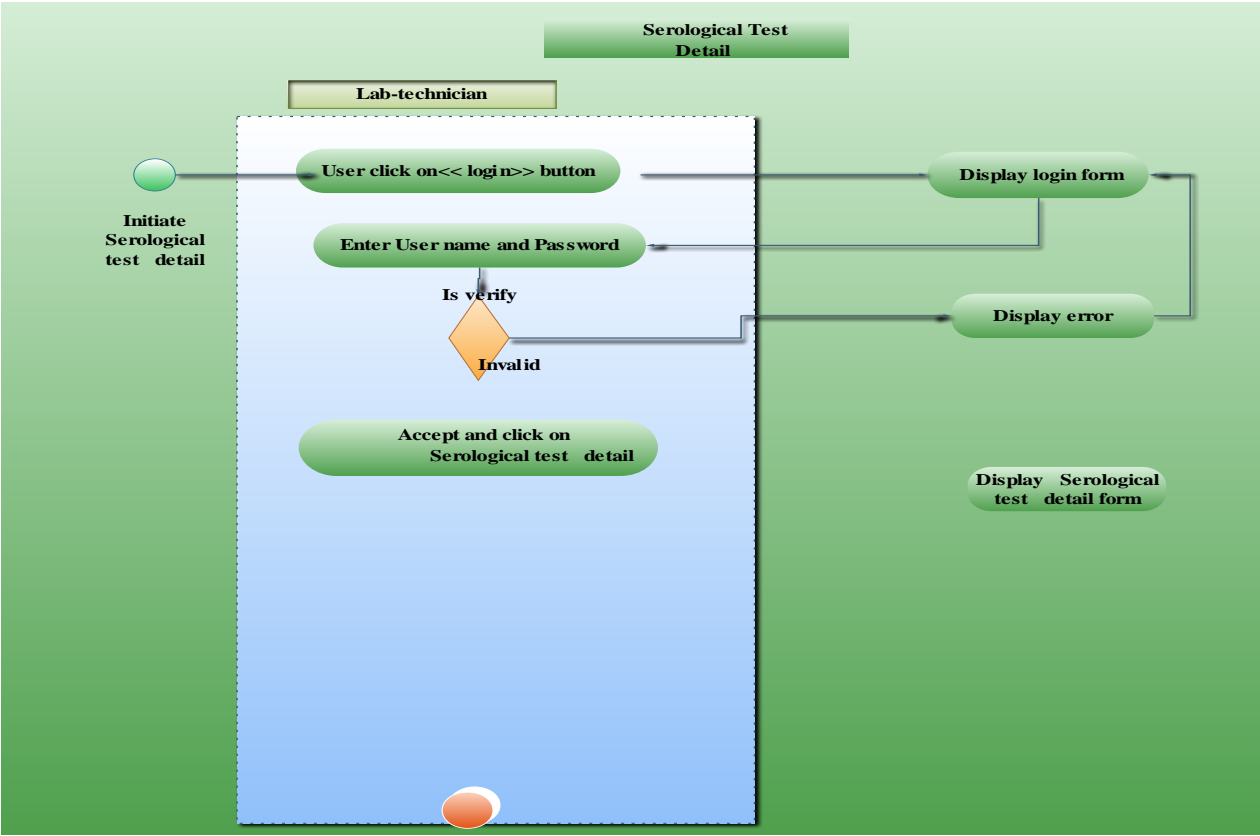
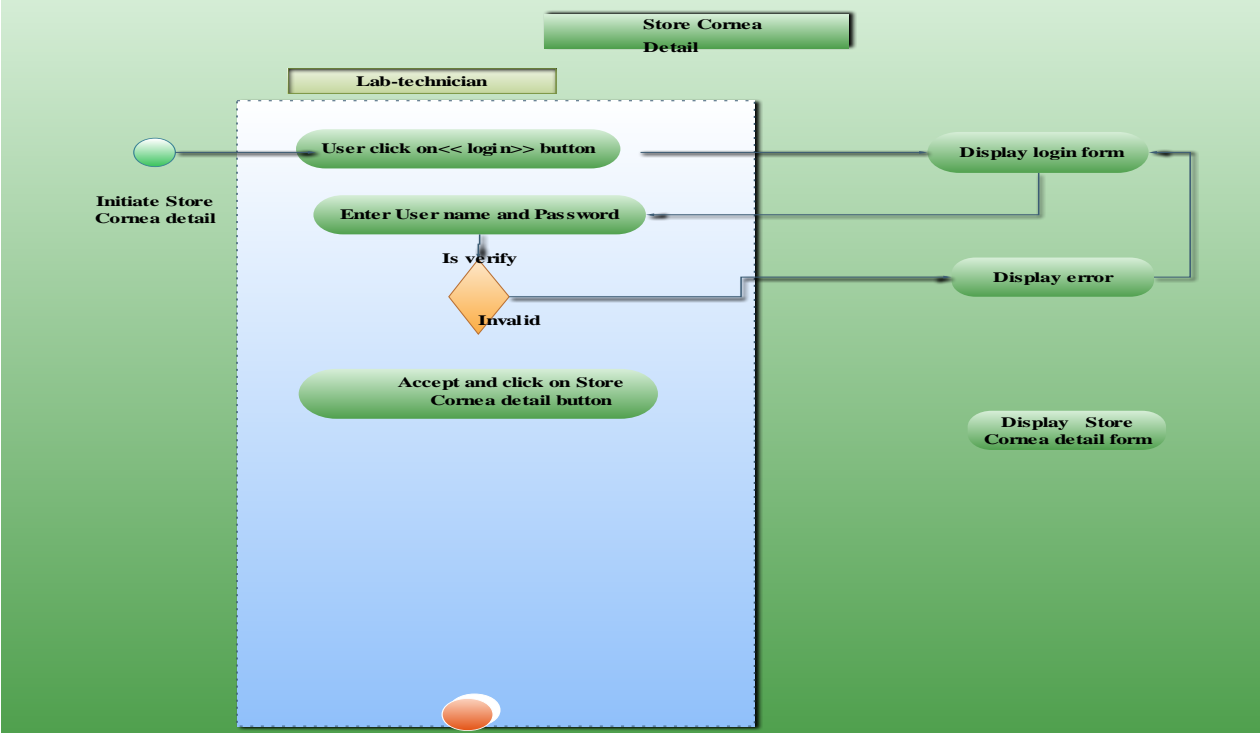
Activity diagram is basically a flow chart to represent the flow from one activity to another activity. The activity can be described as an operation of the system. So the control flow is drawn from one operation to another. This flow can be sequential, branched or concurrent. Activity diagrams deal with all types of flow control by using different elements like fork, join etc. The focus of activity modeling is the sequence and conditions for coordinating lower-level behaviors, rather than which classifiers own those behaviors. These are commonly called control flow and object flow models. The behaviors coordinated by these models can be initiated because other behaviors finish executing, because objects and data become available, or because events occur external to the flow (45).

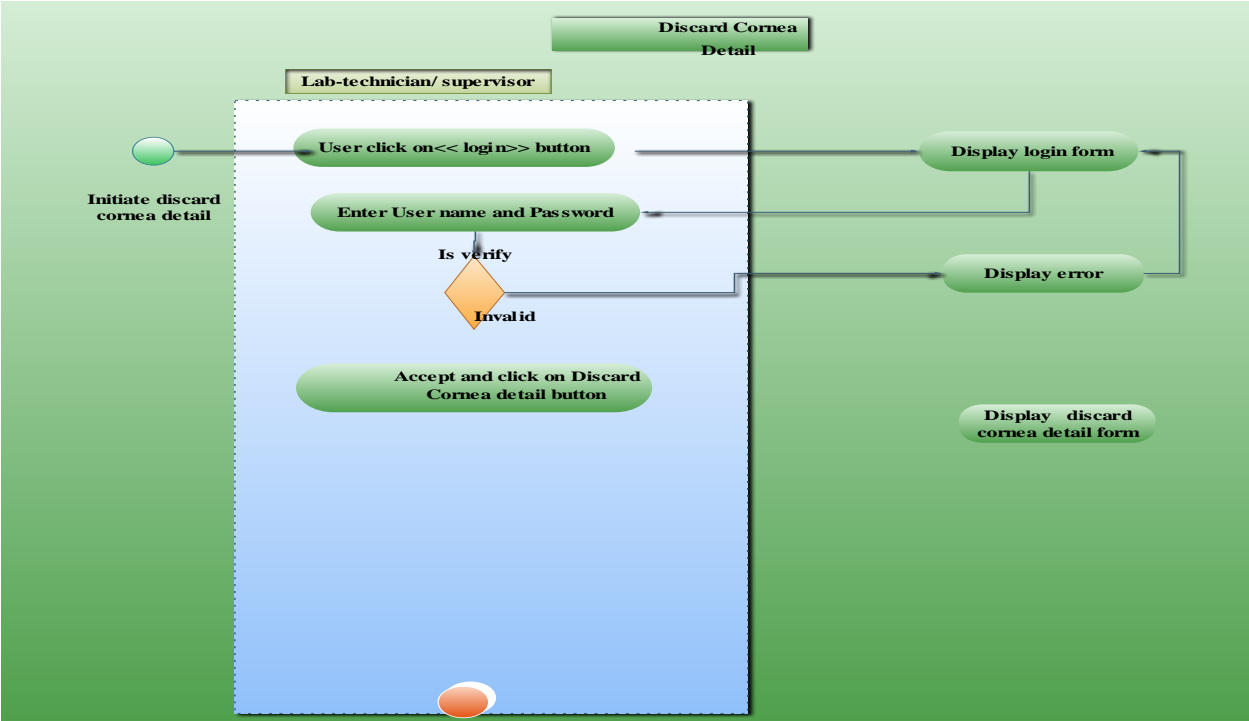
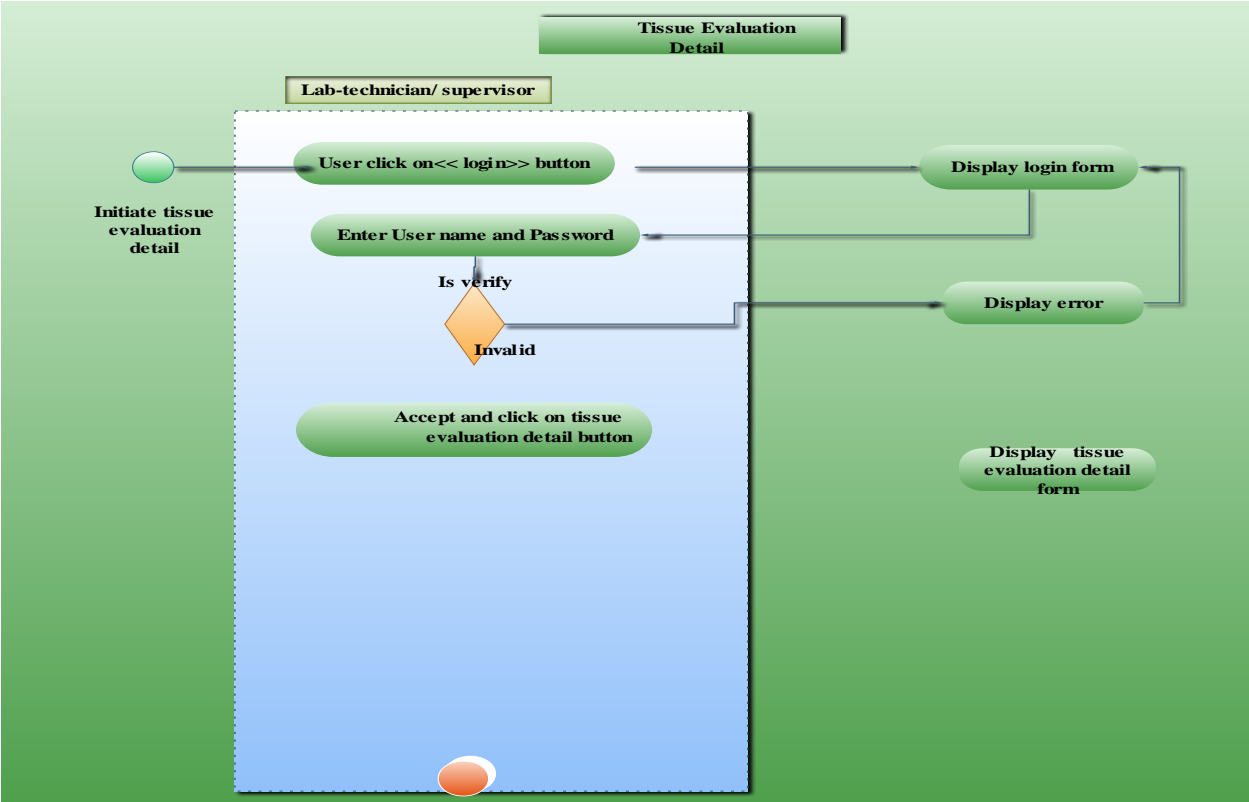


