Addis Ababa University

College of Natural Sciences

E-Complaint management system in local government: Case of Addis Ababa City Administration

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This is to certify that the thesis prepared by Endashaw Wolde, titled: *E-complaint management system in local government: In the Case of Addis Ababa city* and submitted in partial fulfillment of the requirements for the Degree of Master of Science in Computer Science complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Abstract

Today e-government technologies are changing the nature of the interactions between residents and local government of a given city by intensifying the speed and impact of citizen complaints. The question of handling complaints of residents is an important part of service delivery in local government.

The way in which residents of Addis Ababa city can file their complaint to their respective local government and get immediate response for their filed complaint is time taking and complex. Due to absence of effective web based customer complaints management system in the city, the residents are posing a question on the lack of effective complaint handling system.

In this project we developed a web based complaint management system in local government of Addis Ababa city. To do that, we first study the current system to get necessary information to have a clear view of the existing method of complaint management system in AACA. This is done using observation, and revision of documents that AACA currently uses to handle complaint. Based on requirements gathered, analysis and design documents are prepare. The system enables city residents to participate in controlling the quality of the service provided in a city and able to citizens' report/complaint their problems to their local governments to have an effective and efficient response.

Finally, web based complaint management System prototype evaluation is conducted using questionnaire by involving 73 different participants. The results have shown that the web based complaint management system is easy to use, saves time and resource.

Keywords:

Web based Complaint Management System, Local government, E-government.

Dedication to:

My Brother Zenebe Wolde

(Died suddenly due to heart attack)

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Acronyms and Abbreviations

AACA	Addis Ababa City Administration
CSS	Cascading Style Sheet
DBMS	Database Management System
GHZ	Giga Hertz
GB	Giga Byte
GUI	Graphical User Interface
HTTP	Hypertext Transfer Protocol
HTML	Hypertext Markup Language
ICT	Information and Communication Technologies
MySQL	My Structured Query Language
PHP	Hypertext Preprocessor / Personal Home Page
RAM	Random Access Memory
TV	Television

Chapter 1: Introduction

1.1 Background

Addis Ababa is the capital and largest city of Ethiopia. The city was established just over one hundred years ago and was recognized in the late nineteenth century as permanent capital city of Ethiopia. From the time of its foundation, the city has been serving as seat of the central government of Ethiopia [1]. Nowadays, the city is divided into 10 boroughs, called sub cities (Amharic: ክፍለ ከተማ, kifle ketema) [2] and has a population of about three million as of 2007 census [3].

The local government of Addis Ababa city Administration consists of the Mayor, who leads the executive branch, and the City Council, which enacts city regulations [4]. Among the many executive branches of Mayor Office, public complaints and Appeals Corrective office is responsible for receiving, reviewing and responding to public complaint [5].

Public complaints and Appeals Corrective office under Addis Ababa city Mayor office is responsibility to let resident of the city to lodge any complaints and appeals regarding any dissatisfaction on services provides by the local government of Addis Ababa Administration and provide responses to their grievances.

The city Administration Addis Ababa provides various services to its city residents and international organizations. One of the major duties of the city administration is handling any complaints comes from residents regarding services provided by the city administration and problems observed in the city. The question of handling complaints of a resident's of a city is an important part of service delivery in local.

Complaints can be defined as expressions of dissatisfaction that are expressed toward the local government of a city with the aim of making a city governor aware of a situation that is subjectively experienced as unsafe [6]. For instance illegal trash dumping, faulty street lights, illegally parked cars, broken tiles on sidewalks, illegal advertising boards, liquid and solid waste smell, Illegal building construction materials on the road, loud sound echoes beginning at midnight from a nearby nightclub and others are a situation that is subjectively experienced as unsafe.

Complaints' hearing procedure in Addis Ababa city is manual and complex. Local authorities lack the equipment needed to handle complaints of the city. Due to absence of effective customer complaints management system in the city, the residents are posing a question on the lack of effective complaint handling. So, it is very crucial for Addis Ababa city to have a system which manages complaints of a city residents.

Advancement in information communication technology changed the scene of the communication between governments and residents. Information communication technology not just gives chances to governments to direct their citizens to the websites for information, applications and transactions yet it likewise permits residents to take advantage of the internet in place should launch their contact with governments furthermore should express their appeals, complaints, suppositions and suggestions [7].

Therefore, in this study, we propose a system that enables residents to directly report complaints (e.g. potholes, illegal trash dumping, faulty street lights, broken tiles on sidewalks, and illegal advertising boards), and, on the other hand, provides the necessary back-end infrastructure and interfaces for complaint handlers to keep track of the reported issues, schedule their settlement and provide feedback to the resident about the progress status.

1.2 Motivation

"Powerful and user-friendly technologies are changing the nature of the interactions by intensifying the speed and impact of customer complaints" [8] and also by fostering negative customer engagement [9]: Increasingly, firms face the rising threat that Unhappy Customers Strike Back on the Internet [10], voice their dissatisfaction online, and publicly Complain to the Masses [11].

Addis Ababa city government more than any time ever, exerts efforts in transforming the city to make it a prosperous, clean, safe and pleasant for the city inhabitants at least by deploying user-friendly technologies for public service delivery [12] . Despite this, deployment of these user friendly technologies especially technologies in which residents can use it for reacting on local issues such as potholes, illegal trash dumping, faulty street lights, illegal parked cars, broken tiles on sidewalks, illegal advertising boards and others to its city government is not yet implemented.

Residents of the Addis Ababa city are using difficult means to report their problems to their city government. Television and FM radio stations are the widely used means of communication to report their dissatisfactions to their local government. As a result, residents are not getting prompt responses for specific complaints from the local government.

By implementing modern technologies in Addis Ababa city, it is very easy to create direct citizen-government interaction that can connect its citizen with local governors in order to accept localized and timely complaint from its resident's and then react immediately on those complaints.

So, the issue described above motivated us to undertake this study to facilitate the way local government interact with their residents and respond to their requests through modern information communication technology infrastructure.

1.3 Statement of the Problem

Today in AACA, complaint registration and handling service is time taking and complex route for the effective action. Anyone who wants to register complaint should visit in person one of the offices found in Addis Ababa city Woredas or Kifle Ketema or call to one of the radio stations found in the city in order to ask them to broadcast his/her complaints to the concerned body of the city.

Complaints' hearing and handling procedures in Addis Ababa City Administration have several deficiencies. Among them processing and resolving complaints are not an easy task. Processing manually registered complaints requires more time and manual efforts. Hard to analysis the complaint that come from residents also not an easy task of the current system of Addis Ababa City Administration

Re –complaining for not processed complaints also needs another re-visit of complaint handling offices for further registration of complaints [13].

Implementing effective complaint handling system in Addis Ababa city improves complaint handling problems of the city. For deploying effective complaint handling system, information communication technology services opened up huge opportunities for local government of any city to transform operations and service delivery systems into a convenient

one for residents. Hence, ICT based effective complaint handling system in the local government of Addis Ababa city administration efficiently manage resident complaints.

1.4 Objectives of the study

General Objective

The general objective of this project work is to develop web-based complaint management service for local government Addis Ababa City Administration.

Specific Objectives

The following specific objectives are identified in order to achieve the specified general objective:

- Explore the existing Addis Ababa city administration approach of handling citizen complaints.
- Explore the related work in the area of complaint management system.
- Identify the functional and non-functional requirements
- Design a system architecture.
- Develop a prototype that shows the practicability of the work.
- Evaluating the system.

1.5 Methods

In this research work, in order to carry out the stated objectives of the study, different methods was executed.

Literature Review

Different literatures relevant to the study is reviewed and some of the concepts are adopted for our work. Research papers related to complaint management are investigated in detail to acquire a deeper understanding of the research area and its problem domains.

Data Collection

Relevant data for the purpose of requirement determination are collected from different area of Addis Ababa city.

Tools

Various free and open source tools was used for developing the system.

Testing and Evaluation

Appropriate testing is made and the newly proposed solution is evaluated in terms of its goals and contributions by experts in order to verify the significance of the work.

1.6 Scope and Limitations

The scope of this work is to develop web-based complaint management system for Addis Ababa city government in which:

- ✓ Residents are able to report issues from their desktop PC.
- ✓ Complaint handlers to easily manage the reported issues at back-end infrastructure.

1.7 Application of Results

This thesis work is about the process of creating web-based complaint management system for Addis Ababa city government. This study is applicable to provide services to Addis Ababa city government for creating interaction between city government and city citizens. After completely implemented, complaint management services will be used by:

- ➢ Addis Ababa city government in order to encourage the contribution of users in planning specific actions and influencing decisions.
- ➢ Management members of Addis Ababa city government thereby to smooth the progress of the work flow between city dweller and local administration sectors.
- ➢ Residents of the city for viewing the on-hand problems from their point of view and re-act to their desires.
- ➢ Governors' of the city for improving the efficiency, transparency, and accountability of public sector.

1.8 Organization of the Rest of the Thesis

The report is organized as follows. Chapter Two covers literature review. Chapter Three presents the previous works that are related to this thesis. Chapter Four discusses the system analysis of web based complaint management system of Addis Ababa City Administration. In Chapter Five we will discuss system design of CMS of AACA. The test and experiment of the proposed system are discussed in Chapter Seven. Finally, the conclusion made on the

thesis result, the contribution of this research work and recommendation on possible future work related to the thesis are presented.

Chapter 2: Literature Review

2.1 Introduction

In this chapter, a number of different papers that emphasis on “Complaint management system” are presented. Different papers that provide background information about complaint, complaint handling, and public service delivery process and citizen participation in local government are reviewed. Furthermore, technical approaches towards complaint handling have been revised and presented.

2.2 Basic Concept of Complaint

Definitions

A complaint has been defined as an action taken by an individual, which involves communicating something negative regarding a product or service, to either the firm manufacturing or marketing the product or service, or to some third party entity, with expectation of redress [14]. This definition was found suitable for probing into the factors that affect the process of redress. Viewing complaint handling as 'a sequence of events' could facilitate analyses regarding the determinants of the outcome. Another definition define a complaint as an expression of dissatisfaction, about the standard of service, actions or lack of action by an organization to an individual. According to Tronvoll [15] it is an action taken by an individual which involves communicating something negative regarding service. Hoyer & McInnis [16] argues this dissatisfaction is based on the customer’s feelings and perception. This view is very significant in the services domain since quality evaluation to a certain degree is based on customer’s subjectivity and failure in services can affect customer outcome and service process.

2.2.1 Customer complaint

Muhammad [17] in his work defines a complaint as a statement that shows unsatisfactory/unacceptable, or it also may define as a description of a problem and procedures that a person follow in order to resolve that problem before reaching the point where he or she does not know how to. Those whoever receiving the complaints usually

view them as negative attacks by disaffected people, however, complaints can also bring advantages.

Customers' complaints play very important role for any organizations as stated in [17]. Complaints could bring benefits to the organizations such they may identify areas that needed improvement, provide opportunities for customer to voice their opinion on certain matters, and also provide quality service and satisfaction to the customers. So, it is very important to handle a costumer's complaint, because it may lead to an improvement for customer service in the organization.

2.2.2 Customer Complaint Procedures

It is essential for a firm to have an effectual response when a complaint takes place. This should be seen in the form of the quality of the reply, ability to address customers concern and perception and plan for future prevention [18]. Various authors have separately tried to conceptualized complaint management process. For example, Wysocki et al. [19] identifies three important aspects of the complaint process which includes (i) activity seeking customer complaints; (ii) recognizing the type of customer that is complaining; and (iii) responding appropriately based on the type of complainants.

2.2.3 Complaint management

Complaint management is the way in which companies systematically handle problems in customer relations [20]. According to Johnston [21] it involves the receipt, investigation, settlement and prevention of customer complaints and recovery of the customer. A customer complaint is a report from a consumer providing documentation about a problem with a product or service or again, is any expression of dissatisfaction by a customer or potential about customer delivery or a product by the company or its agents. The goal is to stabilize customer relationships that are at risk and to assure a specific level of quality by creating a consistent business environment regarding personnel. Nobody is perfect. Mistakes can, and invariably do occur [22]. What matters is how an organization responds to such incidents. The most effective response is to fix the mistake and improve services, systems, practices, procedures and/or products to reduce the likelihood of incidents occurring again.

2.2.4 Handling Customer Complaints

According to Anderson [23] complaints and the processes for handling complaints are important issues for service providers because they have the potential to have an adverse effect on customer satisfaction and loyalty. Service providers appreciate the importance of managing complaints. Service providers should encourage dissatisfied customers to complain so that they can solve the problem and retain the customer. Unfortunately, organizations that do not rise to the challenge of complaining customers are turning down the important opportunity of reclaiming and improving a relationship.

2.2.5 Customer complaint handling procedure and its outcome

According to *Schaefer et al. reports* [24] , most of the organizations in these days have treated customer handling procedure as a strategic marketing tool. Service providers are frequently exhorted to strive towards a "zero defects" service; the ability to "get it right first time" is thought to offer significant benefits to organizations in terms of both customer evaluations and costs of delivery. Service firms should be better to realize the importance of complaint handling procedure and its outcome and also well again to bring into play this one as a strategic marketing tool to accomplish the benefits such as customer satisfaction, customer loyalty, favorable word-of-mouth publicity, and to decrease litigation.