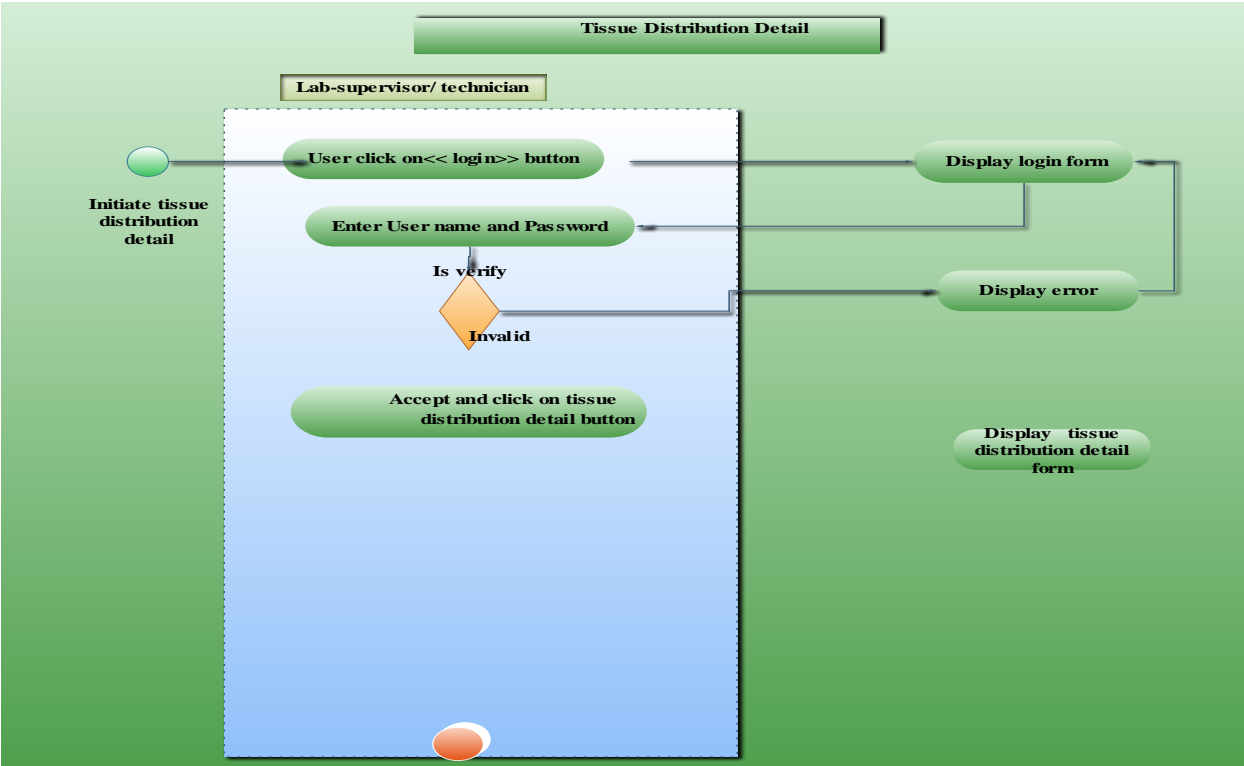
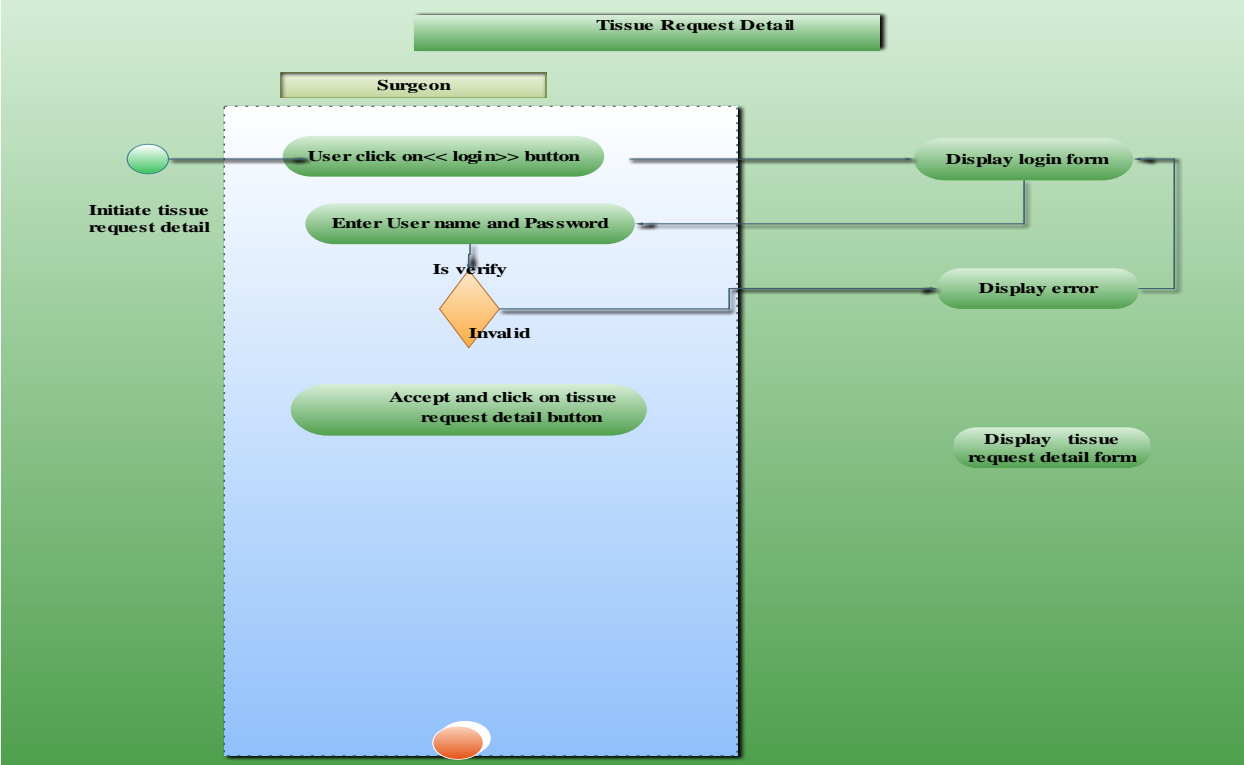


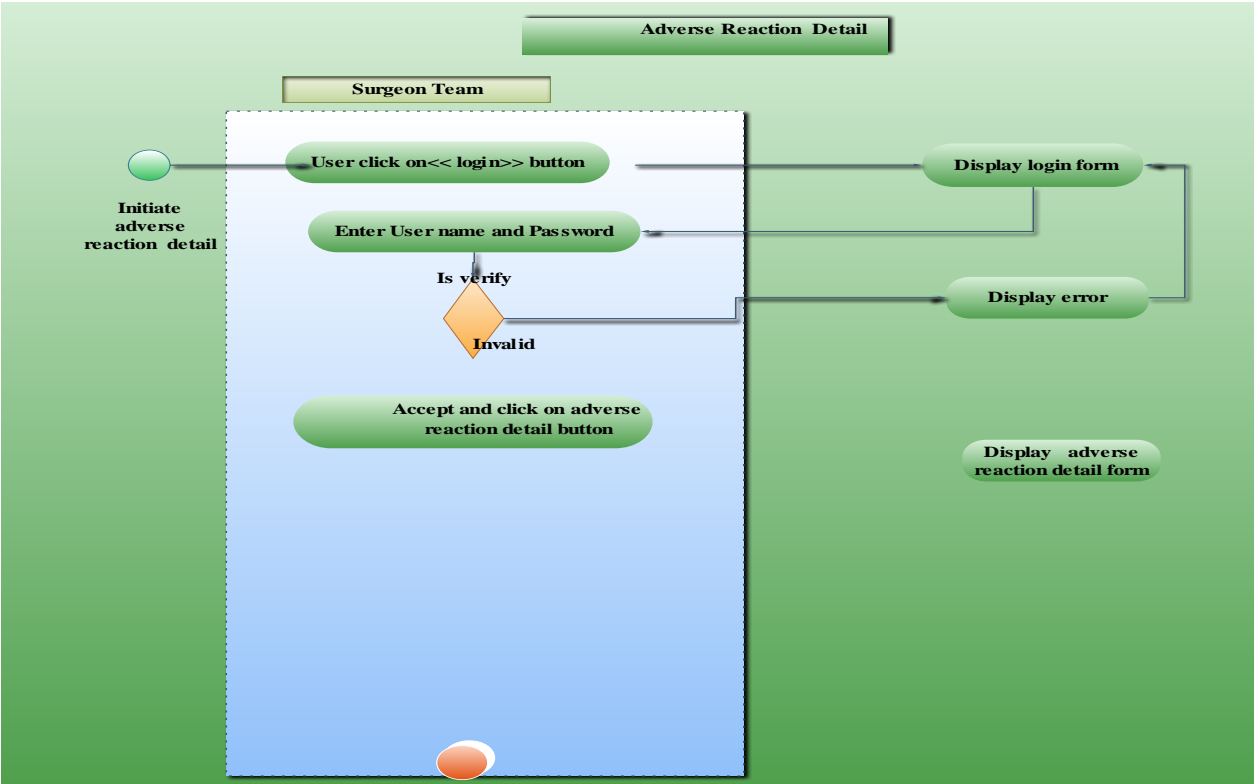
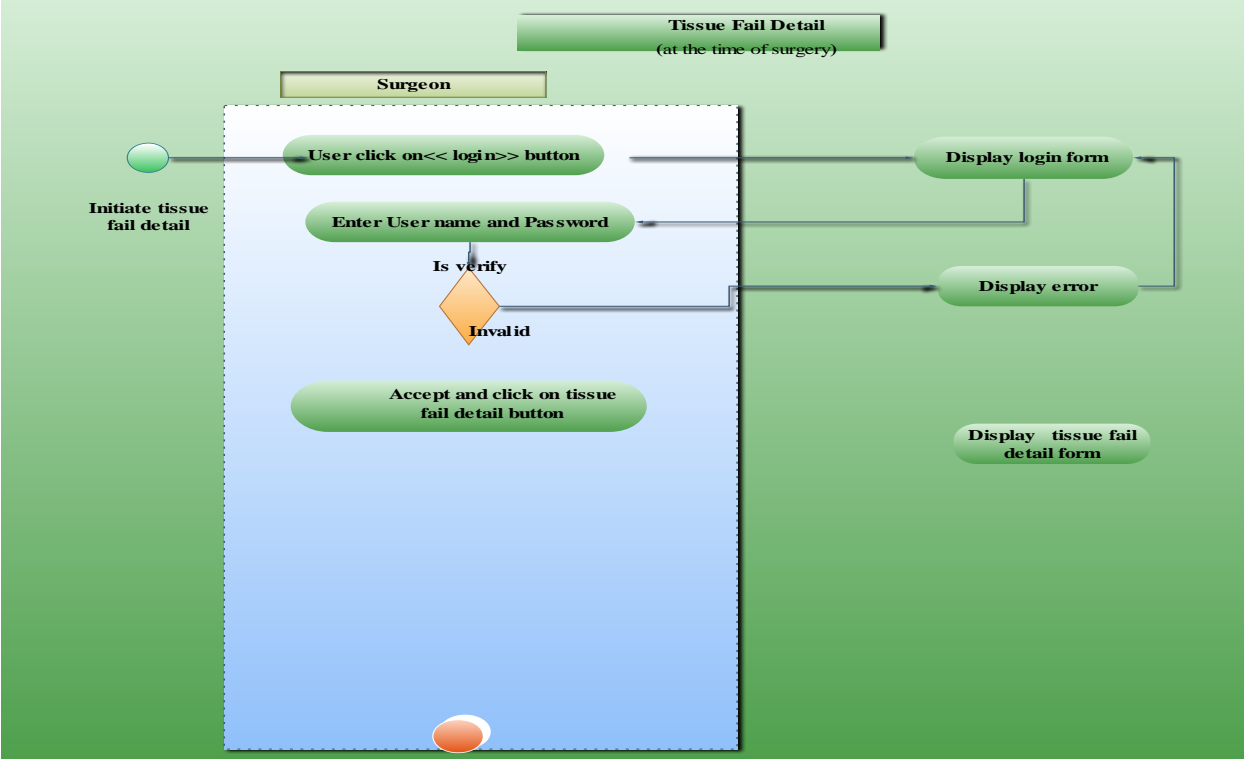












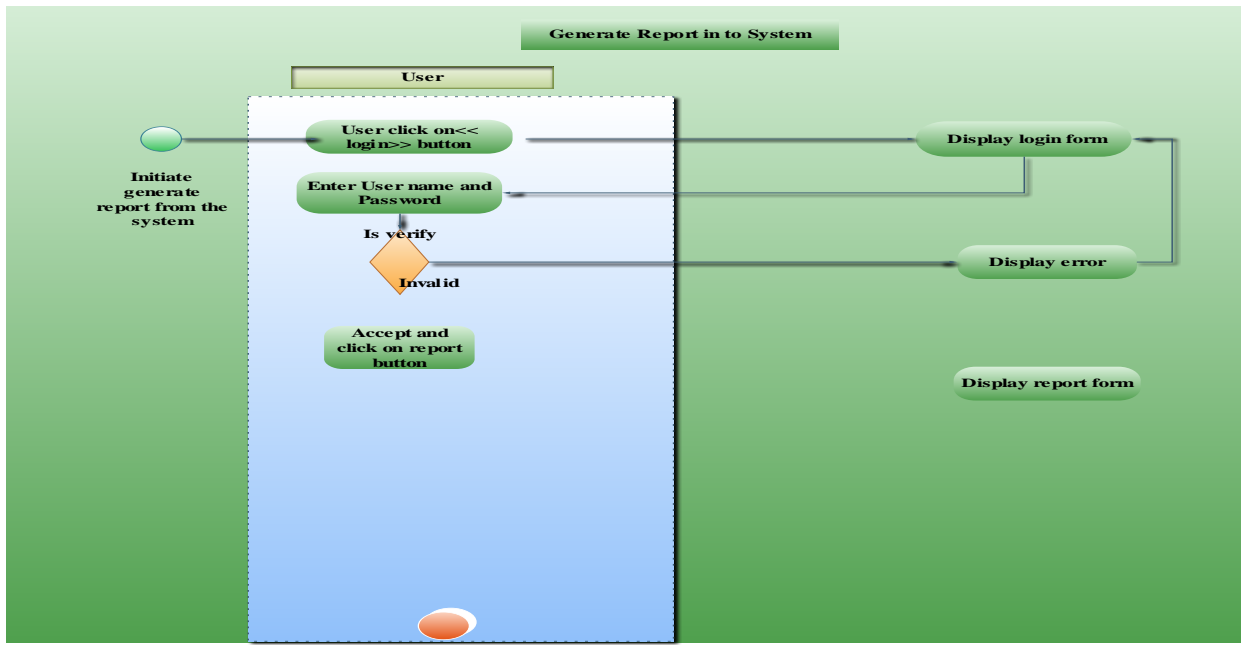
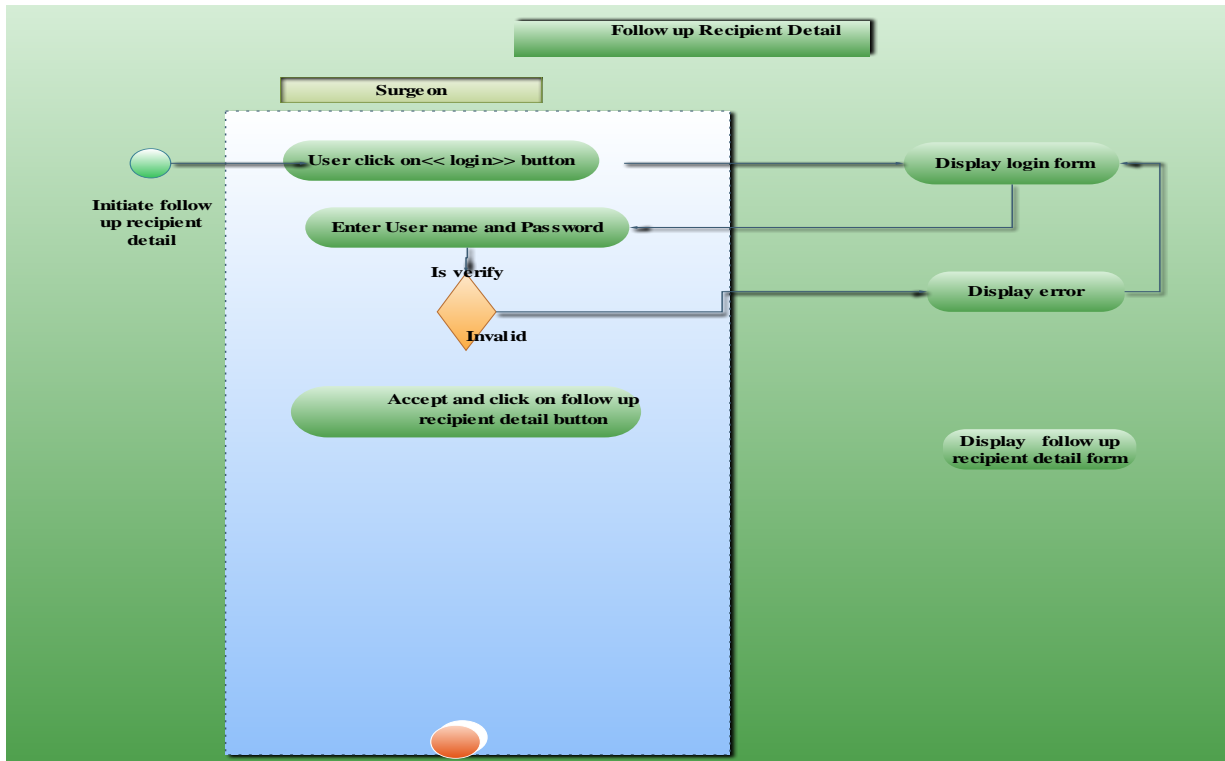


Fig. 43 activity diagrams of EBIMS

CHAPTER SIX

OBJECT ORIENTED SYSTEM DESIGN

6.1. Introduction

Object-Oriented Design (OOD) builds on the results from the analysis stage. Now I have to address certain (but not all) implementation issues and describe a solution to the problem. That includes decisions about actual classes of the Eye Bank and their properties. I have to define actual attributes to describe what the objects of a class know and I have to define actual methods to describe the behaviors of our objects in an appropriate way. Now I can no longer be completely independent of programming languages. This chapter will focus on how to build the Web-Based Eye Bank information Management System of Ethiopia Eye Bank (WBEBIMS) using the standard design artifacts such as class type architecture, class model, collaboration, persistent, component and deployment diagrams .This phase deals with the solution portion of the project.

6.2. Class Type Architecture

The class type architecture provides a strategy for layering the classes of our software to distribute the functionality of my system among classes. Layering is the concept of organizing my software design into layers/collection of classes or components that fulfill a common purpose, such as implementing my user interface or the business logic of my system. This architecture depicts the interactions between classes (47). This OWBHDMS uses the five layered class architecture in the design of object oriented software. The five layers of classes are UI Classes layer, Controller/Process Classes layer, Business/Domain Classes layer, Persistence Classes Layer, and the System classes' layer. The interaction architecture is shown below in Figure 6.1. But before that the description of each layer of classes is as follows.

6.2.1. User Interface Layer

User interface layer classes contain a code for the user interface part of an application. It implements the major user interface elements of the system (47). Designing the user interfaces for the WBEBIMS involves the following major interfaces which are system login screen, main

menu, donor pledge/registration screen, donor call screen, donor medical particulars screen, donor selection screen, donor information detail screen, tissue collection detail, serological test screen, store cornea screen, tissue evaluation screen, Discard cornea screen, tissue Request screen, tissue distribution screen , tissue fill detail screen, adverse reaction detail screen, follow up of recipient screen and, report generation screen.

6.2.2. Controller/Process Layer

The purpose of a controller/process class is to implement business logic that pertains to several objects, particularly objects that are instances of different classes (47). The Controller classes in the WBEBIMS are Validate login entry, accept donor registration, accept donor call, accept donor medical particulars, accept donor selection, accept donor information detail, accept tissue collection detail, accept serological test, accept store cornea, accept tissue evaluation, accept Discard cornea, accept tissue Request, accept tissue distribution, accept tissue fill detail, accept adverse reaction detail, accept follow up of recipient and, accept user, Generate report.

6.2.3. Business/ Domain Layer

Business/domain class, also called an analysis or entity class, usually they're identified during system analysis. The business layer enables you to encapsulate the basic business functionality without having to concern yourself with user interface, data management or system management issues (46). Business classes of the WBEBIMS are user, donors, collected corneas, lab tests, surgeons, lab technicians, lab technician's supervisors, and medical directors.

6.2.4. Persistence Layer

The persistence layer provides the infrastructure for the storage and retrieval of objects. It helps to isolate the application from changes to permanent storage approach. The persistence layer by encapsulating data management functionality it increases the maintainability, extensibility and portability of our application. The persistence layer only provides access to permanent storage. It is not a permanent storage mechanism. The goal of the persistence layers to reduce the maintenance\effort that is required whenever changes are made to my data(46) The persistence classes of the WBEBIMS are donors, collected corneas, lab tests, surgeons, lab technicians, lab technician's supervisors, and medical directors

6.2.5. System Layer

The system layer provides access to the operating system and non-object oriented resources. The operating system must fit the software we develop in a manner that whenever there is modification made on some classes, the operating system must not be disturbed by that change. The system class for the most part encapsulates operating system functionalities that I need to make accessible to the objects with in an application. It is common to wrap a series of operating system calls to provide a related set of functionality.

6.2.6. Architecture

The architecture shows the interactions between the five layers of the WBEBIMS as follows.

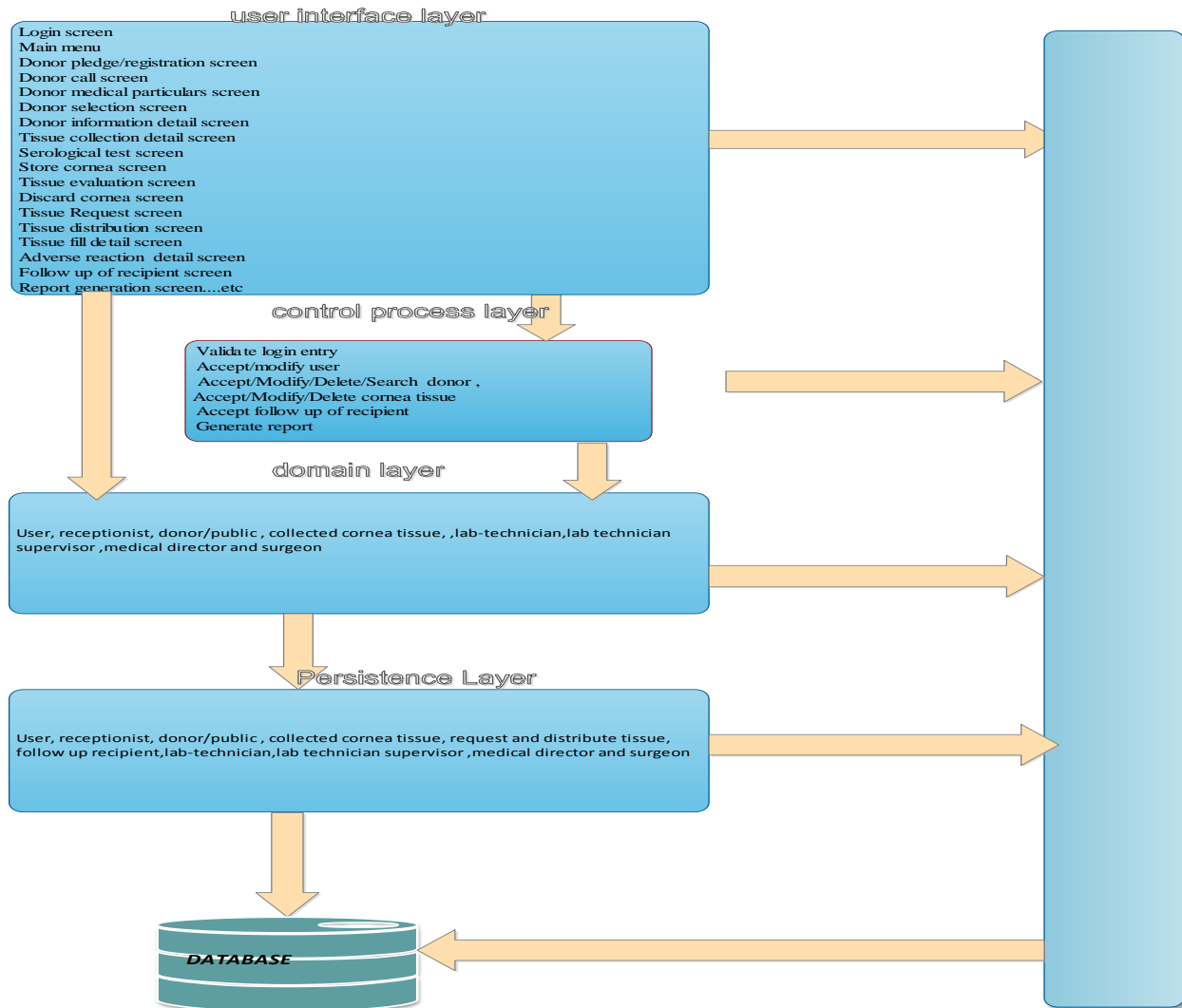
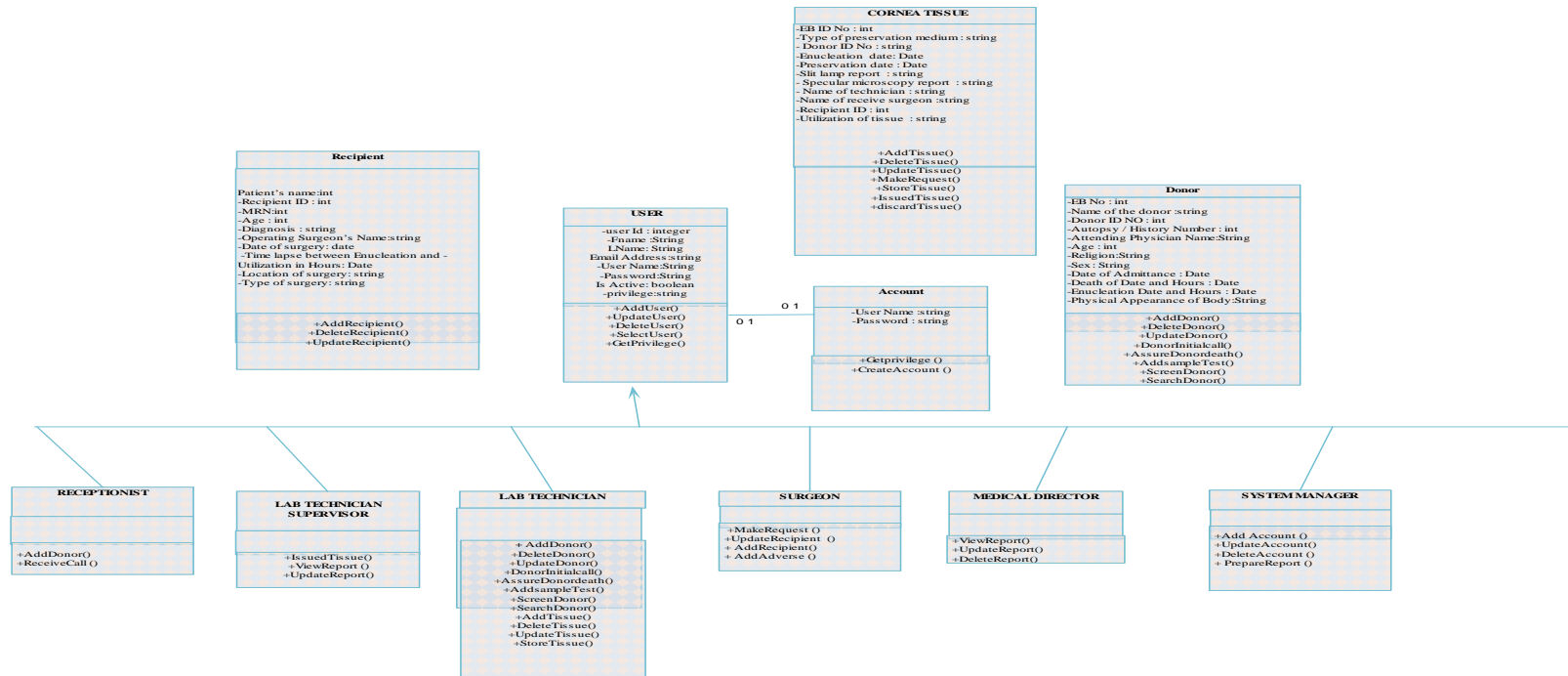


Fig.44 Architecture five layers of the WBEBIMS

6.3. Design level Class modeling

The design class model is model the static nature of how the software will be built. It focuses on the solution domain instead of the problem domain. And it introduces changes to analysis class model based on implementation technologies.

6.3.1. Class diagram



6.4. Collaboration Modeling

Collaboration diagram is form of interaction diagram. It represents the structural organization of a system and the messages sent/received. Structural organization consists of objects and links. A single diagram is not sufficient to describe the dynamic aspect of an entire system, so a set of diagrams are used to capture it as a whole.

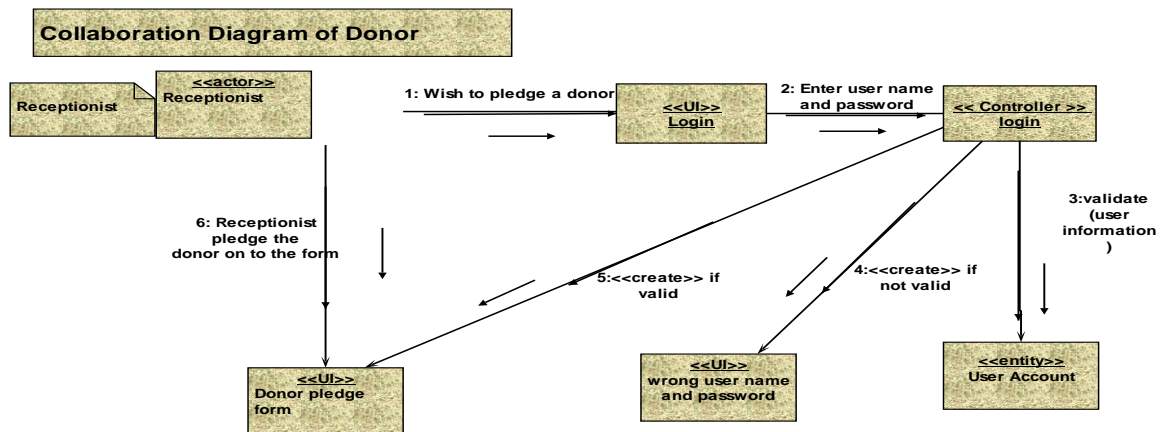
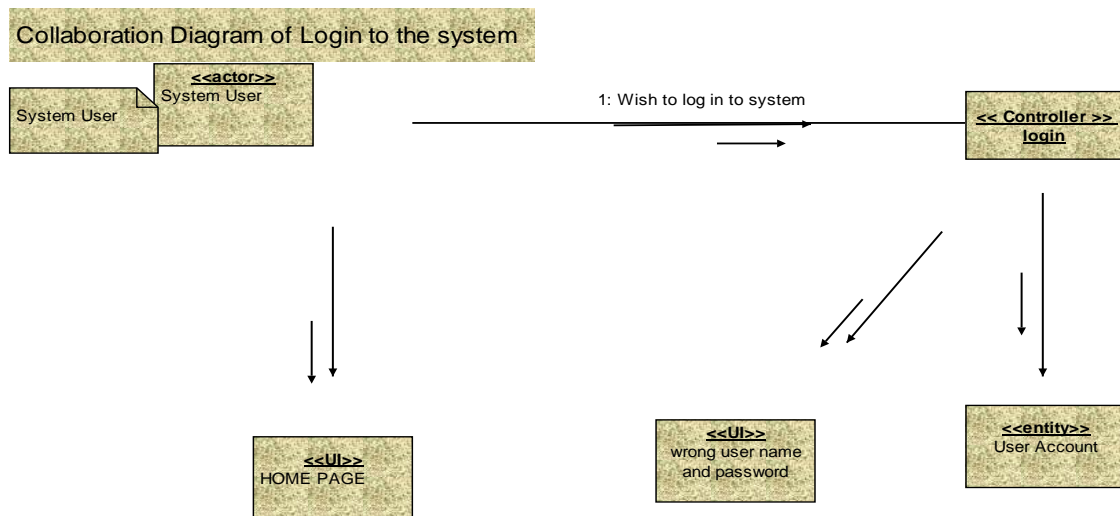