2.2.6 Customer Feedback after Complaint Handling

Once customers have complained about a product or service and the complaining management has been satisfactory, their behavior and attitude can change. Customers can decide to patronize the product or reuse the service provider. In addition, the customer complaint handling process has been set up with the sole objective of ensuring all customer complaints, issues, and concerns are immediately acknowledged, actions are taken to resolve them in a timely manner and we satisfactorily complete the communication protocol with our clients - while ensuring that these errors and issues are not repeated.

2.3 Complaint handling approaches in AACA

Addis Ababa city is divided into 10 sub cities [25]. Addis Ababa city administration is in charge for managing any problems or complaint which actually occurs in the city. The city administration in charge of handling complaints about any inconveniences or problems in

the city.

2.3.1 Complaints' Hearing procedure of a city

Anyone who has complaints on the pervasion of Addis Ababa City Government Labor and Social Affairs Bureau has to mention his/her full name, address (city, sub city, woreda, house number, telephone number), main reason of complaints (application subject or core idea), date and place where the matter is occurred, the pertinent process (sub-process) or case- team, name of concerned civil servant in attaching photo copy of additional evidence if any to present the original ones upon request. In addition, the compliment has to briefly explain what is to be done for him/her. Finally, the applicant has to sign and put the date of application [25].

2.3.2 Complaint handling System in a city

The case is decided by the concerned process (sub- process) owner (coordinator). The pertinent process (sub-process) owner (co- coordinator) investigates and decides within three (3) consecutive working days from the date application and notify to the applicant is dissatisfied with the decision, he/she can apply next to the complaint and application hearing body (committee) of the application entertaining office [25].

2.4 Public service delivery process in Addis Ababa city

These days, urban areas over the world are confronted with various difficulties, which put a great deal of weight on city assets. Thus, the requirement for urban communities to address challenges they are confronting in a clever, well-organized and active manner. Innovative progressions display limitless chances to get down to business how urban areas are overseen and convey open administrations [26].

In addition, progressively capable and easy to use advancements are making open doors for governments to offer better approaches to interface with citizens keeping in mind the end goal to react to their requirements all the more adequately and with their fundamental participation [27].

As shown in the organization structure of the Addis Ababa City Administration in (Figure), the kebeles are responsible to report directly to the sub-cities. Then sub-cities carry many

of the duties of the woredas and some of the duties of city management, which make them focal point of the public administration for Addis Ababa residents [28].

Addis Ababa City Administration is responsible for addressing the complaints that the residents of the city might have. Accordingly, Social Affairs authorities, under Addis Ababa City Administration, is in charge of handling any appellants raised by residents regarding services provided at any level of Addis Ababa City Administration (woredas, sub-city , kebeles or from any other sectors).

2.5 Citizen Participation in local Governments

Unlike traditional types of engagement – Communication and Consultation, Citizen Engagement is an interactive two way process that encourages participation, exchange of ideas and flow of conversation. It reflects willingness on part of government to share information and make citizens a partner in decision making [29].

2.5.1 Citizen Participation

As argued by Punyaratabandhu [30], the concept of citizen participation in democratization context cannot be separated from the concept of good governance. Thus, it is essential to get understanding about the broader theoretical perspective by explaining good governance as a background of citizen participation, particularly in developing countries context.

2.5.2 Good Governance

The concept of good governance is increasingly used in many development literatures [30]. Governance is defined as ‘a complex system of interactions among structures, traditions, functions (responsibilities) and processes (practices) characterized by three key values of accountabilities, transparency and participation’ [30] or ‘exercise of authority and control in a society in relation to the management of its resources for social and economic development’ [31].

2.6 Technological approaches to complaint handling

Governments are increasingly using ICT in their daily operations and business with the promise of more and convenient service delivery, improved communication, transparency and accountability [32]. E-governance is defined as the use of ICT and particularly the Internet as

a tool to achieve better governance [33]. The use of ICT has changed the way of interaction between government and citizens. ICT not only provides the opportunities of government to be more efficient and direct citizens to their websites for information and application but also it allows citizens to take advantages of the internet to initiate their contacts with governments and to express their appeals ,complaints ,suggestion and opinions [34].

2.6.1 E-CRM

Electronic Customer Relationship Management (e-CRM) is gaining the attention of e-business managers who are interested in increasing repeat business and customer loyalty [35].

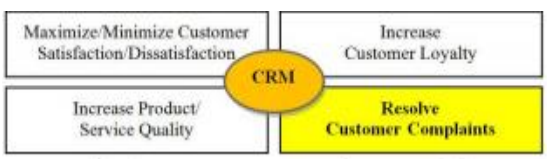

Figure 2. 1 Key components of e-CRM **[36]**

Complaint information should be shared among departments within a company and even other companies through the supply chain. Best-Practice companies have realized that using CRM strategy solves expected problems in implementation as all complaint information and defining between different complaints.

2.6.2 E-Complaint

Each organization has its own definition for complaint. They define complaint related to the services they provide for users. Hence definitions re different because of the variety of services among the organizations [37]. Customer complaining behavior defined as the consequences of customer dissatisfaction [38], it has long been considered an important form of market feedback. On other words, Customer Complaints Management is becoming a critical key success factor in today's business environment. Complaint Management System is a system that can survey customer feedback about any organization. Best-practice organizations consider complaints as opportunities for improvement.

2.6.3 E-government Applications

The World Bank defines E-government as the use of ICTs (such as wide area networks, the Internet and mobile computing) by government agencies to transform government by making it more accessible, effective and accountable [39]. Traditionally, interaction between citizens

and government took places in government offices. The introduction of the technology changed this tradition and makes services available near to citizens. These technologies can serve a variety of different ends: higher quality, cost effective and transparent delivery of government services to citizens, improved relationship between government and citizens, citizen empowerment through access to information and more efficient government management.

According to [40], the primary e-government types or models include:

A. **Government-to-Citizen (G2C)** - is communication link between government and citizens. The communication usually takes places using ICT, media campaigns and direct mail. G2C 7 includes information dissemination to the public, basic citizen services such as license renewals, ordering of birth/death/marriage certificates and filing of income taxes, as well as citizen assistance for such basic services as education, health care, hospital information, libraries, and the like.

B. **Government-to- Business (G2B)** - is communication link between government and business organizations. G2B transactions include various services exchanged between government and the business community, including dissemination of policies, memos, rules and regulations. Business services offered include obtaining current business information, downloading application forms, renewing licenses, registering businesses, obtaining permits, and payment of taxes.

C. **Government-to-Government (G2G)** - G2G services take place at two levels: at the local or domestic level and at the international level. G2G services are transactions between the central/national and local governments, and between department-level and attached agencies and bureaus. At the same time, G2G services are transactions between governments, and can be used as an instrument of international relations and diplomacy. Our main focus is on G2C model. Based on this model, a lot of applications were developed. For instance, Complaint Tracker, CiviRep are the major one.

2.7 Summary

In this chapter, we have reviewed and investigated numerous works. In the first section of this chapter we have reviewed basic Concept of Complaint and define complaints. In next sections of the chapter we reviewed about complaint handling approaches used AACA and in the final two section we have reviewed about citizen participation in local governments for smooth interaction between citizen and government and technological approaches to complaint handling for effective handling of complaint of a citizens.

Chapter 3: Related Work

3.1 Introduction

Today, powerful and user-friendly technologies are creating opportunities for governments to offer new ways to interact with citizens in order to respond to their complaints more effectively and with their essential participation. In Addition, powerful and user-friendly technologies plays a significant role in local government to enhance public service deliver. So far using advantage of the introduction of powerful and user-friendly technologies lots of research works have been conducted in public service deliver to enable citizens react on any dissatisfaction occurring in a certain place. Furthermore, because of the present technological evolution individuals are talented to immediately and easily collect wealthy information and transfer it through different communication devices [41]. In this chapter, the most recent previous related work on complaint management will be discussed in detail and summarized at the end of the chapter.

3.2 Web based complaint handling works

A research on public complaint handling was conducted by Abd et al. [42]. The main objective of this research is to develop a service-oriented framework for e-complaint web-based that targets the charity lifecycle using SOA shown below in *figure 3.1*. The cycle starts with distribution of different services that are provided through charity.

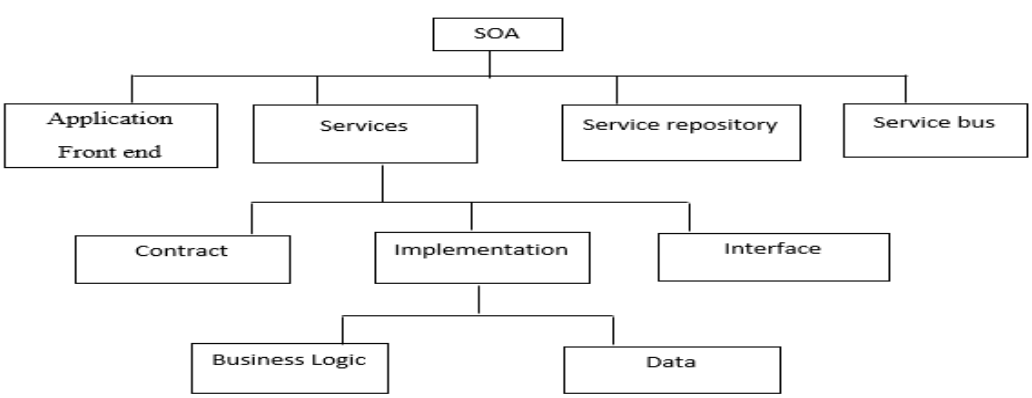

Figure 3. 1 Service Oriented Architecture (SOA) **[42]**.

This paper describes an overview of the development and implementation of the Complaint Management System as a web-service based on SOA. The results obtained from the prototype implementation are encouraging and promising for the development or more complex systems in the future as the Complaints Management is a complex and critical problem. Complaints and compliments are valuable source of information that organizations can use to improve program delivery and service. The researcher believes that the presented model can be helpful in other fields of e-complaining in terms of citizen adaption and citizen loyalty.

Another research work on complaint handling system through web application was also conducted by Abdi [43]. According to Abdi, current complaint management system of Addis Ababa City Administration has some limitations. First, it is difficult to reach large group of people and collect complaint from those groups. Second, it is difficult to manage even the collected ones. The main objective of this research to developed an electronic complaint management system.

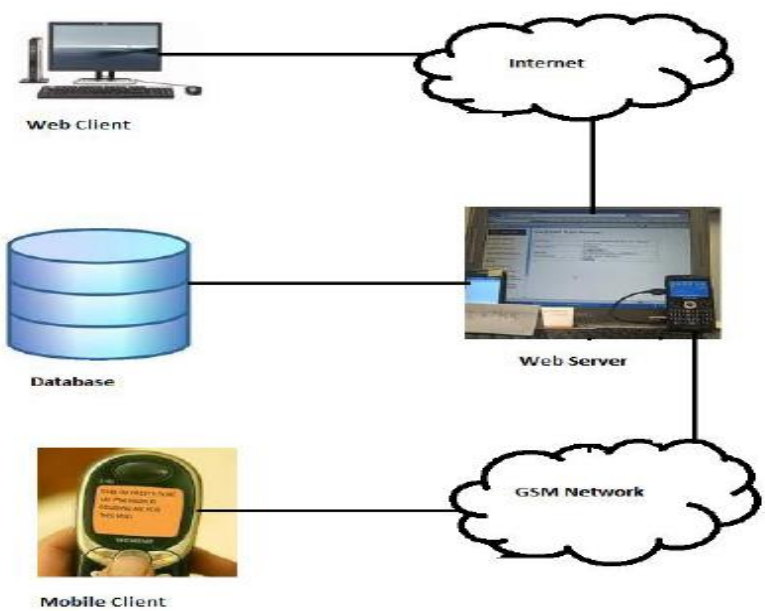

Figure 3. 2 E-CMS and GIS Mapping for AACA **[43]**.

The system architecture shown above in figure 3.2 enables collection of complaint from large group of people using current technologies: Complaints may reach to the system through short message service (SMS) or through website. The system autonomously accepts the complaints and forward to the respective responsibility. The results obtained

from the implementation meets his objective. The work needs improvements on design part to make the complaint management system flexible for users

The “Web Application for Complaint Tracking and Resolving” system was also conducted by Sneha et al. [44]. Their objective is overcomes problems of the existing system by providing easy way of solving the problems which are faced by the user. The proposed system is very helpful in reduce dissatisfaction of person by handling complaint timely. The system provides less paper work, better insight to problem, easy to track complaints, locate the problem areas in the organization, resource utilization, less processing time, managing records, ease of access, and concern of organization towards the users. As initial work they obtained encouraging results. Their work is limited on creating basic GUI for user registration, complaint registration and database connectivity.

Cloud Based Complaint Management Service was also conducted by Ajinkya [45]. Complaint Management is important from both customer as well as business point of view. Complaints contain direct voice of the customer which provides companies a huge volume of data which can be used to improve the quality of the product the company is manufacturing. The primary objective of this study is develop a cloud based multitenant complaint management service for efficiently manage customer complaints which will used by different companies and in the system implement the concept of multi-tenancy which provides the system with the property of designing the system according to terms and requirements of the organization. The results obtained from the implementation are encouraging and promising.