Figure 46 Collaboration diagram for registering donor



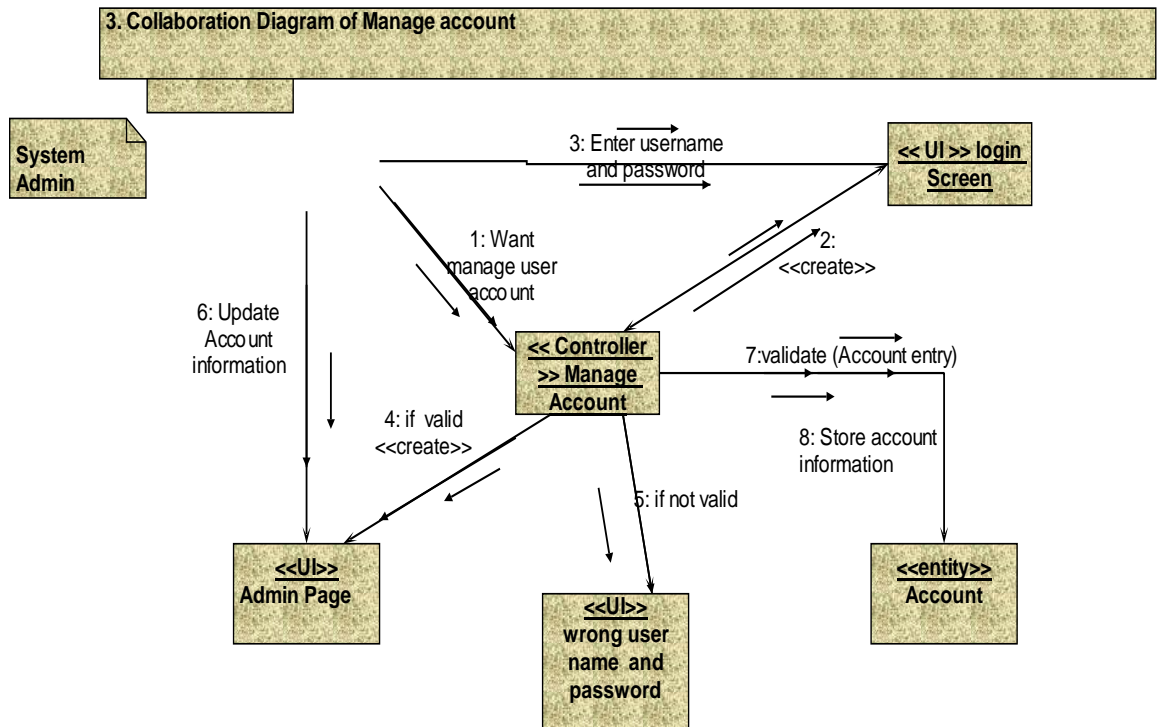


Figure 48 Collaboration diagram for Manage account

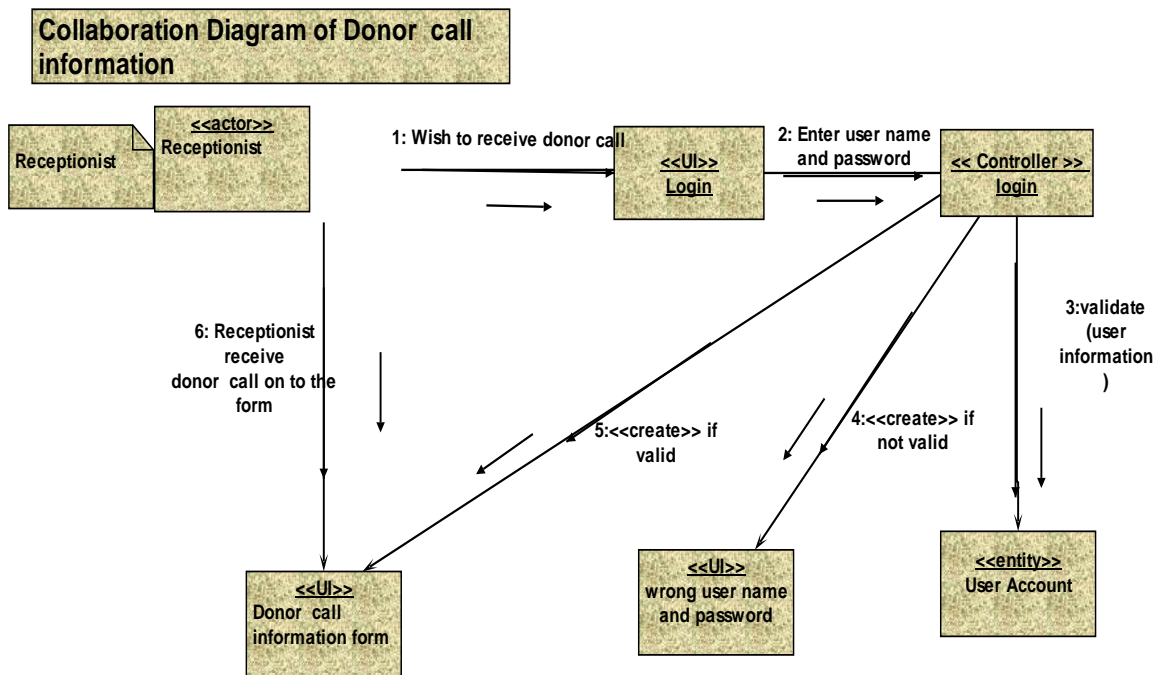


Figure 49 Collaboration diagram for Manage account

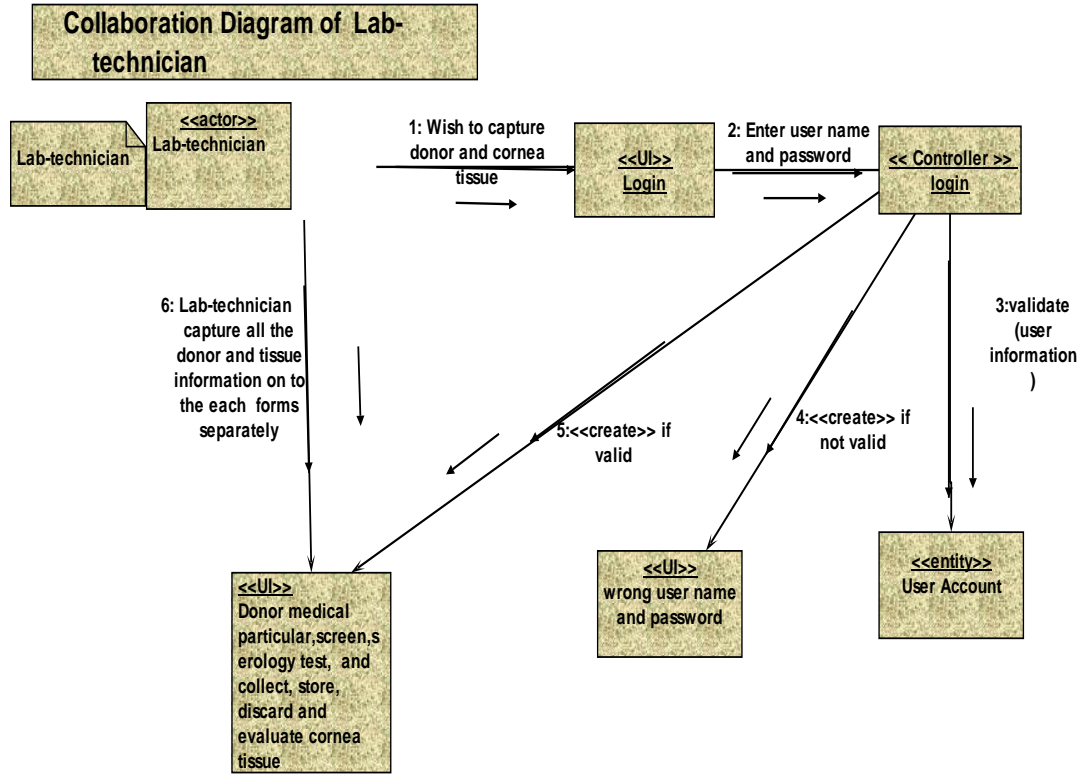


Figure 50 Collaboration diagram for lab-technician of the eye bank.

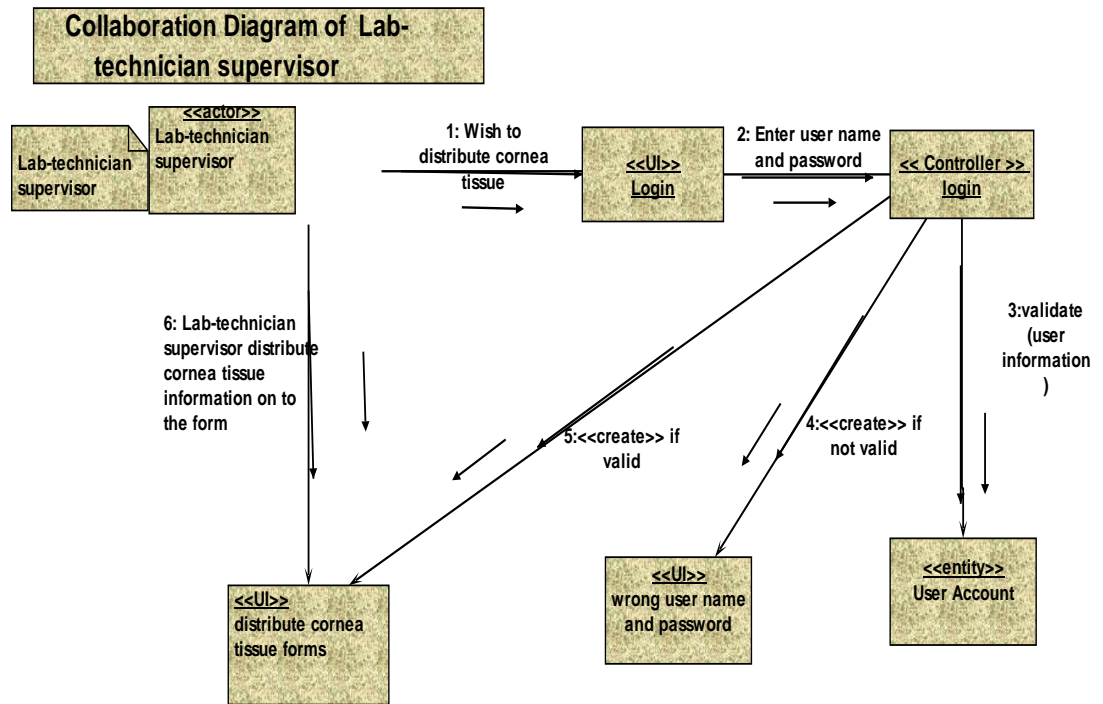


Figure 51 Collaboration diagram for lab-technician supervisor of the eye bank.

Collaboration diagram for surgeon tissue request.

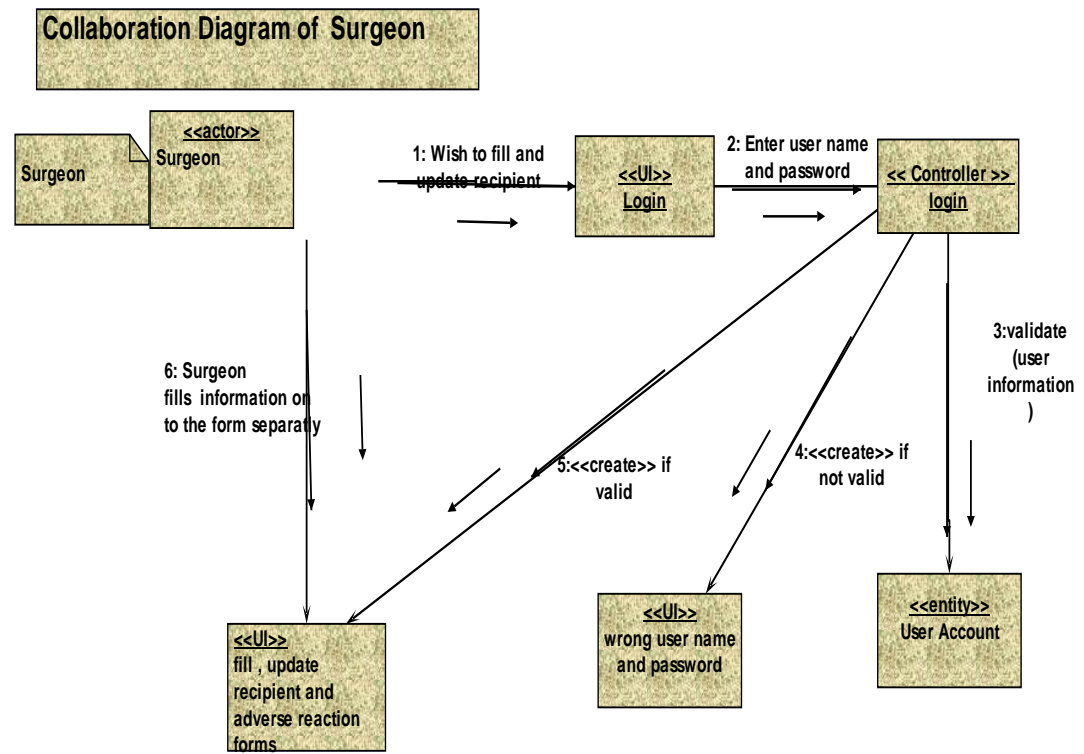
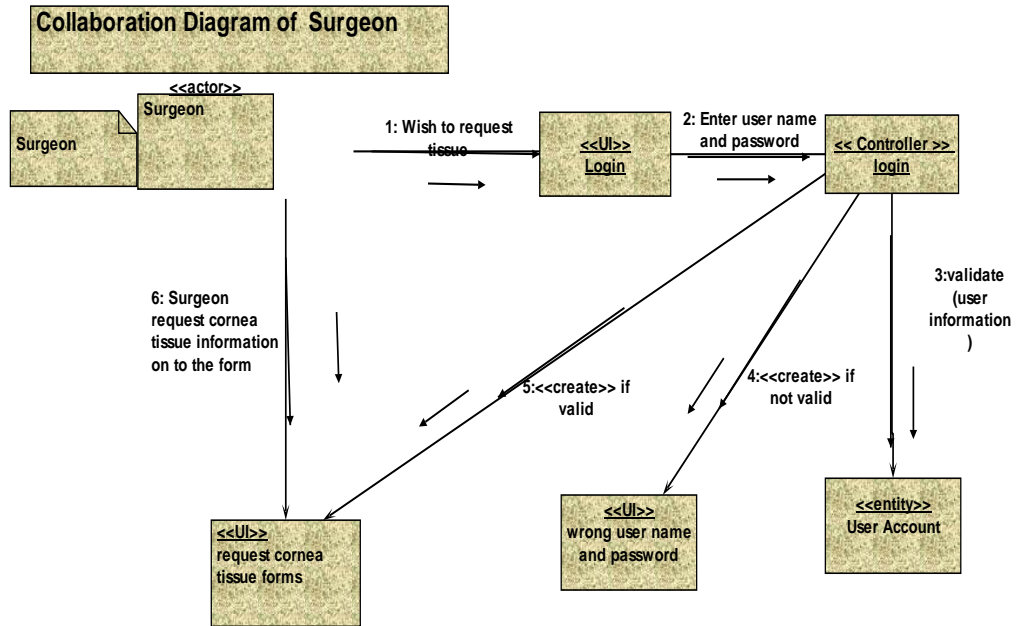


Figure 52 Collaboration diagram for surgeon tissue request.