Another work by Chaudhary [46] on Online Complaint Management System provides an online way of solving the problems faced by the public by saving time and eradicate corruption. The objective of the online complaints management system is to make complaints easier to coordinate, monitor, track and resolve, and to provide company with an effective tool to identify and target problem areas, monitor complaints handling performance and make business improvements. Online Complaint Management is a management technique for assessing, analyzing and responding to customer complaints. Complaints management software is used to record resolve and respond to customer complaints, requests as well as facilitate any other feedback. By this system the public can save his time and eradicate corruption in government offices. In the proposed system the

citizen need not go to the government office for getting his problem solved. As a final result their application software meets the information requirements specified to a great extent.

3.3 Summary

All presented works in section 3.2 provides a direct communication channel between the citizen and local government which will be used by citizens in order to make complaints about their dissatisfaction on provided services. In addition, their works helps citizens in registering the problems that one is facing in particular area and by continuously following up them will result in a good, clean and peaceful environment. As improvement, all presented works in section 3.2 needs further enhancement in all aspect.

Chapter 4: System Analysis

4.1 Overview

This Chapter discusses the functional and non- functional requirements of web based complaint management system in case of AACA and the system models such as use case model, sequence diagram and activity diagram.

4.2 Requirements of web-based complaint management system in the case AACA

This is the list of requirements that the web-based complaint management system in the case of AACA must meet to satisfy city residents. The list consists of functional requirements that define what the application must do and non-functional requirements that define how the functional requirements should be met.

4.2.1 Functional requirements

Functional requirements capture the intended behavior of the system. This behavior may be expressed as services, tasks or functions the system is required to perform. Main functional requirements of the system include:

- ✓ The system should be able to create new accounts and login into the system with their accounts.
- ✓ The system should be able to allow residents of a city to report issues from their home using the web version.
- ✓ The system should be able to allow residents of a city to attach an image on the spot for describing the issue.
- ✓ The system should be able to allow residents of a city to select one of the pre-specified categories complaints.
- ✓ The system should be able to allow residents of a city to monitor status of their complaints.
- ✓ The system should be able to allow complaint management team to view all the issues lodged by resident of the city.

- ✓ The system should be able to allow complaint management team to the set status of the complaint lodged by resident of the city.

4.2.2 Non-Functional requirements

This section describes user-visible aspects of the system that are not directly related with the functional behavior of the system. Non-functional requirements include usability, performance, reliability, maintainability and security.

- ✓ **The system should be easy to use:**

  Usability is the easiness of the system a user can learn to operate, prepare inputs, and interpret outputs of system or component. To insure usability of the system there are:

  - Well-structured user manuals included at help menu
  - Informative error messages
  - Well-formed graphical user interfaces

- ✓ **Reliability:**

  Reliability is one of the important attributes that every system should have. Therefore, our system needs to be reliable in a way that it must continue operating in the expected way over time. For this a thorough testing will be done.

- ✓ **The system should be available all the time.**
- ✓ **Maintainability:**

  Maintenance is the activity of modifying a software product after initial delivery. Maintainability is the ease with which a software product can be modified. Our system will be modified based on user's requirement even after initial delivery. We divide maintenance in three categories:

  - **Corrective maintenance**: the correction of faults when the system does not behave according to its specification;
  - **Adaptive maintenance**: the adaptation of the system to changes in the operational environment while keeping the same functionality;
  - **Perfective maintenance**: the extension of a system's functionality and improvement in the services provided.

- ✓ **Security requirements:**

  To make sure that the system is secure enough, different security techniques will be implemented. These techniques include password hashing, session variables and form validation. Form validation will be done during any input-based functions to insure that the data is valid and the system is not vulnerable for attacks such as SQL injection. Session variables will be assigned a fixed time to expire so that the system will not be vulnerable to attacks such as session hijacking and so on.

4.3 System Modeling

System models consist of use case diagram, class diagram, sequence diagram and activity diagram.

4.3.1 Use Case diagram

The main concepts of use case modeling are actors and use cases. An actor represents an entity (human or may be system) external to the system which communicates with the system in order to achieve certain goals. On the other hand, use case describes the functionalities and a sequence of actions that provides something of measurable value to an actor. The use case diagram for web-based complaint management of AACA is presented on Figure 4.1 below.

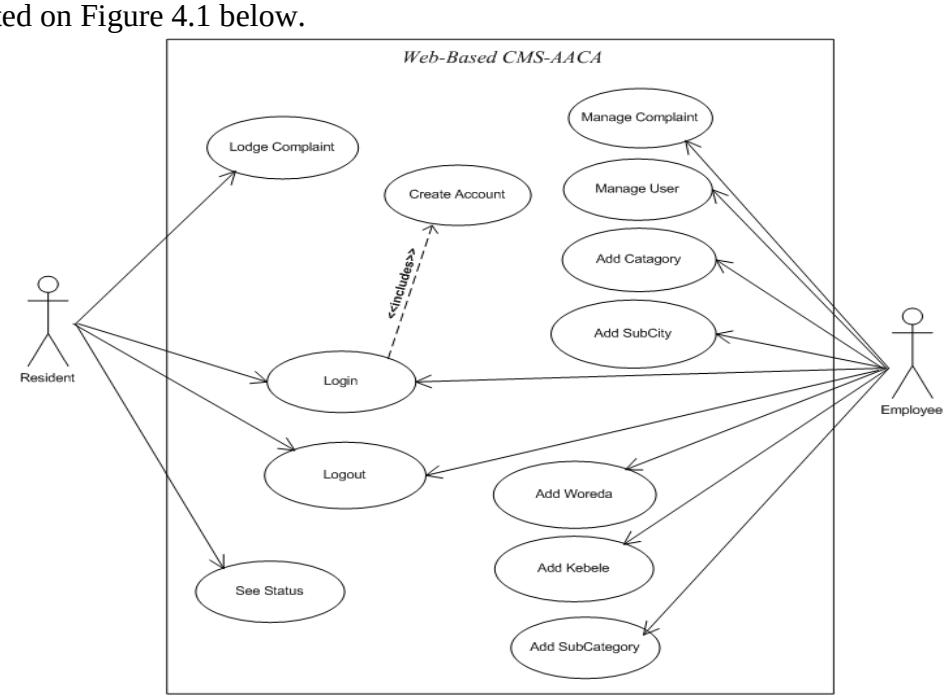

Figure 4. 1 Use case Diagram for Web-Based CMS-AACA

- **Descriptions of Actors**
  - ✓ **Resident:** a person (complainant) who makes complaint and check for existing complaint status.
  - ✓ **Employee:** a person who manages Web-Based CMS of AACA and the responsible staff of the service department who deals with the waiting complaints by identifying and analyzing the causes and actions for each complaint then resolving it according to the management rules and propose a preventive action in order to ensure that this complaint will not be raised again.
- **Use case descriptions of the proposed system**
  - Use case of description of ***create account*** for web-based complaint management of AACA is presented below on Table 4.1.

Table 4. 1 Use case descriptions of Create Account

Use Case Name	**Create Account**
Actor(s)	Resident
Purpose	Allows the residents to create account for themselves.
Pre-condition	The residents must launch the system.
Basic Flow of Events This use case starts when the residents accesses the system feature that enables him/her to create an account by entering information that is maintained in the User's account. 1. The User enters the required User Account information values and requests that the system saves the entered values. 2. The system validates the entered User Account information. 3. The values for the User Account information are stored in the User's account. The system notifies the User that the account has been created. 4. The use case ends	

Post condition	A new user account is created and ready to be granted appropriate access to the system.

- Use case of description of ***Login*** for web-based complaint management of AACA is presented below on Table 4.2.

Table 4. 2 Use case descriptions of Login

Use Case Name	**Login**
Actor(s)	Resident, Employee
Purpose	The Resident, Employee are authenticated and the system displays all features available for the role the Resident, Employee is associated with as defined in his/her user account.
Pre-condition	The residents or Employee must launch the system.
Basic Flow of Events This use case starts when the User accesses the sign in feature of the system. 1. The system prompts the User for his/her username and password. 2. The User enters his/her username and password. 3. The system validates the entered information, making sure that the entered username and password are valid for one user account in the system, and that the required password is entered for the entered username. 4. The User is login in. The system displays a message indicating that the user is login in. 5. The use case ends.	
Post condition	If the use case was successful, the actor is now logged into the system. If not the system state is unchanged.
Alternative Flows	*Invalid Name / Password*

	✓ If in the Basic Flow the actor enters an invalid name and/or password, the system displays an error message. The actor can choose to either return to the beginning of the Basic Flow or cancel the login, at which point the use case ends.

- Use case of description of ***Lodge Complaint*** for web-based complaint management of AACA is presented below on Table 4.3.

Table 4. 3 Use case descriptions of Lodge Complaint

Use Case Name	**Lodge Complaint**
Actor(s)	Resident
Purpose	Allows the residents to register complaints.
Pre-condition	The residents must logged into the system.
Basic Flow of Events This use case starts when the User accesses the complaint register (ቅሬታ አቅርብ) feature of the system. 1. The Residents selects “ቅሬታ አቅርብ” link from the menu item. 2. The system displays a form to be filled. 3. The Residents fills all the required information 4. The system validates the entered information. 5. Residents submits the validated information into the database. 6. The system displays conformation message. 7. The Residents chooses “Ok” button 8. The use case ends.	
Post condition	

Alternative Flows	✓ *Required fields missed.* *1. The system displays appropriate message based on missed filled(s).* *2. Go to step 3.*

- Use case of description of ***See Status*** for web-based complaint management of AACA is presented below on Table 4.4.

Table 4. 4 Use case descriptions of See Status

Use Case Name	**See Status**
Actor(s)	Resident
Purpose	Allows the residents to view their complaint.
Pre-condition	The residents must logged into the system.
Basic Flow of Events This use case starts when the User accesses the complaint status (የቅሬታዎ ሁኔታ) feature of the system. 1. The Residents selects "የቅሬታዎ ሁኔታ" link from the menu item. 2. The system displays the status of each complaint with ***closed***, ***not processed yet*** information. 3. Use case ends	
Post condition	
Alternative Flows	

- Use case of description of ***Logout*** for web-based complaint management of AACA is presented below on Table 4.5.

Table 4. 5 Use case descriptions of Logout

Use Case Name	**Logout**
Actor(s)	Resident, Employee
Purpose	Allows the residents and Employees to logout from the system.
Pre-condition	The residents and Employee must logged into the system.
Basic Flow of Events This use case starts when the User accesses logout feature of the system. 1. The Residents selects "Logout" link from the menu item. 2. The system logout from the system 3. Use case ends	
Post condition	
Alternative Flows	

- Use case of description of ***Manage Complaint*** for web-based complaint management of AACA is presented below on Table 4.6.

Table 4. 6 Use case descriptions of Manage Complaint

Use Case Name	**Manage Complaint**
Actor(s)	Employee
Purpose	Allows the Employee to manage complaints.
Pre-condition	The Employee must logged into the system.
Basic Flow of Events This use case starts when the User accesses the manage complaint (ቅሬታ ማስተዳደር) feature of the system. 1. The Employee selects "ቅሬታ ማስተዳደር" link from the menu item. 2. The system displays a sub menu items containing *Not Processed*, *Pending*, and *Closed* Complaints. 3. The Employee choose one of the sub menu items to take action on complaints. 4. Upon taking action on complaints, the Employee update the status of complaints. 5. The use case ends.	
Post condition	
Alternative Flows	

- Use case of description of ***Manage User*** for web-based complaint management of AACA is presented below on Table 4.7.

Table 4. 7 Use case descriptions of Manage User

Use Case Name	**Manage User**
Actor(s)	Employee
Purpose	Allows the Employee to manage Users.
Pre-condition	The Employee must logged into the system.
Basic Flow of Events This use case starts when the User accesses the manage Users (ተጠቃሚዎችን ያስተዳድሩ) feature of the system. 1. The Employee selects "ተጠቃሚዎችን ያስተዳድሩ" link from the menu item. 2. The system displays a list of users from database. 3. The Employee then will manage users. 4. The use case ends.	
Post condition	
Alternative Flows	

- Use case of description of ***Add Category*** for web-based complaint management of AACA is presented below on Table 4.8.

Table 4. 8 Use case descriptions of Add Category

Use Case Name	**Add Category**
Actor(s)	Employee
Purpose	Allows the Employee to add complaint categories.
Pre-condition	The Employee must logged into the system.
Basic Flow of Events This use case starts when the User accesses the Add Category (ምድብ ያክሉ) feature of the system. 1. The Employee selects "ምድብ ያክሉ" link from the menu item. 2. The system displays a form to be filled. 3. The Employee fills all the required information 4. The system validates the entered information. 5. Employee submits the validated information into the database. 6. The system displays conformation message 7. The use case ends.	
Post condition	
Alternative Flows	

- Use case of description of ***Add Woreda*** for web-based complaint management of AACA is presented below on Table 4.9.

Table 4. 9 Use case descriptions of Add Woreda

Use Case Name	**Add Woreda**
Actor(s)	Employee
Purpose	Allows the Employee to add list of Woredas found in Addis Ababa city.
Pre-condition	The Employee must logged into the system.
Basic Flow of Events This use case starts when the User accesses the Add Woreda (ወረዳ አስገባ) feature of the system. 1. The Employee selects "ወረዳ አስገባ" link from the menu item. 2. The system displays a form to be filled. 3. The Employee fills all the required information 4. The system validates the entered information. 5. Employee submits the validated information into the database. 6. The system displays conformation message 7. The use case ends.	
Post condition	
Alternative Flows	

- Use case of description of ***Add Kebele*** for web-based complaint management of AACA is presented below on Table 4.10.