Collaboration Diagram of Medical director and lab-technician supervisor

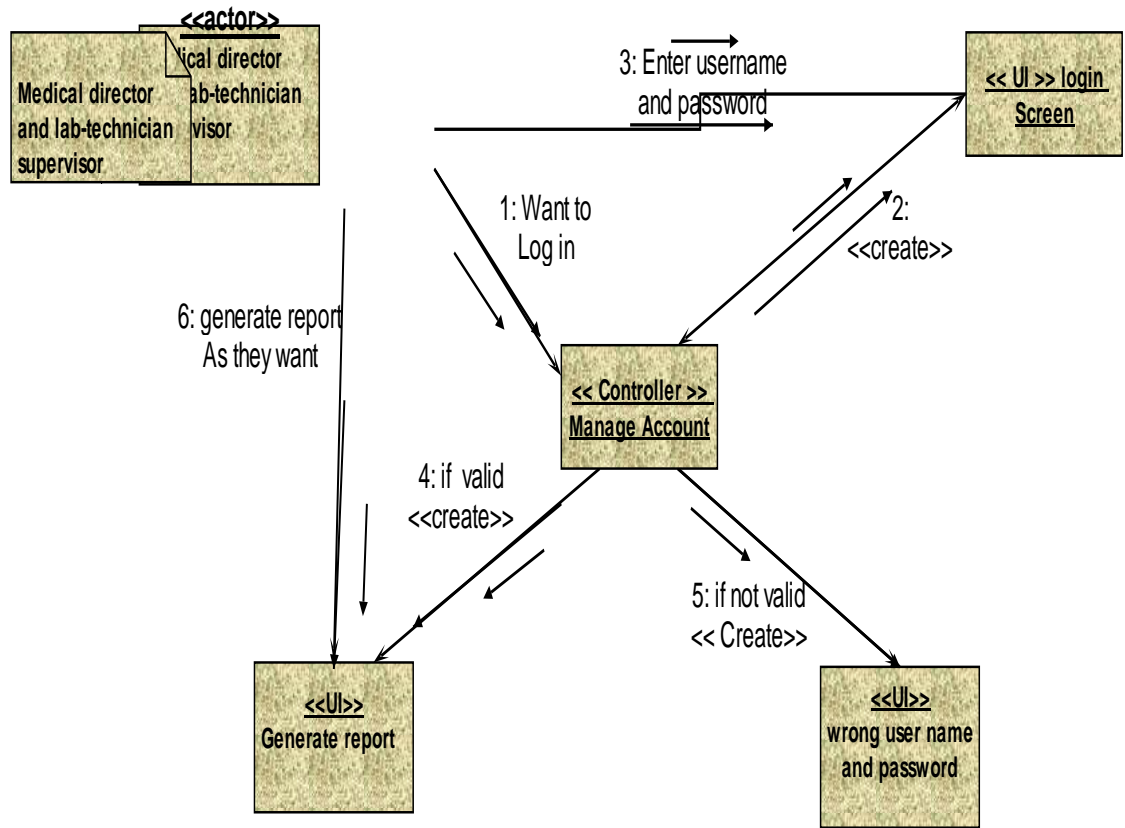


Figure 54 Collaboration diagram for lab-technician supervisor and medical director

6.5. Deployment modeling

The deployment diagram shows how a system will be physically deployed in the hardware environment. Its purpose is to show where the different components of the system will physically run and how they will communicate with each other. Since the diagram models the physical runtime, a system's production staff will make considerable use of this diagram (47).

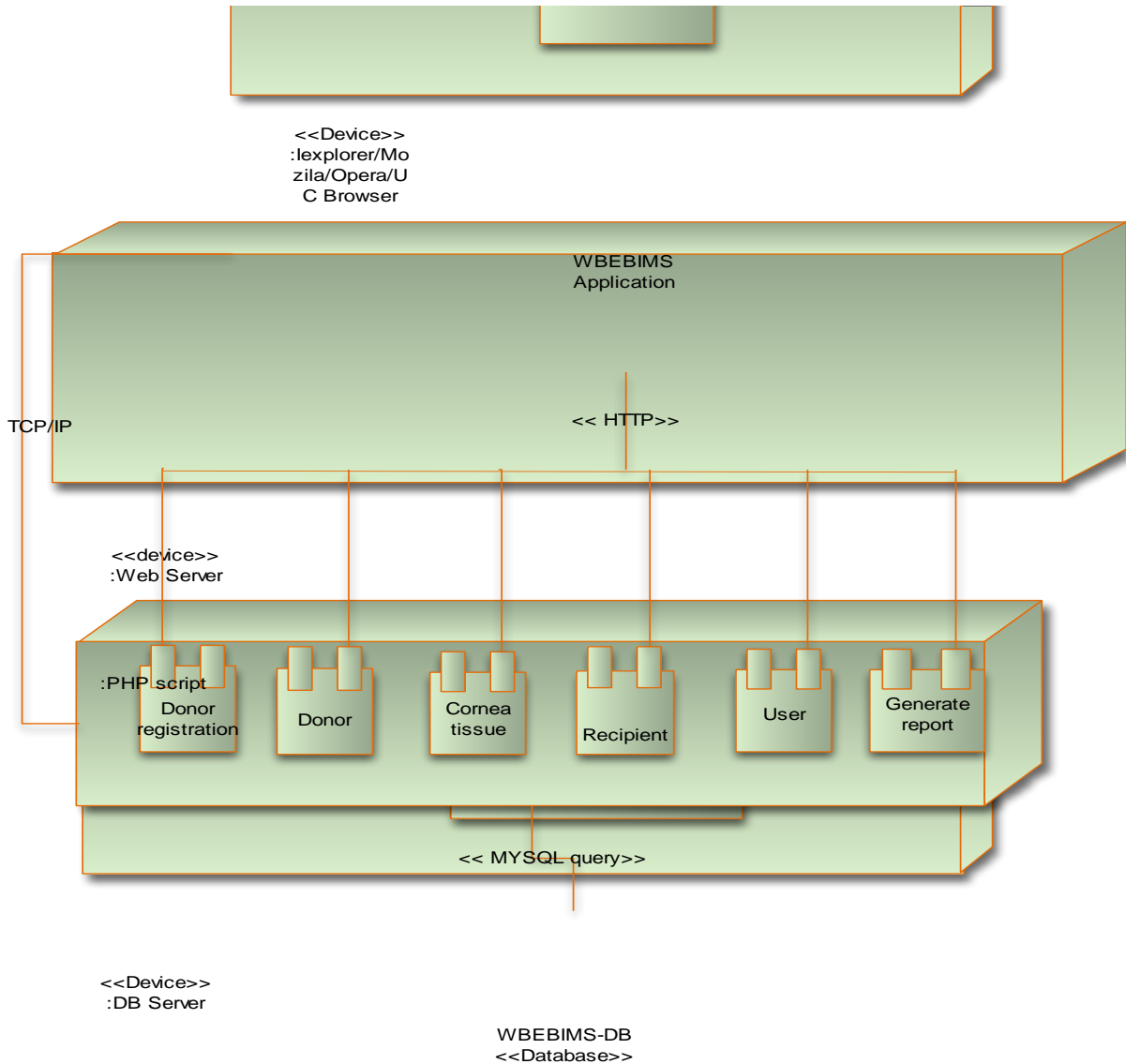


Figure 56 deployment diagrams of EBIMS

This illustration shows a typical three-tier application. Client applications communicate with the web server using a standard protocol such as HTTP. The client machine can be installed any workstation operating system and at least it should have standard browser software. The web server can be installed UNIX based operating system which support apache web service. The web server communicates with the database.

CHAPTER SEVEN

OBJECT ORIENTED PROTOTYPE IMPLEMENTATION AND EVALUATION

1.1. Introduction

Implementation is one of the main phases of system development life cycle (SDLC). It comprises converting designed interfaces to the actual forms or web pages, designed classes to the objects and their properties and methods, persistent classes to database tables or objects, testing at various levels of developed codes, and integrating all components to get the full system. The implementation of EBIMS is performed as a continuation of the design phase.

1.2. Flow chart Diagram

Flowchart is a visual representation of program flow. A flow chart normally uses a combination of blocks and arrows to represent actions and sequence. Blocks typically represent actions. The order in which actions occur is shown using arrows that point from statement to statement (50). Figure 4.8 shows the flowchart that represents basic function of the EBIMS system.

Flowchart Representation of the EBIMS

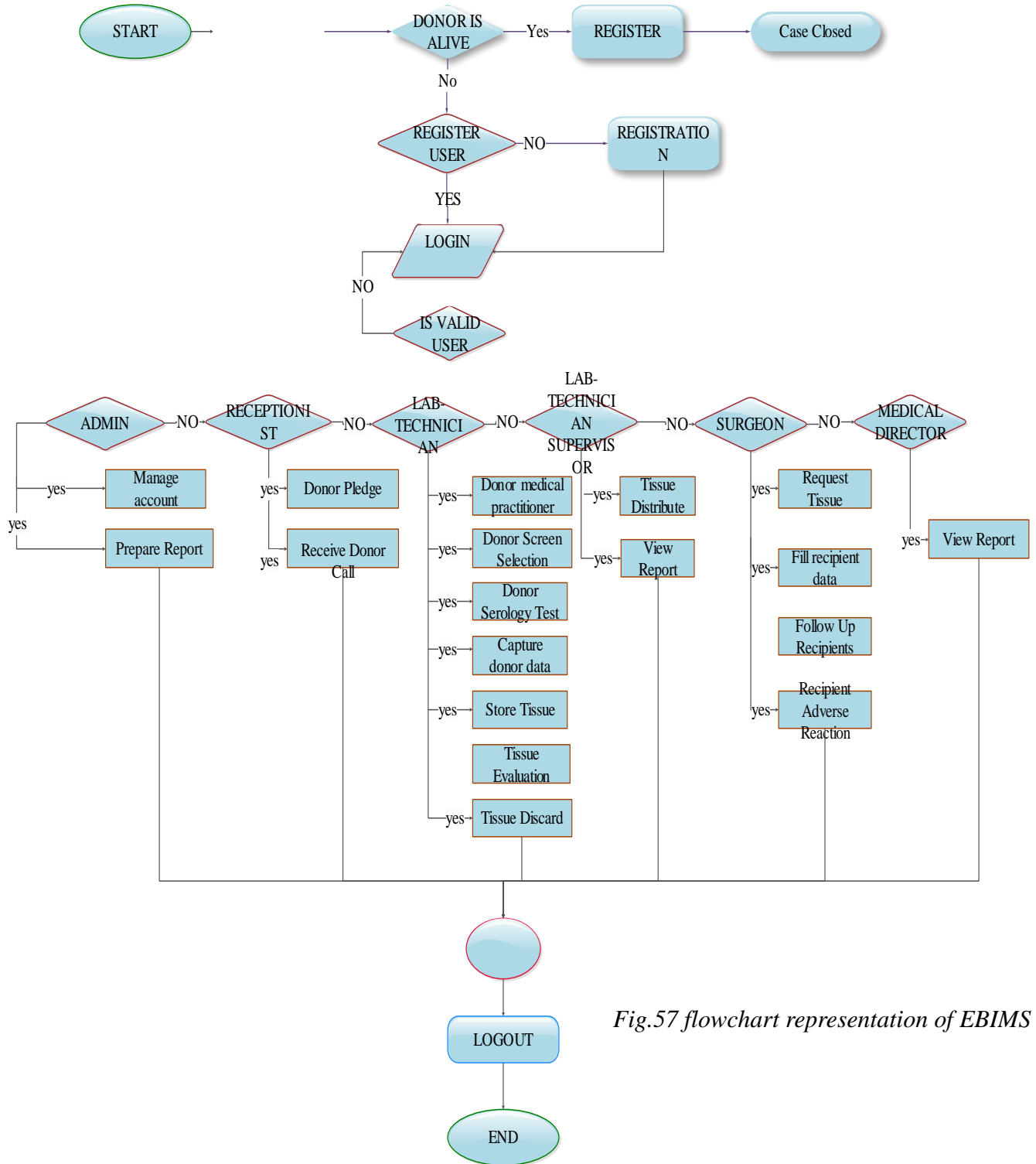


Fig.57 flowchart representation of EBIMS

1.3. User Interface design

The design of user interface includes anything that is visible to the user, interface design extends deep into the design of the interactive system as a whole. A good user interface cannot be applied to a system after it is built but must be part of the design process from the beginning. Proper design of a user interface can make a significant difference in training time, performance speed, error rates, user satisfaction, and the user's retention of knowledge of operations over time (51). User interface is an implementation part of a system where a user interacts with the system through icons, search options, visual indicators.