Table 4. 10 Use case descriptions of Add Woreda Add Kebele

Use Case Name	**Add Kebele**
Actor(s)	Employee
Purpose	Allows the Employee to add list of Kebeles found in each Woredas of Addis Ababa city.
Pre-condition	The Employee must logged into the system.
Basic Flow of Events This use case starts when the User accesses the Add Kebele (ቀበሌ አስገባ) feature of the system. 1. The Employee selects "ቀበሌ አስገባ" link from the menu item. 2. The system displays a form to be filled. 3. The Employee fills all the required information 4. The system validates the entered information. 5. Employee submits the validated information into the database. 6. The system displays conformation message 7. The use case ends.	
Post condition	
Alternative Flows	

- Use case of description of ***Add Sub-Category*** for web-based complaint management of AACA is presented below on Table 4.11.

Table 4. 11 Use case descriptions of Add Sub-Category

Use Case Name	**Add Sub-Category**
Actor(s)	Employee
Purpose	Allows the Employee to add complaints sub categories for each main category of a complaint.
Pre-condition	The Employee must logged into the system.
Basic Flow of Events This use case starts when the User accesses the Add Sub-Category (ንዑስ ምድብ ያክሉ) feature of the system. 1. The Employee selects "ንዑስ ምድብ ያክሉ" link from the menu item. 2. The system displays a form to be filled. 3. The Employee fills all the required information 4. The system validates the entered information. 5. Employee submits the validated information into the database. 6. The system displays conformation message 7. The use case ends.	
Post condition	
Alternative Flows	

- Use case of description of ***Add Sub-City*** for web-based complaint management of AACA is presented below on Table 4.12.

Table 4. 12 Use case descriptions of Add Sub-City

Use Case Name	**Add Sub-City**
Actor(s)	Employee
Purpose	Allows the Employee to add list of sub cities found in Addis Ababa city.
Pre-condition	The Employee must logged into the system.
Basic Flow of Events This use case starts when the User accesses the Add Woreda (ክፍለ ከተማ ያክሉ) feature of the system. 1. The Employee selects "ክፍለ ከተማ ያክሉ" link from the menu item. 2. The system displays a form to be filled. 3. The Employee fills all the required information 4. The system validates the entered information. 5. Employee submits the validated information into the database. 6. The system displays conformation message 7. The use case ends.	
Post condition	
Alternative Flows	

4.3.2 Sequence Diagram

Sequence diagram are used to formalize the behavior of the system and to visualize the communication among objects. Since it is useful for identifying additional objects that participate in the use cases and describe patterns of communication among a set of interacting objects, the diagram is developed for each use case. An object interacts with another object by sending message. The reception of a message by an object triggers the execution of an operation, which in turn may send messages to another object. Arguments may be passed along with a message and are bound to the parameters of the executing operation in the receiving message. In this section, sequence diagram for lodge and manage complaint for web-based complaint management of AACA is presented on Figure 4.2 and Figure 4.3 respectively. The sequence diagram for other use cases is shown in Annex C. The Sequence diagram

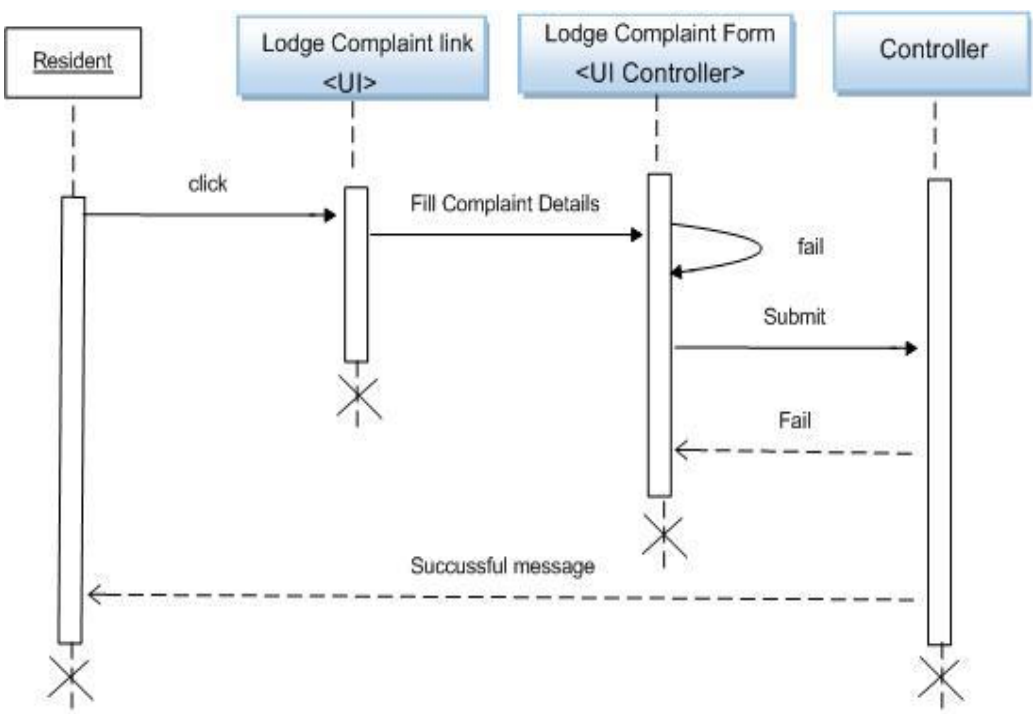

Figure 4. 2 Sequence Diagram for Lodge Complaint

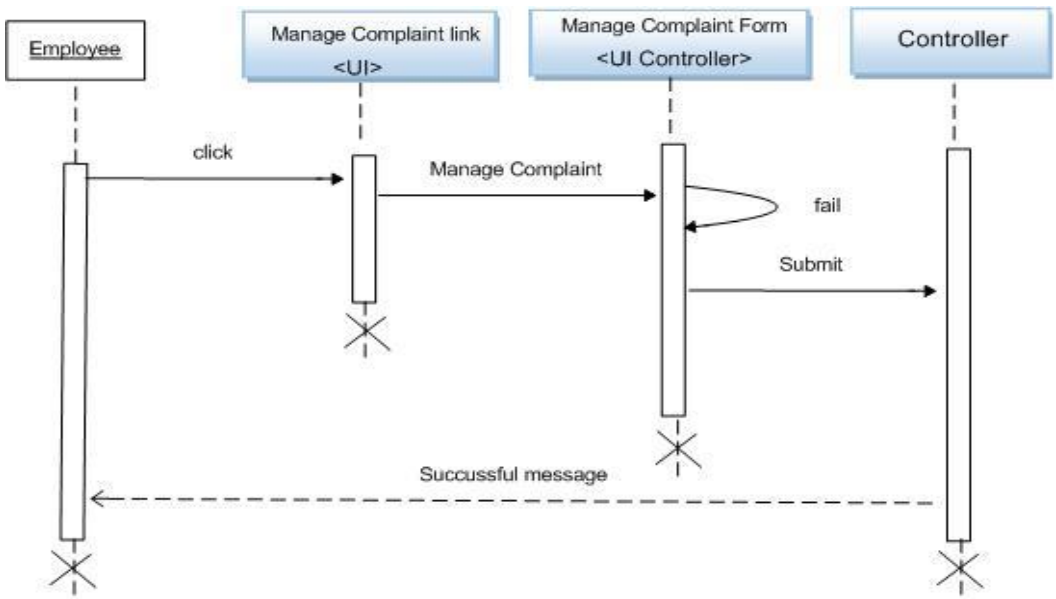

Figure 4. 3 Sequence Diagram for Lodge Complaint

4.3.2 Activity Diagram

Activity diagram describe the workflow behavior of a system. In this section, activity diagram for lodge and manage complaint for web-based complaint management of AACA is presented on Figure 4.4 and Figure 4.5 respectively. The sequence diagram for other use cases is shown in Annex C.

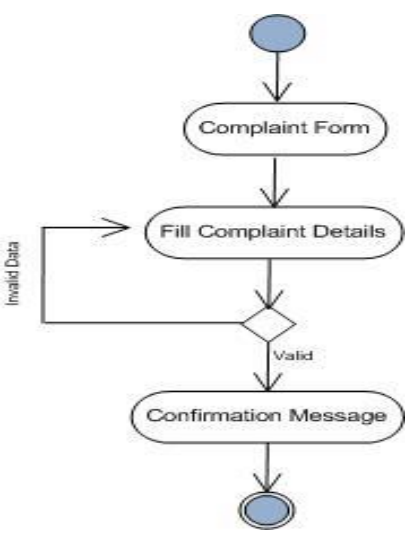

Figure 4. 4 Activity Diagram for Lodge Complaint

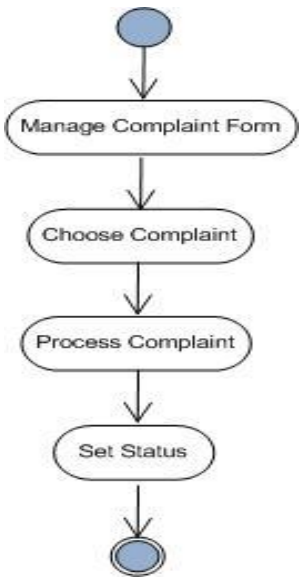

Figure 4. 5 Activity Diagram for Manage Complaint

4.3.3 Class Diagram

Class diagrams are used to describe the structure of a system in terms of classes, attributes, operations and association of objects in the class. The class diagram of web-based complaint management of AACA is presented on Figure 4.6 below.

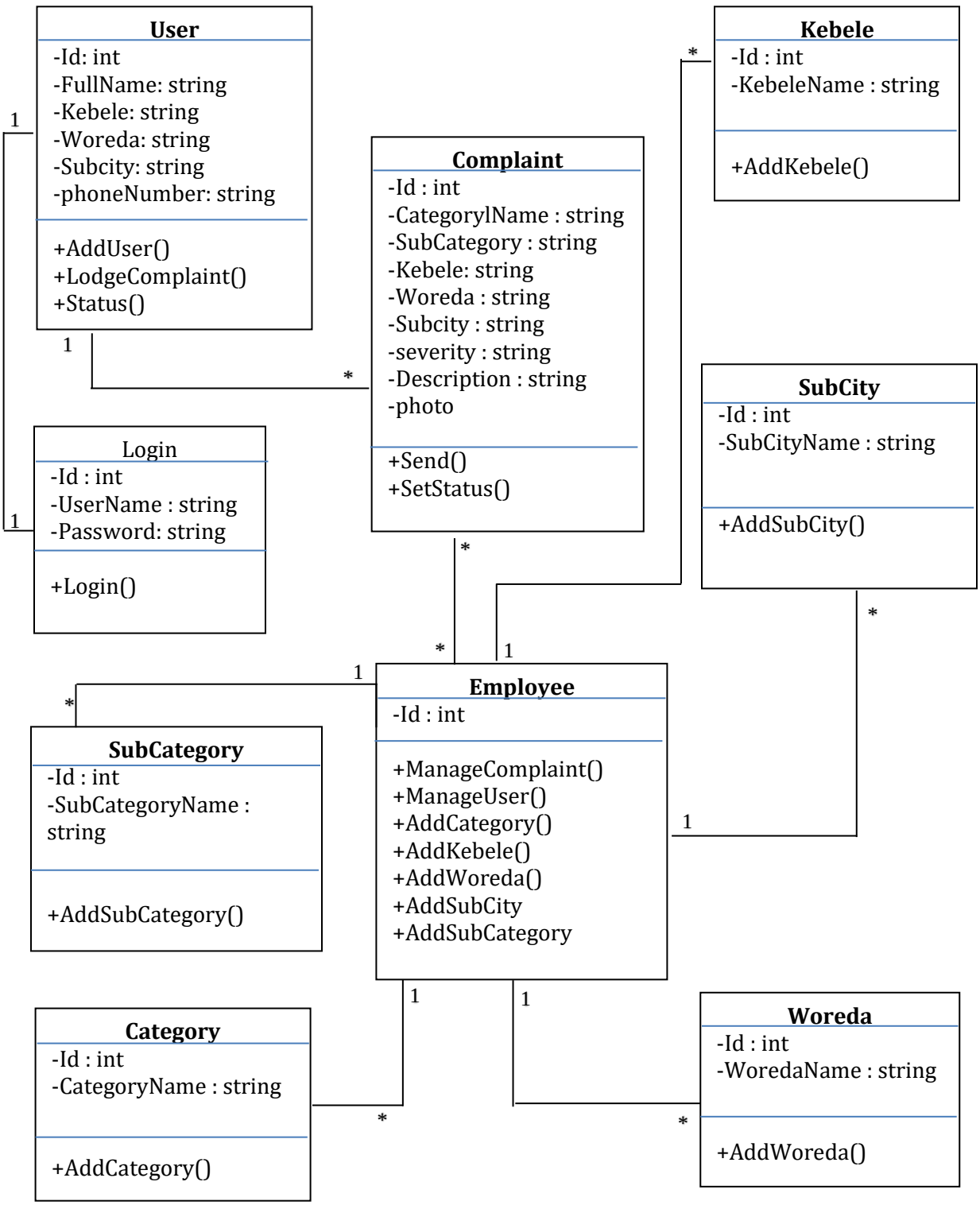

Figure 4. 6 Class Diagram of AACA CMS

Chapter 5: System Design of the CMS of AACA

5.1 Overview

In this chapter, we will discuss the design of Web-based CMS of AACA. Particularly, we will discuss the design goal of the system, the proposed software architecture for the system, sub-system decomposition, system hardware/software and persistent database design.

5.2 Design goal

Design goals represent the expected qualities of the system and provide a consistent set of criteria that must be considered when making design decisions. Most of the design goals of the system are inferred from the non-functional requirements and the application domain will follow the same set of criteria. The design goals can be generally grouped into performance criteria, dependability criteria, maintenance criteria and end user criteria.

- **Performance Criteria**

Response time:

The system should provide as fast response as possible, at least before the session expires in registering bus and route records, and displaying information. In order to minimize the time it takes to provide response, interface design has not included any large graphic files and middle-tier processing code is made as efficient as possible. Of course, the bus route map and graphical information might take a bit more time to be displayed, which might be seen as a trade-off.

Throughput:

The system should be able to support a number of users at a time using the available bandwidth of the system. The MYSQL DBMS used in the system development supports a number of users' concurrent access of the database without consistency problem.

- **Maintenance Criteria**

Modifiability:

The system should be easily extensible to the need of the CMS of AACA data formats availability and to add new functionalities to the system. The system is built from several more or less independent classes which can be used as a standalone application or replaced by other classes. This makes the system easy to change the existing functionality or add new ones when the need arises.

Portability:

The system should be easily portable to different platforms. As the PHP languages achieved platform independence through the Common Language Runtime (CLR), the end user can use the system using any browser such as Google Chrome, Firefox, Microsoft edge and Internet Explorer.

- **Dependability Criteria**

Robustness:

Ability to survive invalid user input is assured during data input, updating and deletion of data by providing some information about the error and then the system resets itself to the previous safe state.

Reliability:

In order to maintain the difference between specified and observed system behavior we try to test it as much as possible.

Security:

The system does not allow non-authorized users using a form based authentication.

- **User Criteria**

Utility:

The system must address the possible functional requirement of the system users. Consequently, all the functional requirements identified in the previous chapter have been implemented in the system.

Availability:

The system should be available for any legitimate users as long as the service provider is available or it is not shut down by the system administrator.

5.3 Architecture of the System

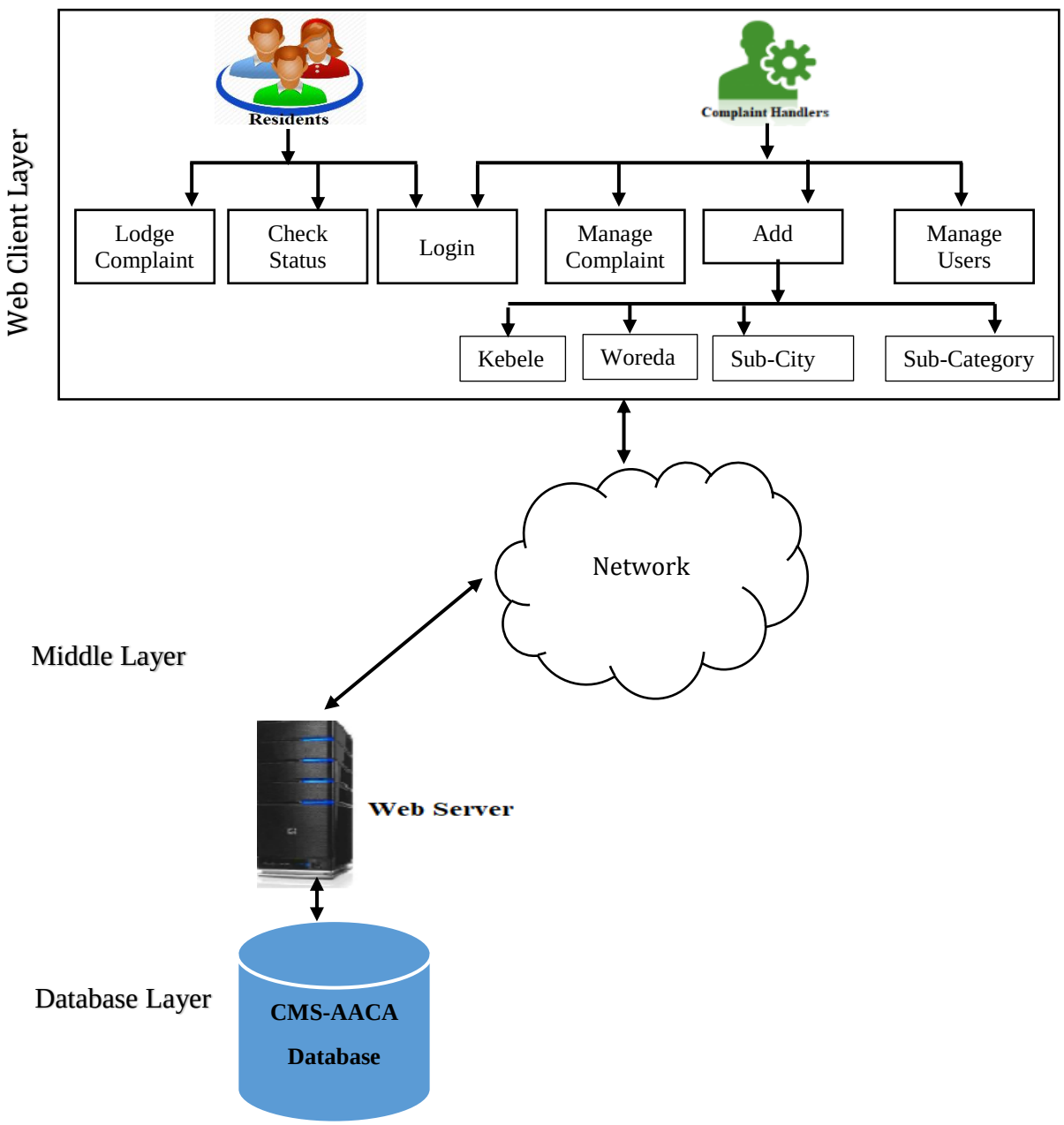

Figure 5. 1 Architecture of CMS in local government of AACA

The system architecture shows the overall organization and communication between the users and the system. As shown in Figure 5.1, web based CMS in local government of AACA can be divided into three layers; client layer, middle layer and database layer.

Web Client Layer

Through client layer components the residents of Addis Ababa city can register and lodge their local complaint to their local government and track the status of their complaint. The city administration also provide immediate response to their citizen's complaint through web client layer components. Individual components in the proposed architecture provides different functionalities.

Middle layer

Create connection between web client layer and data layer by using network protocols such as HTTP. Web servers accepts the request from both residents and complaint handlers and redirect it into database and vice versa. It is responsible for any kind of communication among resident, complaint handlers and database.

Data Layer

This layer is responsible for management of database; retrieving, updating and storing data. Middle layer uses web server component and network component so that data is transferred to the client layer and presented to the residents and complaint handlers.

5.4 Subsystem Decomposition

In order to simplify and minimize complexity of the system, Web based complaint management system for Addis Ababa city administration has been divided into four subsystems. These are resident sub-system, complaint handler's sub-system, connectivity sub-system and database sub-system. The decomposition of the system is represented in Figure 5.2.

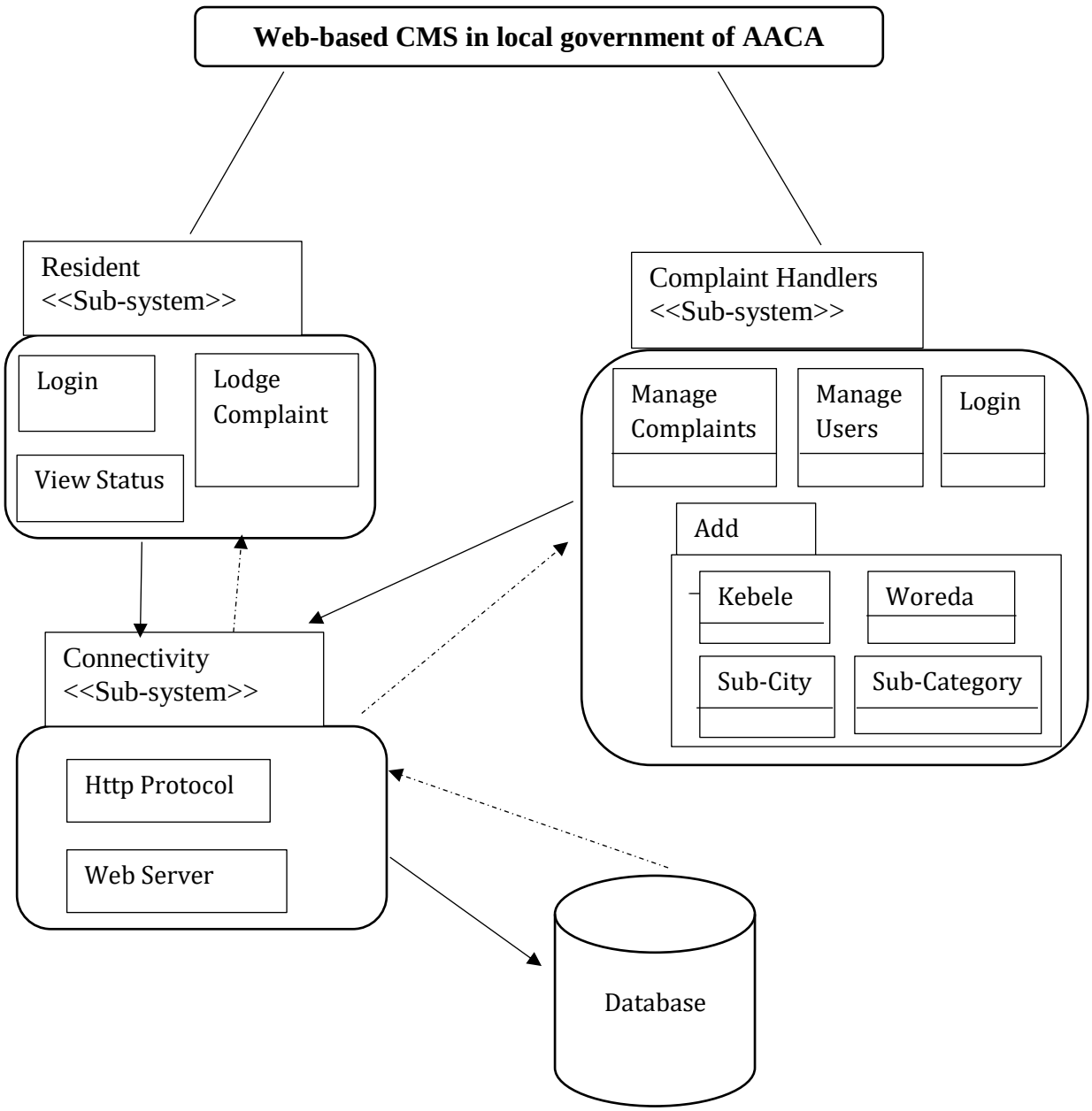

Figure 5. 2 Subsystem Decomposition of Web based CMS AACA

Resident Sub-system

This is the resident sub-system side application of the system which helps the users of the system who use laptop or desktop computers to get web based complaint management system of AACA. Through this sub-system, the resident can login into the system, register complaint and view status.

Complaint Handlers Sub-system

This is the complaint handler's sub-system side application of the system. The complaint handler's modules endows the complaint management team with the permission and accessibility which the team uses to manage complaints, add/remove (Woreda, Kebele, Sub-city and Sub-category and manage users.

Connectivity

Through this sub-system the residents and complaint handlers subsystem utilizes the network to access the complaint management service.

Database

This is the database part of the system, used for storing and accessing the data.

5.5 Hardware /Software Mapping

The system has three main components: Web Client, Web server and database. User can access the system through Client. The Web client component defines users of the system which access the system through Http protocol. The client send request using browser software found on a client machine and the system responses for request reaches to the system through Internet. The communication between the client and server is through Http protocol. The second component of the system is a web server on which an application runs and communicates with database to provide responses for the user. The third component of the system is a database used for providing responses and storing the data of the system. In Figure 5.3 , the proposed system hardware/software mapping is presented

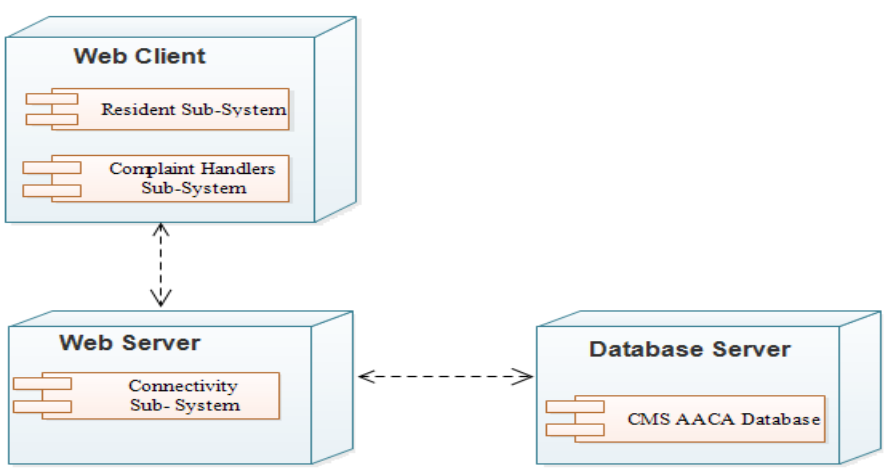

Figure 5. 3 Hardware/Software Mapping of AACA CMS

5.6 Persistent data storage

Persistent data management deals with how the persistent data are stored and managed. Information related to complaint and users are persistent data and stored in a database management system. In order to store data persistently in a database, those entity classes identified in analysis model of class diagram of CMS of AACA system are transformed into tables and attributes of the classes are also mapped into tables fields. Figure 5.4 depicts the system's relational model that handles data relation, integration and persistent data management.