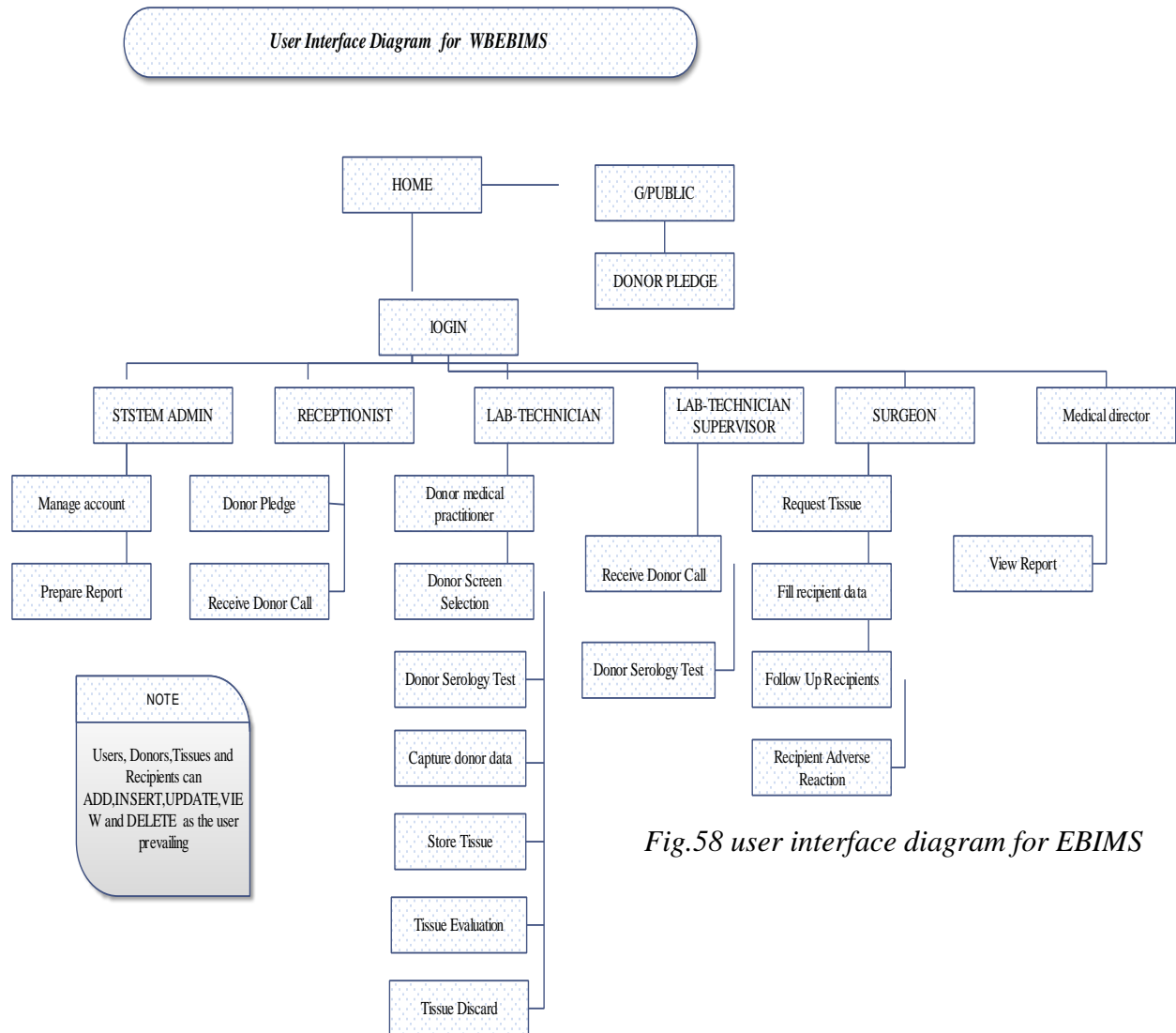


Fig.58 user interface diagram for EBIMS

Home Page

The first page displayed when the user need to access Eye bank information management system. It includes login page, registration page, and currant information of Eye Bank / news section and link of contact about the bank. To help guide users and let the user interface become user friendly and easily intractable

Home **Become A Donor** **Contact Us**

Welcome to Eye Bank Information Management System

Sign in to start your session

Please enter your username and password

Username
surgeon

Password

Remember me

Login

What We Do

Eye banks are the institutions responsible for collecting (harvesting) and processing donor corneas, and for distributing them to trained corneal graft surgeons. Eye banks are regulated and part of the local health system; they may be attached to a hospital or housed in a separate building. Cornea harvesting is the surgical removal from a deceased person of either the whole eye (enucleation) or the cornea (in situ corneal excision). This can be done by appropriately trained eye care personnel (eye bank technicians, ophthalmology residents, ophthalmologists, or general practitioners) in a variety of settings, including hospitals, homes, and funeral grounds

[More Info](#)

Institutions And Personnel

The Eye Bank in Addis Ababa has been in existence since 2003. It is associated with Menelik II Referral Hospital, a tertiary referral centre, where most of the transplants are done. The eye bank also sends corneas to two university referral hospitals in northwestern and southern Ethiopia. Between 130 and 150 corneas are harvested (using in situ corneal excision) and used in 90–120 transplants every year. There are five corneal transplant surgeons in Ethiopia. Cornea donation is encouraged in a variety of ways, including media campaigns with well-known personalities such as the president of Ethiopia and athlete Haile Gabreselassi. So far, 6,000 Ethiopians, including Mr Gabreselassi, have pledged their corneas, and next-of-kin consent is being used increasingly. The eye bank is funded by ORBIS International Ethiopia and Addis Ababa City Government Health Bureau; it also raises funds locally.

[Pledge To Donate Now](#)

Eye Bank Of Ethiopia© Your Website 2017

Figure 59: home page User Interface

Donor pledge /Registration page

The registration page offers the donor online register to the system while his personal information is saves onto the database which include personal information's like full name, date of birth, sex weight, BMI, religion, employ ID No ,donor address, witness full name ,r/ship, witness Address, phone number and and email address than save the information entered.

Add Pledge

Full Name

Date Of Birth

Body Mass Index

Weight

Religion

Sex

Employee Id Number

Donor Address

Witness Full Name

Relationship

Witness Address

Phone Number

Email

Pledges

Id	Full Name	Date Of Birth	Body Mass Index	Weight	Religion	Sex	Employee Id Number	Donor Address	Witness Full Name	Relationship	Witness Address	Phone Number	Email	Created	Modified	Actions
4b4c67b5-87a8-4c5d-938f-045dcf14c894	Abebe Kebede	1/1/22	27	50	male	male	12345667		Kebede Abebe	Father		0911234567	foo@gmail.com	5/12/17, 8:43 AM	5/12/17, 8:43 AM	View Edit Delete

Page 1 of 1, showing 1 record(s) out of 1 total

Figure 60: donor pledge page User Interface and table

Donor medical particular page shows the lab-technician assure the donor death in this page and know the immediate cause of death.

Welcome to Eye lab_technician

Search...

Donor Info

- List
- Add
- Donor Screenings
- Serology Tests
- Tissue Collection
- Tissue Evaluation
- Store Tissues
- Discard Tissues

Donor Medical Particular

Name Of Deceased

Manner Of Death

Cause Of Death

Secondary Cause Of Death

Information Given By Next Of Kin

Relationship With Donor

Is Death Certificate Available

Reason For Not Availability

Name Of Next Of Kin

Attending Doctor Name

Date Attended 2022 ▾ 1 ▾ 1 ▾

Attending Registration No

Placed At

Welcome to Eye lab_technician

Search...

Donor Medical Particulars

- List
- Add
- Donor Screenings
- Serology Tests
- Tissue Collection
- Tissue Evaluation
- Store Tissues
- Discard Tissues

Donor Medical Particulars

Name Of Deceased	Manner Of Death	Relationship With Donor	Name Of Next Of Kin	Is Death Certificate Available	Attending Doctor Name	Date Attended	Attending Registration No	Actions
sjfdkljlkjr as	asjdfk	dfakjds	jsdfkjaslkdjf	1	skadjfllkasjd	on 1/1/22	kjfalksdjflkj	View Edit Delete Screening Serology Tests

< previous next >

Page 1 of 1, showing 1 record(s) out of 1 total

Fig.61 New Donor Call and Donor Calls List

Donor serology test page shows the lab-technician save the donor lab test result information to the database

Welcome to Eye lab_technician

Search...

- Donor Info
- Donor Screenings
- Serology Tests
- Tissue Collection
- Tissue Evaluation
- Store Tissues
- Discard Tissues

Serology Test

Donor Medical Particular:

Donor Name:

Test Done At:

Medical Record Number:

Serology Number:

Referring Institution:

Reference No:

Test Done Report:

Technician Name:

Welcome to Eye lab_technician

Search...

- Donor Medical Particulars
- Donor Screenings
- Serology Tests
- Tissue Collection
- Tissue Evaluation
- Store Tissues
- Discard Tissues

Serology Tests

Donor Name	Test Done At	Medical Record No	Serology Number	Referring Institution	Reference No	Technician Name	Created	Modified	Actions
djfals asdjflk	1/1/22	lkjsdfkas	399303	930u9023	93209309	sadjfkljaslkdj	5/17/17, 9:27 AM	5/17/17, 9:27 AM	View Edit Delete Collection
djfals asdjflk	1/1/22	lkjsdfkas	399303	930u9023	93209309	sadjfkljaslkdj	5/17/17, 9:27 AM	5/17/17, 9:27 AM	View Edit Delete Collection
djfals asdjflk	1/1/22	lkjsdfkas	399303	930u9023	93209309	sadjfkljaslkdj	5/17/17, 9:27 AM	5/17/17, 9:27 AM	View Edit Delete Collection
djfals asdjflk	1/1/22	lkjsdfkas	399303	930u9023	93209309	sadjfkljaslkdj	5/17/17, 9:27 AM	5/17/17, 9:27 AM	View Edit Delete Collection

< previous next >

Page 1 of 1, showing 4 record(s) out of 4 total

Fig.62 donor serology test page and table

Tissue request interface page shows the surgeons fill request information and submit it and the eye bank can easily identify priority of recipients.

Tissue Request

Surgeon Name

Surgeon Phone No

Surgeon Email

Surgery Time 2022 ▾ 1 ▾ 1 ▾ 0 ▾ 00 ▾

Surgery Type

Comment

Urgency

Reason If Rejected

Submit Reset Cancel

Welcome to Eye surgeon

Search...

Tissue Requests

Surgeon Name	Surgeon Phone No	Surgeon Email	Surgery Time	Surgery Type	Urgency	Is Approved	Created	Actions
jasfkljdkasjfdl	ljksajdfklj	lkjsadklfjkl	1/1/22, 12:00 AM	jfasdjf	lkjslfdjalksj		1 week, 2 days ago	View Edit Delete
me me	0909090909	me@me.com	1/1/22, 12:00 AM	simple	foo	1	3 weeks, 1 day ago	View Edit Delete
Surgeon Name	090293939	foo@email.com	7/5/21, 12:00 AM	simple	very urgent	1	on 1/2/17	View Edit Delete

< previous next >

Page 1 of 1, showing 3 record(s) out of 3 total

Fig.63 Tissue request page and List

Generates Reports page: In this section, the medical director and lab-technician supervisor view the report and can easily decide as the right time and place. Under below report generated interface shows how many donors are registered by month and year. It also shows how many tissues are requested by month and year accordingly

Pledges By Year and Month

Year	Month	Pledges Count
2017	May	1

< previous next >

Page 1 of 1, showing 1 record(s) out of 1 total

Tissue Requests By Year and Month

Year	MonthName	Request Count
2017	January	1
2017	May	2

< previous next >

Page 1 of 1, showing 2 record(s) out of 2 total

1.4. Evaluate the effectiveness of system usability

The Investigator presented the designed system functionality to respondents to evaluate the effectiveness of the system. Usefulness design WBEBMIS is the issue of whether the system can be used to achieve some desired goal. 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. Usability evaluation is an important part of the overall user interface design process, which ideally consists of iterative cycles of designing, prototyping, and evaluating. Usability evaluation is itself a process that entails many activities depending on the method employed (51).

A questionnaire is a measurement tool designed to assess a user's subjective satisfaction with a design WBEBMIS. It is a list of questions that are distributed to users for responses based on system attributes. The goal is to evaluate the effectiveness of the process and the result .The goal is to improve the interface design process and results. Responses on a questionnaire are usually quantitative and the evaluation of the result demonstrated in table below.

Table 5 Evaluation Checklist

SN	System effectiveness evaluation criteria	Strongly disagree	Disagree	Not decided	Agree	Strongly agree
1	The content of the system is clearly understandable			1	1	3
2	The design system could increases the performance of the users				1	4
3	The design system made the user to save time and cost		1			4
4	The design system could be automating Eye bank information system.			1		4
5	The design system could be helpful to recipient patient in the health institutions.				2	3

6	The design system could be minimizing the error.			1		4
7	The design system could increase donor pledge number.					5
8	The design system has unnecessary content available in the interface				1	4
9	The design system could friendly use to improve donor data quality		1		1	3
10	The design system provides secured and reliable information		1			4
TOTAL EVALUATION			6%	6%	12%	76%

From the above table 5 questionnaires help to capture the opinion of the respondents and individual interest for the system use. They evaluate the proposed system effectiveness and functionality of the system were 76% of them respond strongly agree 12% of uses respond agree, 6% users of the system respond not decided and 6% disagree. Therefore, according to the acceptance testing and the users ‘remarks, it indicates that: implementing this system within the center with better infrastructure and network connection will benefit them.

1.5. Hardware and Software Requirements

1.5.1. Hardware Requirements

It is quite obvious that in order to realize the functionalities of the system acquiring hardware is a mandatory. The minimum specification of the hardware required to implement the system are specified in two categories:

Machine specification for server and workstation

One server computer

- ✓ Minimum of 2 dual core 2.4GHz
- ✓ Pentium Xeon Processor
- ✓ A minimum of 3 GB of RAM and greater than 3 TB hard disk.
- ✓ Mouse, keyboard, Monitor
- ✓ Network interface card (NIC)
- ✓ Back up device

Client computers

- ✓ Operating System Windows 7 and above
- ✓ Minimum of 3.4 GHz
- ✓ Pentium IV processor
- ✓ A Minimum of 1 GB RAM and 80 GB hard disk.
- ✓ Scanner
- ✓ Printer

1.5.2. Software Requirements

In order to obtain the required functionalities of WBEBIM system, it will not be enough to have the above listed hardware which is not functional without software.

Software needed for Server

- ✓ Operating System Windows 2003 Server and above
- ✓ Apache
- ✓ PHP
- ✓ Mysql Server 5.0
- ✓ Web Services provided by the operating system

CHAPTER EIGHT

SUMMARIZATION AND RECOMMENDATIONS

This chapter contains summary of the project, concluding remarks and recommendations to the Eye bank of Ethiopia in attempt to minimize problems which have been prevalent in the manual system.

8.1. Summarization(conclusion)

The overall activities of WBEBIMS project is controlling and managing the performance of the Eye Bank of Ethiopia. The system register a donor for donating an eye and records all information regarding to donors, cornea tissue and recipients such as donor call information, donor medical particular, screen donor ,serological test of a donor, collected(stored , discarded and evaluate) donated cornea tissue, request and distribution of cornea to concerned surgeon. In addition to this the system generates different standard reports for the stakeholders.

In the developing of the project, the first chapter deals with project identification and planning. In this chapter background of the organization, its service delivery and problems that are hindered the service delivery are identified and mentioned. As the study continued, objective, scope and answered at the end of the project that is significant of the project are clearly specified and identified. The second chapter deals with revise documents and site visit have been carried out and all the results mentioned in a general and related reviews detail about the project in this chapter.

The third chapter deals with which method used to design and develop the project .these are interview, observation, document review were used as a tool for data collection, OOA, Agile approach were a method used to analysis the design. Edraw Max and visio a tool to analysis the system. UML were used to model the diagrams.

The fourth chapter deals with Business analysis and requirement definition. In this chapter major functions of the existing system have been identified, form and documentation which are used in the existing system are listed, business rules are mentioned, major role players are identified, useful practices that has been deployed in the current system have been identified, different options which can solve identified problems and different criteria's which can be used to select

the best solution among available options have been set. As the chapter continued modeling of the existing system has been depicted using essential use case modeling, essential user interface, and functional and non-functional requirements of the proposed system clearly mentioned.

The fifth chapter deals with Object Oriented Analysis in which functional requirements has been depicted using system use case modeling ,use case diagram, use case description, sequence diagram, class modeling, and activity diagrams are the models used to analyze the proposed system and also supplementary specifications are discussed in details.

The sixth chapter object-oriented design describes the solution domain in detail using class type architecture, design level class modeling, collaboration diagrams, and deployment diagram. The Seventh chapter deals with final implementation details presents flow and design of user interface, minimum specification of the hardware and software requirement, and flowcharts to be implemented along with the user evaluation testing procedures to be applied and User test for the system prototype was done and it shows that 88% of the participants in the evaluation and testing have shown positive attitude and response for the system usability.

Generally, this project develops only the prototype of the eye bank information management system. Since the project follows an iterative process model it can be developed until it satisfies the end user needs.

8.2. Recommendations

Based on the results of the project, the following recommendations are forwarded to the concerning bodies.

Eye Bank of Ethiopia

The Eye Bank of Ethiopia might provide sustainable budget for the implementation of EBIMS. In addition to that, I recommend the Eye Bank of Ethiopia to upgrade the hardware and network infrastructure of the eye bank in order for the system to work well.

The eye bank should collaborate with health institutes. The eye bank should provide information to the people to increase the awareness for maximizing number of pledge donors

Federal minster of health

The federal minster of health should support their respective and humanitarian Eye Bank of Ethiopia with necessary hardware, network infrastructure for the WBEBIMS. In addition, for the

sustainability of the system in federal minister of health should give guarantee by assigning sufficient budget and manpower.

The researchers/students

It is recommended for future researchers to implement the complete web-based Eye Bank Information Management System by enriching it with additional functionalities. Such functionality may include: adding SMS based promotion component, equipment (registration, cleaning, sterilize and refrigerator) record, the system limited some functionalities that may include supportive operations of the Eye bank and continue the project and work on the development and implementation of the system. Researchers/ students should make further research on this project.

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Appendix A
ADDIS ABABA UNIVERSITY
SCHOOL OF PUBLIC HEALTH AND SCHOOL OF INFORMATION SCIENCE
DEPARTMENT OF HEALTH INFORMATICS

Information Sheet

My name is _____. I am a student at Addis Ababa University and I am currently conducting a project for the partial fulfillment of master's degree in health informatics. The purpose of this project is to design a Web-Based Eye Bank Information Management System" for the Eye Bank Ethiopia.

I would like to ask you some questions related to the topic I mentioned above and all of your responses to questions will be kept strictly confidential throughout the project. Participation in this project is voluntary and you can choose not to answer any individual question or all of the questions. I look forward for your full participation as the answers you give on this form will help in better understanding of the situation of the research data handling of the institution and will help to designing appropriate technology to alleviate the existing system problems. Your participation, non-participation or refusal to answer the questions will have no effect now or in the near future on your professional activities and personal life.

May I get your permission to continue?

Yes Go to the consent form

No Stop -

Consent Form

My name is Dr./Sr._____. I am informed that this questionnaire is part of project that proposes design a Web-Based Eye Bank Information Management System” at the Eye Bank Ethiopia.

, I have been told that the project will help in better understanding of the situation about the institution health research data handling mechanism, understanding the situation will help in designing a Web-Based Eye Bank Information Management System to alleviate the existing system problems for future which will benefits, eye bank of Ethiopia, all health researchers and peoples. In addition I have been told about how the data collection will proceed. I clearly understand that my participation/non participation, or refusal to answer the questions will have no effect now or in the future on professional work as well as personal life. At last I am assured that confidentiality of my response is maintained. Therefore, I am consented to participate in the study by signing this form.

The study participant’s Signature_____

Date_____

Code_____

Appendix B
Requirements Collection Checklist
Addis Ababa University
School of Information Science and School of Public Health MSc.in
Health Informatics Program

Consent Form

The interview is designed as part of my MSc. Project. It intends to the “Design of a Web-Based Eye Bank Information Management System” for the Eye Bank Ethiopia.

Dear Respondents,

The result of this interview will be utilized for project purpose only. Your contribution will help the outcome and it's expected that the result of this project work will contribute on the improvement of Eye bank information management. Therefore, you are kindly asked to provide genuine to the questions that follow.

I am grateful for your time and effort in completing the interview.

In-Depth Interview Guide

I. Process

1. What does the Eye donation process look like?
2. How do you control the Eye inventory process?
3. Is there any mechanism by which donors reserve before visiting the Eye bank in person?

Yes/No

4. If No to Q3 above, what kind of reservation system/mechanism do you want to have?

5. Is there any problem on the Eye bank management system?

II. Management

6. What does the organizational structure of the Eye Bank of Ethiopia look like?

III. People

7. How many professionals are there in the center?

8. How many professionals are involved in the Eye bank management information system?

IV. Computer Software

9. Is there any software application in use in the center?

10. What functions should the software provide? \

11. Does the Eye Bank of Ethiopia have a plan to develop Eye bank information management system?

12. What is the data format you use?

V. Computer Hardware

13. What kind of computer related hardware devices are being used in the center?

14. To what extent is the center ready to fulfill hardware requirements of the Eye Bank Information Management System?

VI. Network

15. Does the center have any network infrastructure?

16. What kind of network does the center have?

17. What is the bandwidth of internet connection the center currently has?

18. How many number of users does the network support?

19. How many departments in the center are connected to the network?

20. What kind of network hardware devices are being used in the center?

VII. Report

21. What kind of report do you produce?

22. How do you produce a report and how often?

23. How and for whom do you generate the reports?

I. Document Review Guide

1. What kind of forms do you use to record eye inventory management?

2. What information does the forms include?

3. Is there any important information missed in the form? What are they?

4. What is your report formats look like?

Appendix C

Checklist Evaluation

SN	System effectiveness evaluation criteria	Strongly disagree	Disagree	Not decided	Agree	Strongly agree
1	The content of the system is clearly understandable					
2	The design system could increase the performance of the users					
3	The design system made the user to save time and cost					
4	The design system could be automating Eye bank information system.					
5	The design system could be helpful to recipient patient in the health institutions.					
6	The design system could be minimizing the error.					
7	The design system could increase donor pledge number.					
8	The design system has unnecessary content available in the interface					
9	The design system could friendly use to improve donor data quality					
10	The design system provides secured and reliable information					
TOTAL EVALUATION						

Appendix D

Sample code

1. Pledges Controller .php

```
<?php
namespace App\Controller;
use App\Controller\AppController;
class PledgesController extends AppController {
public function index() {
$query = $this->Pledges->find('search', ['search' => $this->request-
>query]);
order(['created' => 'desc']);
;
$pledges = $this->paginate($query);
$this->set(compact('pledges'));
$this->set('_serialize', ['pledges']);
}
public function view($id = null) {
$pledge = $this->Pledges->get($id, [
'contain' => []
]);
$this->set('pledge', $pledge);
$this->set('_serialize', ['pledge']);
}
public function add() {
$pledge = $this->Pledges->newEntity();
if ($this->request->is('post')) {
$pledge = $this->Pledges->patchEntity($pledge, $this->request->getData
());
if ($this->Pledges->save($pledge)) {
$this->Flash->success(__("The pledge has been saved.));
return $this->redirect(['action' => 'index']);
}
$this->Flash->error(__("The pledge could not be saved. Please, try
again.));
}
$this->set(compact('pledge'));
$this->set('_serialize', ['pledge']);
}
public function edit($id = null) {
$pledge = $this->Pledges->get($id, [
'contain' => []
]);
if ($this->request->is(['patch', 'post', 'put'])) {
$pledge = $this->Pledges->patchEntity($pledge, $this->request->getData
());
if ($this->Pledges->save($pledge)) {
$this->Flash->success(__("The pledge has been saved.));
return $this->redirect(['action' => 'index']);
}
$this->Flash->error(__("The pledge could not be saved. Please, try
again.));
}
$this->set(compact('pledge'));
$this->set('_serialize', ['pledge']);
}
```

```

}
public function delete($id = null) {
$this->request->allowMethod(['post', 'delete']);
$pledge = $this->Pledges->get($id);
if ($this->Pledges->delete($pledge)) {
$this->Flash->success(__("The pledge has been deleted.));
} else {
$this->Flash->error(__("The pledge could not be deleted. Please, try
again.));
}
return $this->redirect(['action' => 'index']);
}
}

```

2. PledgesView.php

```

// Add
<div class="pledges form large-9 medium-8 columns content">
<?= $this->Form->create($pledge) ?>
<fieldset>
<legend><?= __("Add Pledge") ?></legend>
<?php
echo $this->Form->control('full_name');
echo $this->Form->control('date_of_birth');
echo $this->Form->control('body_mass_index');
echo $this->Form->control('weight');
echo $this->Form->control('religion');
echo $this->Form->control('sex');
echo $this->Form->control('employee_id_number');
echo $this->Form->control('donor_address');
echo $this->Form->control('witness_full_name');
echo $this->Form->control('relationship');
echo $this->Form->control('witness_address');
echo $this->Form->control('phone_number');
echo $this->Form->control('email');
?>
</fieldset>
<?= $this->Form->button(__("Submit")) ?>
<?= $this->Form->button(__("Reset"),['type' => 'reset','btn btn-danger']) ?>
<?= $this->Html->link(__("Cancel"),'/',['class' => 'btn btn-warning']) ?>
<?= $this->Form->end() ?>
</div>
// edit
<div class="pledges form large-9 medium-8 columns content">
<?= $this->Form->create($pledge) ?>
<fieldset>
<legend><?= __("Edit Pledge") ?></legend>
<?php
echo $this->Form->control('full_name');
echo $this->Form->control('date_of_birth');
echo $this->Form->control('body_mass_index');
echo $this->Form->control('weight');
echo $this->Form->control('religion');
echo $this->Form->control('sex');
echo $this->Form->control('employee_id_number');
echo $this->Form->control('donor_address');
echo $this->Form->control('witness_full_name');
echo $this->Form->control('relationship');
echo $this->Form->control('witness_address');
echo $this->Form->control('phone_number');
echo $this->Form->control('email');
?>

```

```

</fieldset>
<?= $this->Form->button(__('Submit')) ?>
<?= $this->Form->button(__('Reset'), ['type' => 'reset', 'btn btn-danger']) ?>
<?= $this->Html->link(__('Cancel'), '/', ['class' => 'btn btn-warning']) ?>
<?= $this->Form->end() ?>
</div>
// List Pledges
<div class="pledges index large-9 medium-8 columns content">
<h3><?= __( 'Pledges' ) ?></h3>
<table cellpadding="0" cellspacing="0">
<thead>
<tr>
<th scope="col"><?= $this->Paginator->sort('id') ?></th>
<th scope="col"><?= $this->Paginator->sort('full_name') ?></th>
<th scope="col"><?= $this->Paginator->sort('date_of_birth') ?></th>
<th scope="col"><?= $this->Paginator->sort('body_mass_index') ?>
</th>
<th scope="col"><?= $this->Paginator->sort('weight') ?></th>
<th scope="col"><?= $this->Paginator->sort('religion') ?></th>
<th scope="col"><?= $this->Paginator->sort('sex') ?></th>
<th scope="col"><?= $this->Paginator->sort('employee_id_number') ?
></th>
<th scope="col"><?= $this->Paginator->sort('donor_address') ?></th>
<th scope="col"><?= $this->Paginator->sort('witness_full_name') ?
></th>
<th scope="col"><?= $this->Paginator->sort('relationship') ?></th>
<th scope="col"><?= $this->Paginator->sort('witness_address') ?></
th>
<th scope="col"><?= $this->Paginator->sort('phone_number') ?></th>
<th scope="col"><?= $this->Paginator->sort('email') ?></th>
<th scope="col"><?= $this->Paginator->sort('created') ?></th>
<th scope="col"><?= $this->Paginator->sort('modified') ?></th>
<th scope="col" class="actions"><?= __( 'Actions' ) ?></th>
</tr>
</thead>
<tbody>
<?php foreach ($pledges as $pledge): ?>
<tr>
<td><?= h($pledge->id) ?></td>
<td><?= h($pledge->full_name) ?></td>
<td><?= h($pledge->date_of_birth) ?></td>
<td><?= h($pledge->body_mass_index) ?></td>
<td><?= $this->Number->format($pledge->weight) ?></td>
<td><?= h($pledge->religion) ?></td>
<td><?= h($pledge->sex) ?></td>
<td><?= h($pledge->employee_id_number) ?></td>
<td><?= h($pledge->donor_address) ?></td>
<td><?= h($pledge->witness_full_name) ?></td>
<td><?= h($pledge->relationship) ?></td>
<td><?= h($pledge->witness_address) ?></td>
<td><?= h($pledge->phone_number) ?></td>
<td><?= h($pledge->email) ?></td>
<td><?= h($pledge->created) ?></td>
<td><?= h($pledge->modified) ?></td>
<td class="actions">
<?= $this->Html->link(__('View'), ['action' => 'view', $pledge-
>id]) ?>
<?= $this->Html->link(__('Edit'), ['action' => 'edit', $pledge-
>id]) ?>
<?= $this->Form->postLink(__('Delete'), ['action' => 'delete',
$pledge->id], ['confirm' => __( 'Are you sure you want to delete # {0}'? , $pledge-

```

```

>id)) ?>
</td>
</tr>
<?php endforeach; ?>
</tbody>
</table>
<div class="paginator">
<ul class="pagination">
<?=$this->Paginator->first('<<' . __('first')) ?>
<?=$this->Paginator->prev('<' . __('previous')) ?>
<?=$this->Paginator->numbers() ?>
<?=$this->Paginator->next(__('next') . '>') ?>
<?=$this->Paginator->last(__('last') . '>>') ?>
</ul>
<p><?=$this->Paginator->counter(['format' => __('Page {page} of
{pages}), showing {current} record(s) out of {count} total']) ?></p>
</div>
</div>
// View
<section class="content-header">
<h1>
<?php echo __('Pledge'); ?>
</h1>
<ol class="breadcrumb">
<li>
<?=$this->Html->link('<i class="fa fa-dashboard"></i>' . __('Back'),
['action' => 'index'], ['escape' => false])?>
</li>
</ol>
</section>
<!-- Main content -->
<section class="content">
<div class="row">
<div class="col-md-12">
<div class="box box-solid">
<div class="box-header with-border">
<i class="fa fa-info"></i>
<h3 class="box-title"><?php echo __('Information'); ?></h3>
</div>
<!-- /.box-header -->
<div class="box-body">
<dl class="dl-horizontal">
<dt><?=$this->Paginator->id ?></dt>
<dd>
<?=$this->Paginator->id ?>
</dd>
<dt><?=$this->Paginator->religion ?></dt>
<dd>
<?=$this->Paginator->religion ?>
</dd>
<dt><?=$this->Paginator->sex ?></dt>
<dd>
<?=$this->Paginator->sex ?>
</dd>
<dt><?=$this->Paginator->employee_id_number ?></dt>
<dd>
<?=$this->Paginator->employee_id_number ?>
</dd>
<dt><?=$this->Paginator->witness_full_name ?></dt>
<dd>
<?=$this->Paginator->witness_full_name ?>