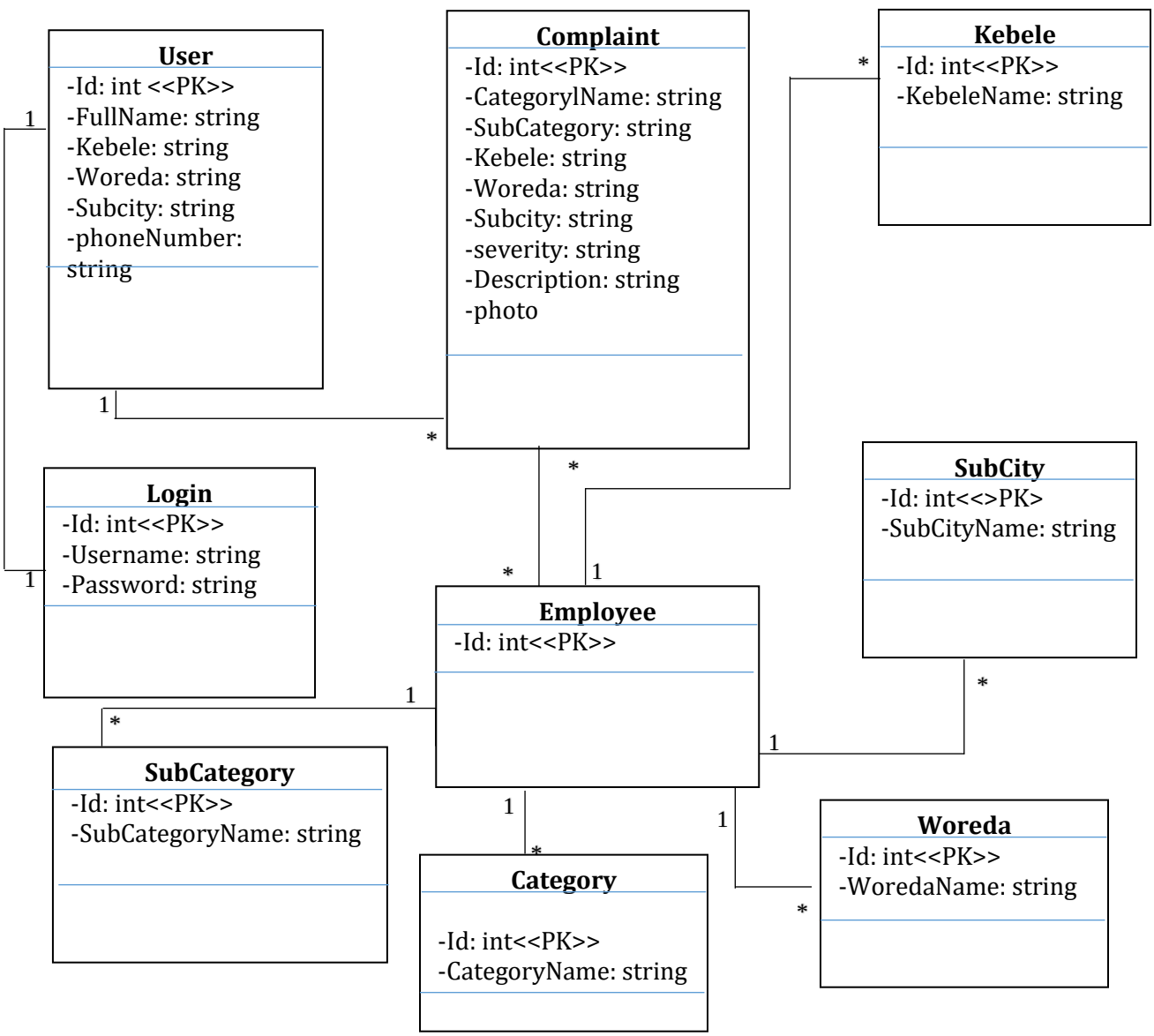

Figure 5. 4 Persistence database diagram of AACA CMS

Chapter 6: Prototype and Evaluation

6.1 Overview

In this Chapter, we will present different tools and development environments used to develop the prototype of the system. Moreover, screen shots will be presented to demonstrate the user interface and the outputs of the system. At long last, we have assessed the precision of the prototype by hosting the system on the server and lets the prototype got accessed by clients to see and assess the general frameworks exactness.

6.2 Development Environment

To achieve the objective of the project, several tools and technologies were used. The tools used to develop the system are presented in the section 6.2.1. The prototype is developed and tested in a system with Intel Core i7 CPU of 2.4 GHZ speed, 8 GB RAM, and a Windows 10 operating system.

6.2.1 Tools Used

Several tools are used in the development of web based complaint management system for the local government of AACA. The following is a list of programming, communication and database management environments tools that have been used for the implementation of complaint management system for AACA

XAMPP Server: XAMPP is a free and open source cross-platform web server solution stack package developed by Apache Friends, consisting mainly of the Apache HTTP Server, Maria DB database, and interpreters for scripts written in the PHP and Perl programming languages.

MySQL Database Server: MySQL database server is used for persistent data management (for storing the incoming complaint from users) on the server.

PHP: PHP is a server-side scripting language designed primarily for web development but also used as a general-purpose programming language. PHP is used for developing a prototype as web application for complaint management system in local government of AACA.

JavaScript: is used for client-side behavior: broadly speaking, actions that are beyond the scope or capability of HTML or CSS.

HTML: is used to create the actual content of the user interface pages of our system.HTML
CSS: is responsible for the design or style of our web application, including the layout, visual effects and background color.

JQuery: is a fast, small, and feature-rich JavaScript library. It makes things like HTML document traversal and manipulation, event handling, animation, and Ajax much simpler with an easy-to use API that works across a multitude of browsers.

6.3 The Prototype

In this section, we will look into the details of the implementation of the prototype web based complaint management system of AACA.

6.3.1 Residents Part

This section is about interactions between resident and the system. In order to use the services delivered by the system, a resident should first be registered on the system to be a member. To do that, a resident has to browse web based complaint management system through URL ***(http://localhost/cms/).*** As a result, the CMS home page is displayed. The resident can now click the register page link and has to provide the required fields as shown in Figure 6.1 to get registered. Once the user finish filling the required fields then he can click the register button and then user get confirmation message in successful registration. After resident registered successfully, now he/she can login into the complaint management system of AACA. For login the resident has to provide username and password as shown in Figure 6.2. In successful login, residents are redirected to a page in which they can lodge their complaint as shown in Figure 6.3 and view status of their complaints as shown in Figure 6.4 below.

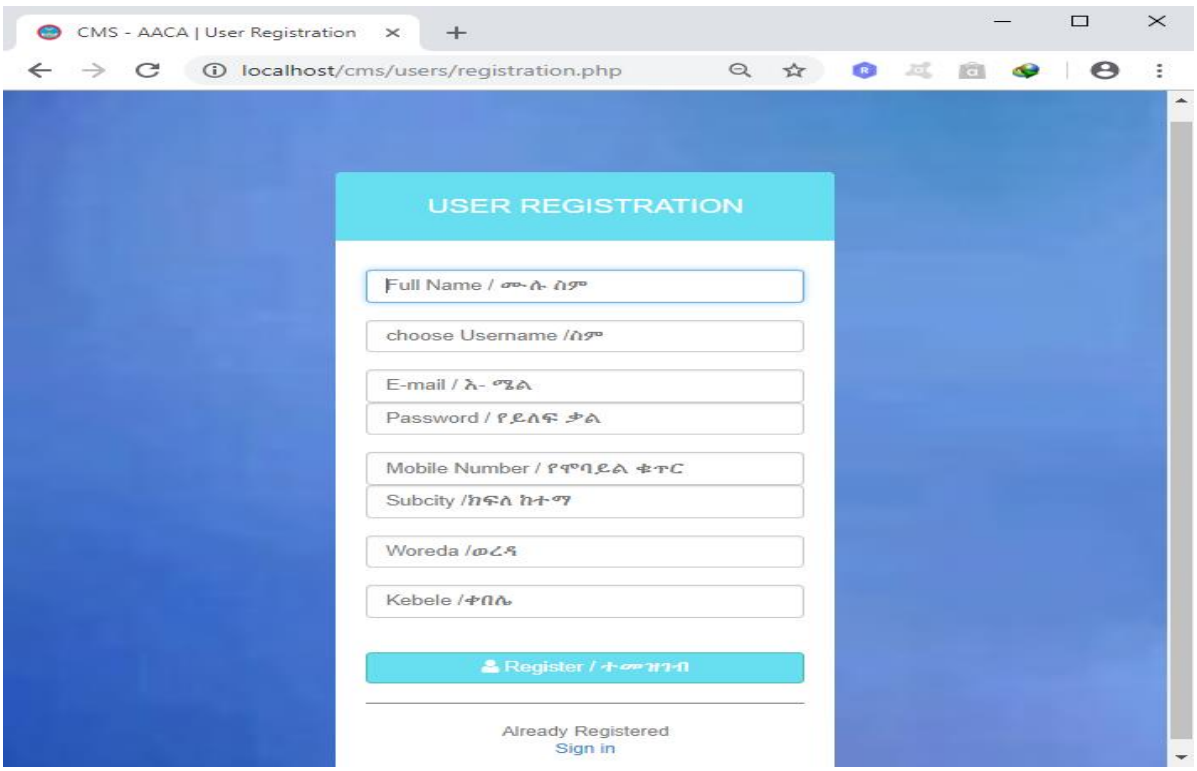

Figure 6. 1 CMS of AACA Login Page of Residents

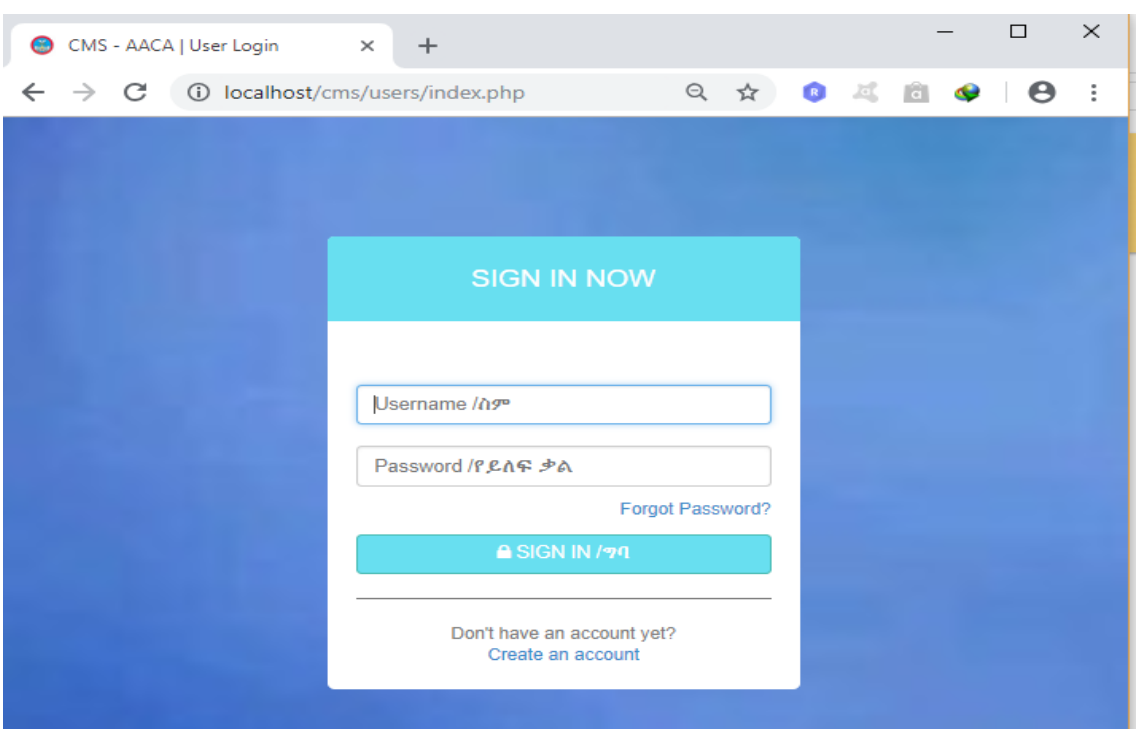

Figure 6. 2 Residents Login Page

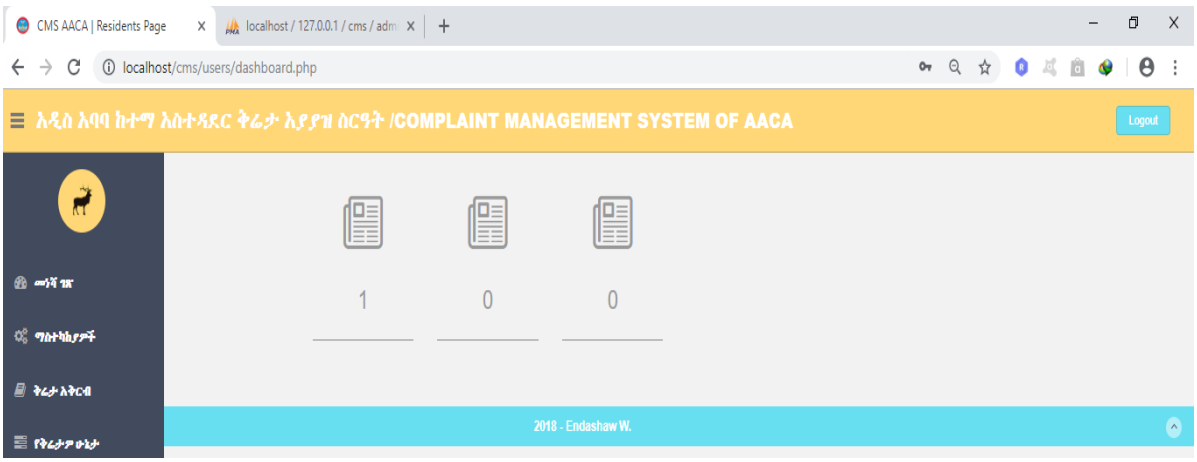

Figure 6. 3 Residents Home Page

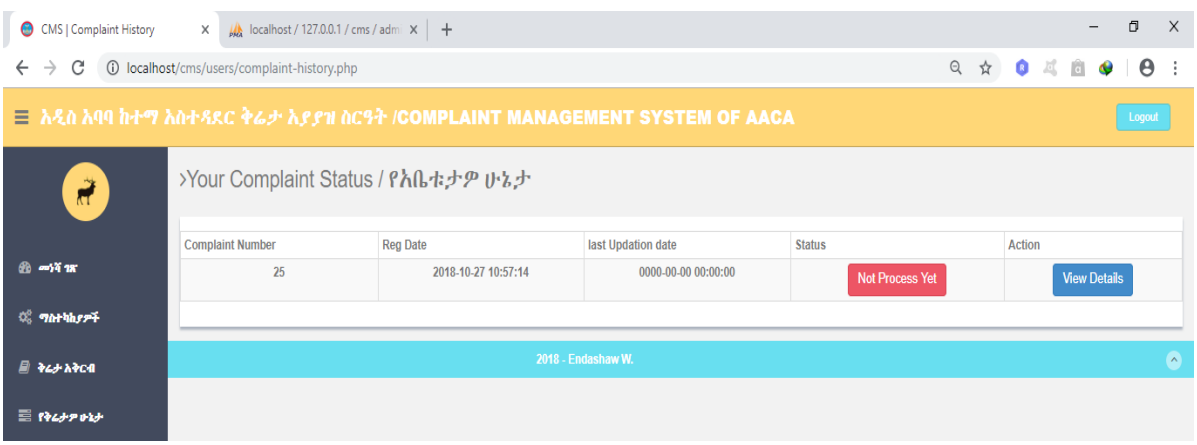

Figure 6. 4 Complaint Status Page

6.3.2 Complaint Handler's Part

This section is about interactions between complaint handlers and the system. In order to use the services delivered by the system, a complaint handler should first be registered on the system to be a member as shown in Figure 6.5. To do that, a complaint handler has to browse web based complaint management system through URL ***(http://localhost/cmsAdmin/).*** As a result, the Complaint handlers CMS login page is displayed as shown in Figure 6.6. To access the system complaint handlers has to register and login into the system. After successful login, complaint handers is redirected into home page of the system as shown in Figure 6.7. Inside home page of the system, complaint handlers can access all the component of complaint management system of AACA as shown in Figure 6.8.