```


```

</dd>
<dt><?=__('Relationship') ?></dt>
<dd>
<?= h($pledge->relationship) ?>
</dd>
<dt><?=__('Full Name') ?></dt>
<dd>
<?= h($pledge->full_name) ?>
</dd>
<dt><?=__('Phone Number') ?></dt>
<dd>
<?= h($pledge->phone_number) ?>
</dd>
<dt><?=__('Email') ?></dt>
<dd>
<?= h($pledge->email) ?>
</dd>
<dt><?=__('Body Mass Index') ?></dt>
<dd>
<?= $this->Number->format($pledge-
>body_mass_index) ?>
</dd>
<dt><?=__('Weight') ?></dt>
<dd>
<?= $this->Number->format($pledge->weight) ?>
</dd>
<dt><?=__('Date Of Birth') ?></dt>
<dd>
<?= h($pledge->date_of_birth) ?>
</dd>
</dl>
</div>
<!-- /.box-body -->
</div>
<!-- /.box -->
</div>
<!-- /col -->
</div>
<!-- div -->
</section>

```

Appendix E

Forms of Existing System

		EYE BANK OF ETHIOPIA የኢትዮጵያ የዓይን ባንክ Cornea Donors CARD የዓይን ብሉን ለጋሾች ካርድ ☎: +251-11-122 38 38 ፋክስ: +251-11-12249 83 ✉ 31642 ኢ. ሜይል: eyebank@ethionet.et	
ሙሉ ስም Full Name _____	ም.ቁ. Ref. No. _____		
ዕድሜ Age _____	ፆታ Sex _____	ከተማ City _____	ቀን Date _____
ክፍለ ከተማ Sub city _____	ቀበሌ Kebele _____	የቤት ቁ. H.No. _____	
የቤት Res. _____	የመ/ቤት Off. _____	ፖስታ <input type="checkbox"/> _____	
ሞባይል Mob. _____	ፋክስ Fax. _____	ኢ.ሜይል E-mail _____	
የኢትዮጵያ የዓይን ባንክ ዓላማ ባቻ የሚያገለግል			

እኔ ስሜ በዚህ ካርድ የተጠቀሰው ከዚህ ዓለም በምት በተለየሁ ጊዜ የዓይን ብሉን፣ የኢትዮጵያ የዓይን ባንክ እንዲለገሱ በፈቃደኝነት በመስማማት ፈርሜያለሁ። ይህም በዓይን ብሉን ጠባላ ምክንያት የሚመጣ ዓይነውርነትን ለመከላከል የዓይን ባንኩ ለሚሰጠው አግልግሎት ድጋፍ እንዲሆን ነው።

I, the undersigned hereby voluntarily pledge my corneas to the Eye bank of Ethiopia upon my death. This is in support of the Eye Bank's activity in combating cornea blindness.

የሌጋሽ ፊርማ Donor's Signature	የዓይን ብሉን ልገሳ አስተባባሪ ስምና ፊርማ Cornea Donation Coordinator's Name & Sign.
የኢትዮጵያ የዓይን ባንክ ዓላማ ባቻ የሚያገለግል	

Appendix - 2
EYE DONOR MEDICAL PARTICULARS

1. Name of the Deceased : _____

2. Age & Sex : _____

3. Permanent address : _____

4. Date of Death : _____

5. Time of Death : _____

6. Place of Death : _____

7. Manner of Death : Natural Accident Suicide Homicide Pending investigation

8. Cause of Death : _____

9. Secondary Causes : _____

10. Visible Identification Marks : _____

11. Information given by next-of-kin & Relationship with the donor : _____

12. Death Certificate : Available Not Available
Reason for not obtaining death certificate copy: _____

13. The certificate is under process & will be submitted later

Signature _____
Name of Next-of-kin _____

I hereby certify the death of Mr. / Mrs. / Ms: _____

Signature _____
(Doctor attending Eye donation call)
Name: _____
Regn. No. _____

Date: _____
Place: _____

Appendix - 1
DONOR CALL - INITIAL INFORMATION

Time _____ Date _____

Name of the donor _____

Age of the donor _____ Sex of the donor _____

Time of death _____ Cause of death _____

Name of the caller _____

Relationship with the donor _____ Contact Phone _____

Body availability

Placed at: House Hospital Mortuary

Will be taken away to the house from Hospital / mortuary in about _____ mins./hrs.

Address (where the body is available) _____

Specific landmarks & detailed directions to reach the above address: _____

Death Certificate Available Not available

Comments & additional remarks _____

Receiver's Name _____ Designation _____

Case# _____ Month _____ Year _____

Signature _____

60

NA : NOT APPLICABLE NRA : NO REPORT AVAILABLE

DEATH TO REFRIGERATION TIME : _____

LAB TEST RESULTS : _____

WBC / DATES / COUNT : _____

Temp, trends : _____

CULTURE TYPE : Blood _____ Date _____ Growth _____

CULTURE TYPE : Blood _____ Date _____ Growth _____

MEDICATIONS : _____

Name & Signature of fellow _____

HARVESTED DONOR EYE DATE

EYE DONATION Voluntary []

Motivated [] Motivated by : _____

Designation : _____

DONOR DATA

Consent taken at : _____ a.m. / p.m.

Consent given by : _____

Position of body : _____

Phakic : _____ Aphakic : _____

of tissues : [] Blood sample obtained : Yes / No []

During the procedure : Problems : _____

Solutions : _____

Procedure done by : _____ Time _____ a.m./ p.m.

Procedure done at : _____

Assisted by : _____

Team members : _____

Mode of transport: Eye Bank to donor site _____

Donor site to Eye Bank _____

Case # _____ Month _____ Year _____

Date received _____ Time received _____

DONOR INFORMATION SHEET

Donor Eye Bank No: _____ / _____ / _____ / _____ / (Right / Left)

Name of the donor _____

Institution _____

Autopsy / History Number _____

Medical Examiner / Attending Physician _____

Age : _____ Religion : _____ Sex : _____

Date of injury / Admittance : _____

Death : Date _____ Hours _____

Enucleation / In situ Excision : Date _____ Hours _____

Type of Tissue : _____

Type of Preservation : _____

Lot Number : _____

Death to Preservation : _____

Immediate cause of death : _____

Medical / Case History : _____

Physical Appearance of Body _____

PATHOLOGIST'S COMMENTS concerning autopsy & Date of Interview _____

If Pathologist observed signs of IV drug use or infection? Yes / No _____

Donor visited a hospital? Yes / No If yes, length of stay _____

Hospital chart available to examine : Yes / No _____

Donor on a respirator? Yes / No If Yes, how long _____

Donor received blood products within 48 hours of death? Yes / No _____

Number of Units : _____ Last date / time obtained _____

type In Situ Observation : _____

Check / if any of the following apply : DO NOT USE FOR SURGERY

AIDS OR HIGH RISK GROUP _____ LYMPHOMAS / LYMPHOSARCOMA _____

ACTIVE HEPATITIS _____ INTRINSIC EYE DISEASE _____

BACTEREMIA / SEPTICEMIA _____ BLAST FORM S _____

CONGENITAL RUBELLA _____ RABIS _____

CNS DISEASE OF UNKNOWN ETIOLOGY _____ REYES SYNDROME _____

CREUTZFELD / JACOB DISEASE _____ ACTIVE SYPHILLIS _____

ENCEPHALITIS _____ CONJUNCTIVITIS _____

MULTIFOCAL LEUKOENCEHALOPATHY _____ DEMENTIA _____

JAUNDICE / except when due to non-infectious causes / _____

SUBACUTE SCLEROSING PANENCEPHALITIS _____

Donor refrigerated? Yes / No, if Yes : Date & Time of refrig. _____

Appendix - 8

Case # _____ Month _____ Year _____

TISSUE DISTRIBUTION INFORMATION

Eye Bank No : _____ / _____ / _____ / _____ / (Right / Left)

ORIGINAL
Should be filed and
kept in the eye
bank.

Age : _____ Religion : _____ Sex : _____
Injury / Admittance Date _____ Hour _____
Death : Date _____ Hour _____
Enucleation / Excision : Date _____ Hour _____
Preservation : Date _____ Hour _____
Cause of Death : _____

Medical History : _____
Ocular History : _____
Medications : _____

TISSUE PRESERVATION AND CORNEAL STATUS INFORMATION

Death - Preservation : (Time) _____ Hrs. _____ Mins.
Tissue Type : _____ Storage Method: _____
Lot Number: _____
Status: _____

Corneal Rating : _____
Epithelium : _____
Stroma : _____
Descemet : _____
Endothelium : _____
Count : _____ Cells / mm

Serology test for : HIV Antibody (Performed - Yes / No) Results _____
(Hepatitis B surface Antigen test (Performed - Yes / No) Results _____

Test for : HCV (Performed - Yes / No) Results _____

Test for : Syphilis (Performed - Yes / No) Results _____

General Comments : _____

Research only - _____ Name & Signature of EB Tech _____

Appendix - 5

IMMUNOLOGY LABORATORY SEROLOGY REPORT

Name _____ Date : _____

MRL No : _____ Serology No : _____

Age & Sex : _____ Category : Eye Bank _____

Nature of specimen : Blood : _____

Referring Eye Bank : _____

Reference No. : _____

Tests Done _____ Report _____

- 1. HIV : _____
- 2. HBe Ag : _____
- 3. VDRL : _____

Date : _____

Note :
1. The results relate only to items tested
2. This report shall not be reproduced except in full without written approval of the laboratory.

Technician : _____

Appendix - 6
TISSUE EVALUATION REPORT

Eye Bank No : _____ / _____ / _____ / _____ / (Right / Left) Size of cornea _____ mm

- Intact surface : Yes / No
- Haze : Yes / No
Degree : Light / Moderate / Heavy
- Exposure Keratitis: Yes / No
Amount _____ % (of surface)
Degree : Light / Moderate / Heavy
Location : Central / Periphery / Mid-periphery
Type : Diffuse / Band
- Sloughing : Yes / No
Amount _____ % (of surface)
Degree : Light / Moderate / Heavy
Location : Central / Periphery / Mid-periphery
- Other defects : Yes / No
Type _____
Location : Central / Periphery / Mid-periphery
Dimension : _____ mm

STROMA

- Clear : Yes / No
- Cloudiness: Yes / No
Degree : Light / Moderate / Heavy
- Arcus Senilis: Yes / No
Amount _____ mm (from limbus)
- Opacities : Yes / No
Comments _____

DESCEMET'S MEMBRANE

- Folds
Amount : None / Few / Several / Numerous
Degree : Light / Moderate / Heavy
Location : Periphery / Central / Mid-periphery/ Diffuse (total surface)

Appendix - 9
DONOR TISSUE TENTATIVE UTILITY DATA & ADVERSE REPORT FORM

ID # : _____ Date : _____ Time : _____

Age : _____ Death : _____

Sex : _____ Preservation : _____

Received : _____

ORIGINAL
(Should be sent back to the eye bank)

Tissue sent by : _____

Proposed date to use the tissue : _____

Name of the Surgeon : _____

Name of the Patient : _____

Hospital registration /Medical records I.D. no. of Patient : _____

Date of Surgery : _____

Date : _____

COUNSELLOR'S SIGNATURE & NAME

ADVERSE REPORT

Details of adverse findings:

Likely Reasons for adverse findings:

Suggestions:

Signature of Operating Surgeon / Team

RECIPIENT DATA (TO BE FILLED AT THE TIME OF SURGERY)

M.R. No: _____ Name: _____ Age: _____

Eye / Diagnosis _____

Time lapse between Enucleation and Utilization _____ Hours

Date of Surgery / Time _____

Operating Surgeon's Name _____

Surgical Procedure _____

Name & signature of the surgeon

ENDOTHELIUM

Excellent / Very Good / Good / Fair / NSFS
Comments _____

Cells per mm _____

OVERALL RATING OF TISSUE

EXCELLENT / VERY GOOD / GOOD / FAIR / POOR (Reason for rejection-Preventable / Partly preventable / Non-preventable)

Suitability for Surgical Use	< Yes No	Reason _____
Particles in Medium	Yes / No	Medium (if transferred) _____
Ratings changed	Yes / No	Media changed Yes / No
Labels	Very Good / Adequate / Poor	
Scleral Rim	Very Good / Adequate / Poor	

Checked by	Technician _____	Date & Time _____
	Fellow _____	Date & Time _____
	Consultant _____	Date & Time _____

DONOR DATA FOR CORNEAL TRANSPLANTATION

1. Consignment No: CP 256 20/20/20 No. of tissues received _____ Eyes _____
Blood Sample / Report received _____ Corneas _____
 2. Name of Eye Bank / Place / Code _____
 3. Time lapse between Enucleation & Receipt of Consignment _____ Hours _____ Minutes
 4. Age of the Donor / Initials _____
 5. Time of Death / Date _____
 6. Time of Enucleation / Date _____
 7. Time lapse between Death and Enucleating _____ Hours _____ Minutes
 8. Cause of Death _____
 9. Method of Preservation:

Moist Chamber: _____	Medium Preserved: _____
Condition of bottle _____	Name of Medium _____
Condition of Cap _____	Lot No. _____
Bottle had _____ 1/4 1/2 3/4 Full _____ Water _____	Condition of Vial _____
Colour of the water present _____	Colour of Medium _____
Trimming of conjunctiva Yes / No _____	Any foreign body present in medium _____
Discolouration of sclera _____	Position of cornea _____
Presence of foreign matter _____	
 10. Condition of thermocol box _____
 11. Position of ice in the thermocol box _____
 12. General Evaluation of Eye Ball _____
 13. Aphakia: Yes / No _____
 14. Lens ----- Slit Lamp Evaluation: _____
Nuclear Sclerosis _____
- Posterior Sub Capsular _____
Cortical Cataract _____
Total Cataract _____
Clear _____
Case No _____

Declaration

I declare that this project is my original work and has not been presented for a degree in any other university.

Signature

Date

The project has been submitted for examination with my approval a university advisor.

Name and signature of Advisors:

Name	Signature	Date
1. Dr. Lemmma Lassa (PhD)	_____	_____
2. Professor. Ahmed Ali (professor)	_____	_____

Jun 2017, Addis Ababa, Ethiopia