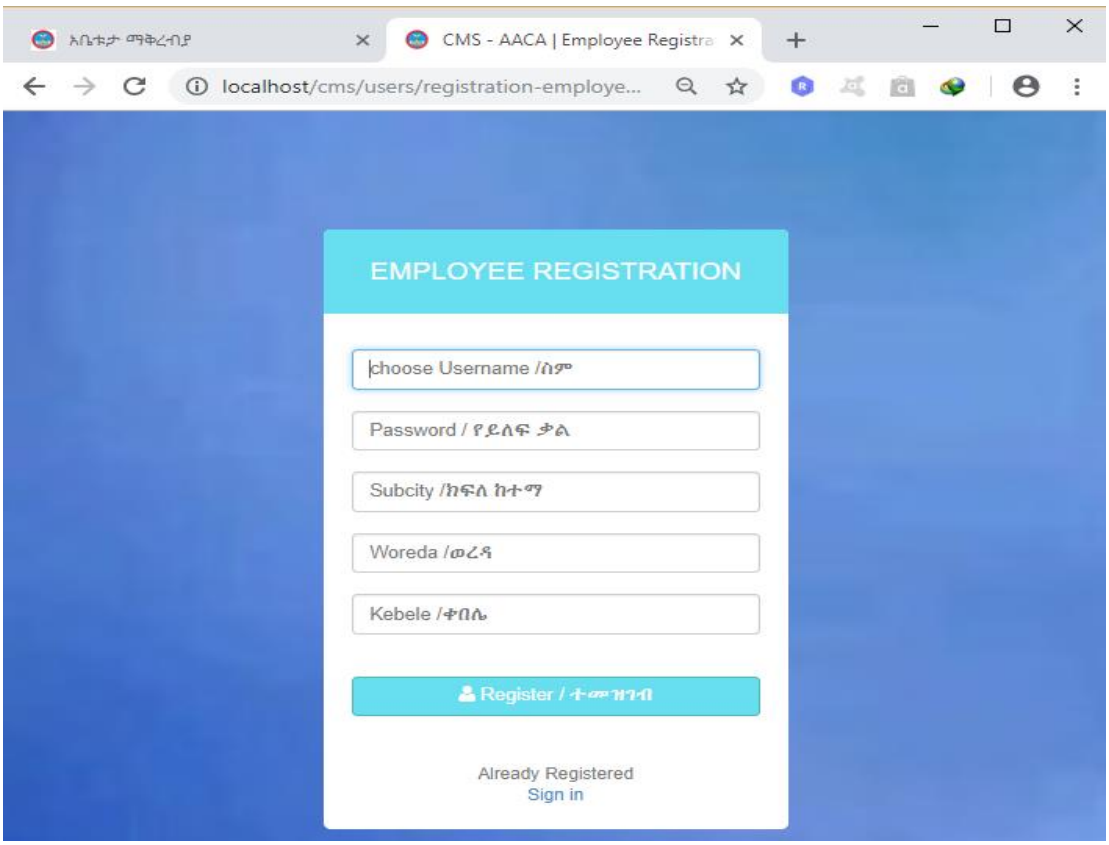

Figure 6. 5 Registration Page of Complaint handlers team

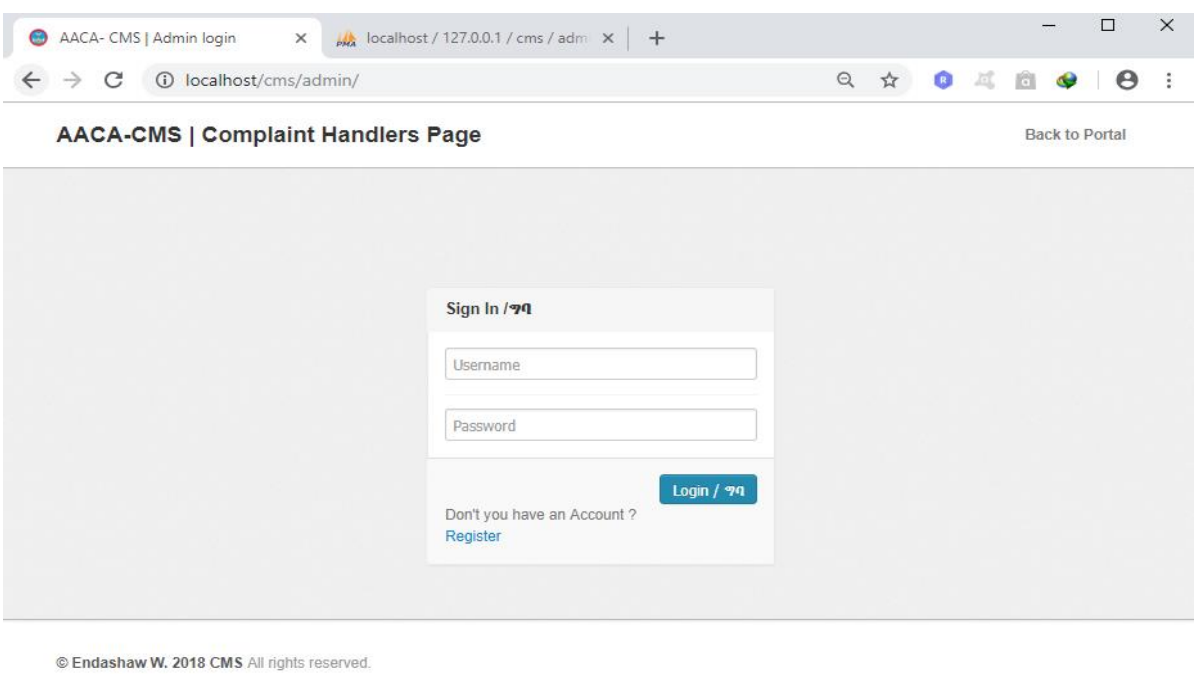

Figure 6. 6 Login Page of Complaint handler

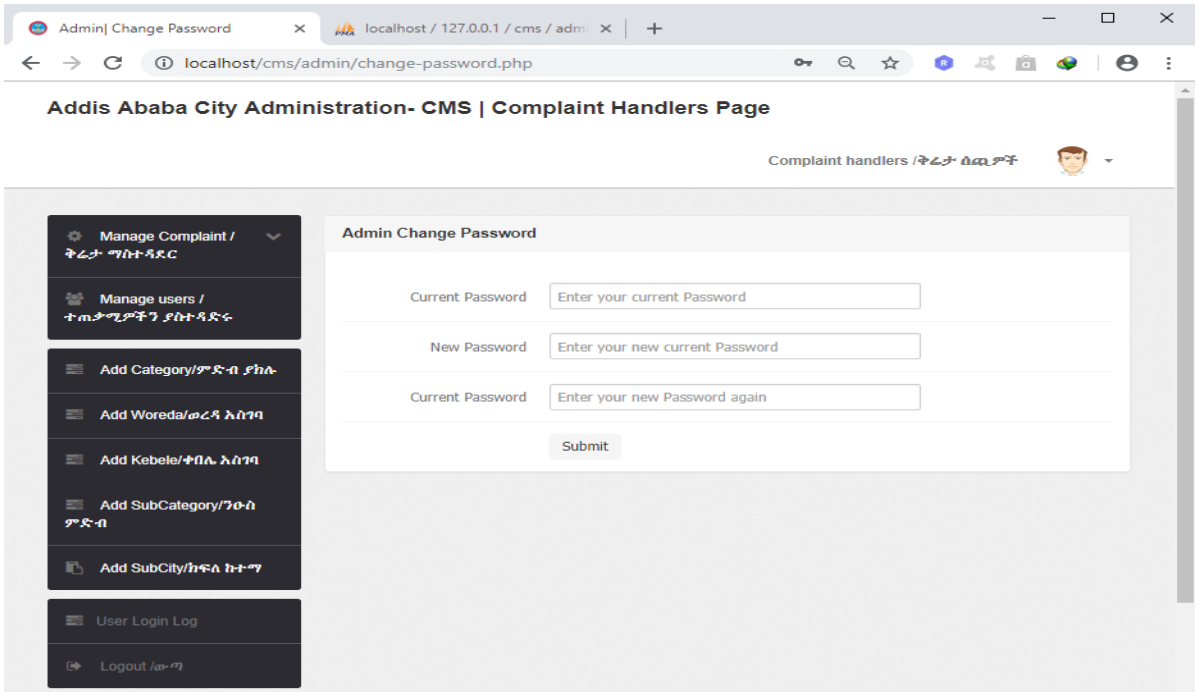

Figure 6. 7 Complaint handlers Page

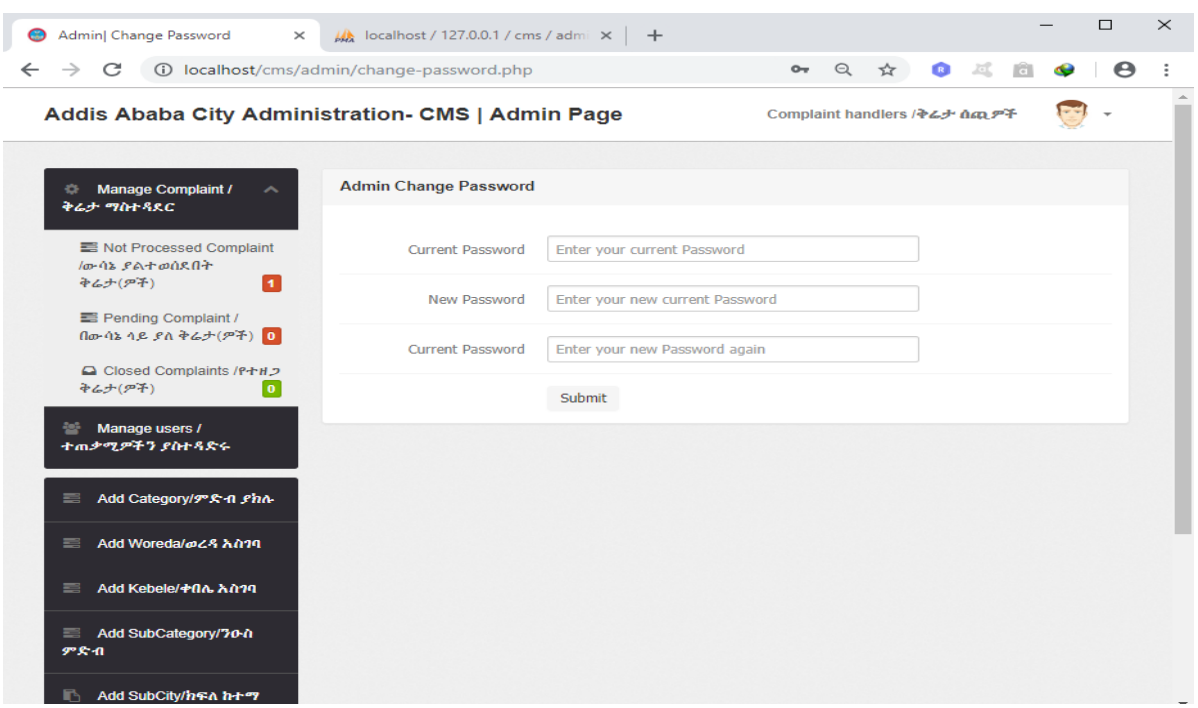

Figure 6. 8 Complaint Viewing Page

6.4 Evaluation of the CMS of AACA

This section will assess the practicability of the system we have made for the AACA as web based complaint management service in local government of AACA. The assessment is done to test if the system has implemented based on the design framework requirements that are shown in chapter five. To demonstrate and evaluate the performance of the proposed prototype of complaint management service in local government of AACA; interview survey has been conducted by questions (See Annex A) and the results were discussed.

With a specific end goal to assess the created system, we have utilized 73 participants for evaluating the overall performance of the developed system. Participants for the evaluation are possible or genuine end users selected from Addis Ababa city. Among the chosen participants 69 were the actual city dwellers and at least lived for 15 years in the city. The reason for choosing participants from Addis Ababa city for this evaluation is because Addis Ababa is the research area of our study.

6.4.1 Discussion of the results

1. The preliminary section of the assessment was prearranged to evaluate the ease of use of the resident's part of the system and 65 volunteers were participated. In table 6.1, detailed summary of questionnaire result of resident's part is presented.

Table 6. 1 Detailed summary of questionnaire result of resident's part

Question No.	**Participants response**			
	Disagree (1)	Strongly disagree (2)	Strongly agree (3)	Agree (4)
1	0	0	61	4
2	0	0	65	0
3	0	0	60	5

4	0	0	55	10
5	0	0	62	3
6	0	0	59	6
7	0	0	60	5
8	0	0	61	4
9	0	0	65	0
Total	**0**	**0**	**548**	**37**

Table 6. 2 Analysis of questionnaire result

Answers	Resident's part participants	
	Number of Marked answered by participants	Percentages (%)
Disagree (1)	0	0
Strongly disagree (2)	0	0
Strongly agree (3)	548	93.68
Agree (4)	37	6.32
Total	585	100

Based on the analysis of questionnaire result indicated in Table 6.2, web based complaint management system is easy to use, user friendly and well organized system. Hence, it can save time and resource imposed by traditional paper based complaint management system.

2. The second section of the assessment was prearranged to evaluate the ease of use of the complaint handling part of the system and 8 volunteers were participated. In table 6.3, detailed summary of questionnaire result of complaint handler's part is presented.

Table 6. 3 Detailed summary of questionnaire result of complaint handler's part

Question No.	Complaint handler's part participants response			
	Disagree (1)	Strongly disagree (2)	Strongly agree (3)	Agree (4)
1	0	0	7	1
2	0	0	8	0
3	0	0	6	2
4	0	0	5	3
5	0	0	6	2
6	0	0	5	3
7	0	0	5	3
8	0	0	7	1
9	0	0	6	2
Total	0	0	55	17

Table 6. 4 Analysis of questionnaire result of Complaint handler's part participants

Answers	Complaint handlers part participants	
	Number of Marked answered by participants	Percentages (%)
Disagree (1)	0	0
Strongly disagree (2)	0	0
Strongly agree (3)	55	76.39
Agree (4)	17	23.61
Total	72	100

Based on the analysis of questionnaire result indicated in Table 6.4, web based complaint management system is easy to use, user friendly and well organized system. Hence, it can save time and resource imposed by traditional paper based complaint management system. Generally, from the result analysis boards in Table 6.2 and 6.4, we concluded that the respondents granted that the system satisfies all the conditions'. Overall the system performance was rated as acceptable.

Chapter 7: Conclusion and Future Work

7.1 Conclusion

Managing complaints in AACA is not an easy task and usually it needs a great effort and skill. The problem becomes even worst when complaint managing process is done manually. Now-a-days, the scenario has changed. In today's world, more focus is given on the availability of the Internet and thus things become very easy. Thus we are supposed to use this opportunity to manage our daily complaints.

In this project we illustrates the web based complaint management system of AACA .We first study the current system to get necessary information to have a clear view of the existing method of complaint management system in AACA. This is done using observation, and revision of documents that AACA currently uses to handle complaint. Based on requirements gathered, analysis and design documents are prepared. To design the architecture of the system, the functional and non-functional requirements of the system are identified and analyzed using the use case diagram, sequence diagram and class diagram.

The web based complaint management system prototype is evaluated through a questionnaire about the prototype which is prepared to test usability test standard attributes. In the prototype evaluation, a total of 73 volunteers were involved. The respondents participated on the demonstration of the system using a personal computer. The results of the evaluation have shown that the web based complaint management system in local government of AACA is easy to use and can save time and resources.

7.2 Future Works

The following are some of the possible future works to the continuation of this project.

- ✓ **Include alarming system.** If complaint is not followed up in the specified period of time then the alarm will buzz in order to notify that the complaint processed
- ✓ **Include fake complaint detection mechanism.**

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ANNEXES

Annex A: Questionnaire

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I. Purpose of the questionnaire

The purpose of this questioner is to assess a research prototype on complaint management service in local government in the case of AACA. Your participation will help us understand the performance of this work and find holes for further improvement.

III. Subject's Permission

By completing this questioner, you agree that you have used web based complaint management system in local government in the case of AACA prototype and give your voluntary consent to participate. If you have any discomfort on this question, you are free to ask for further clarifications.

The research investigators would like to thank you for generously volunteering your time to participate in this prototype evaluation.

E-Complaint management system in local government in the case of AACA

Web based complaint management system in local government of AACA used enable citizens of Addis Ababa enables to react on local problems such as potholes, illegal trash dumping, faulty street lights, illegal parked cars, and broken tiles on sidewalks, illegal advertising boards and others to Addis Ababa city administration.

Please provide your Evaluation points with the following criterion having a look at the Complaint management service in local government of AACA system prototype.

(Please mark only one ,X. for each line in the labeled column)

Disagree = 1, Strongly disagree = 2,
agree = 3, Strongly agree = 4

Prototype usability test		**1**	**2**	**3**	**4**
1.	In relation to other software I have used, I found the web based complaint management system of AACA prototype is easy.				
2.	The menu items were well organized and functions were easy to find				
3.	I immediately understood the function of each menu item.				
4.	All of the functions I expected to find in the menus were present.				
5.	The menus were well organized and easy to find.				
6.	I immediately understood the function of each menus.				

7.	All of the functions I expected to find on the menu bar were present.				
8.	I found navigating around the pages on web based complaint management system of AACA prototype easy.				
9.	Web based Complaint management system of AACA prototype is user friendly.				

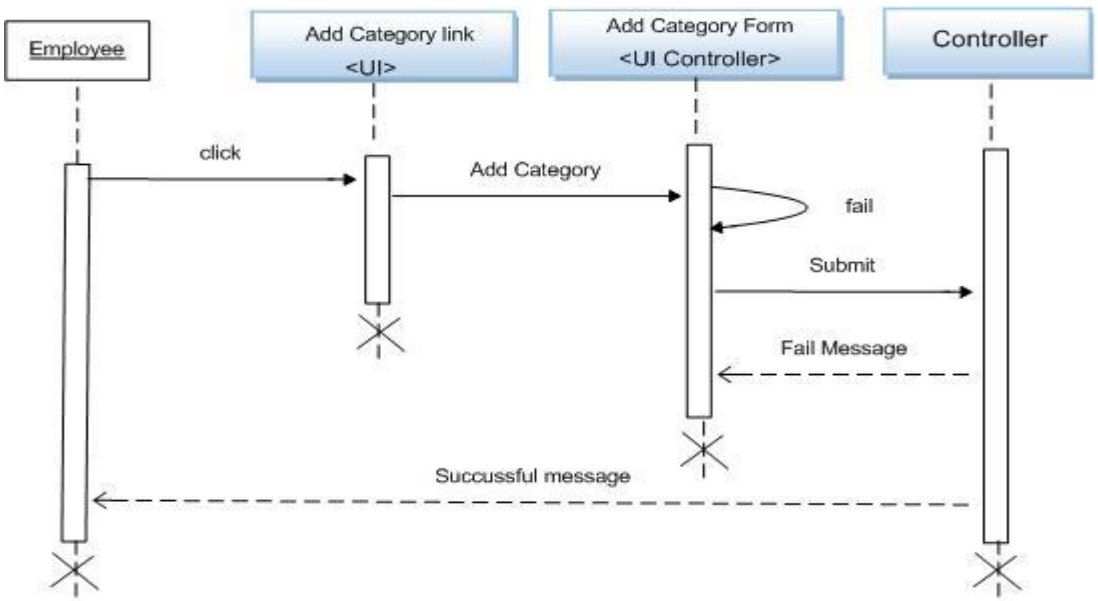
Any comments/ suggestions

_____

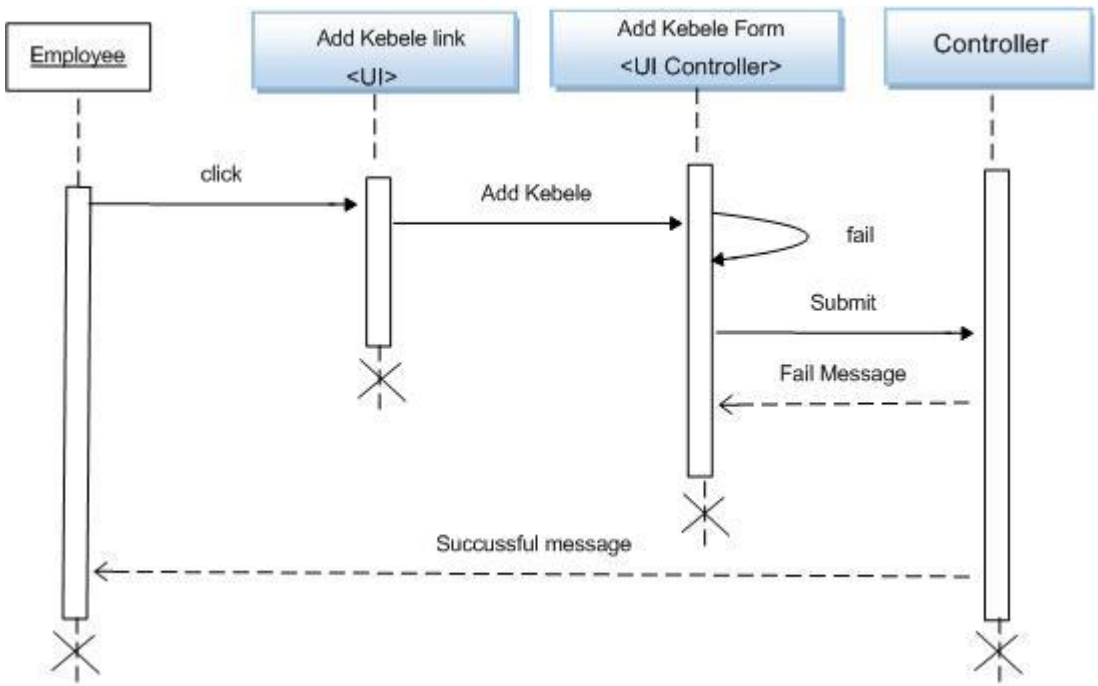
_____

Annex B: List of UML Diagrams

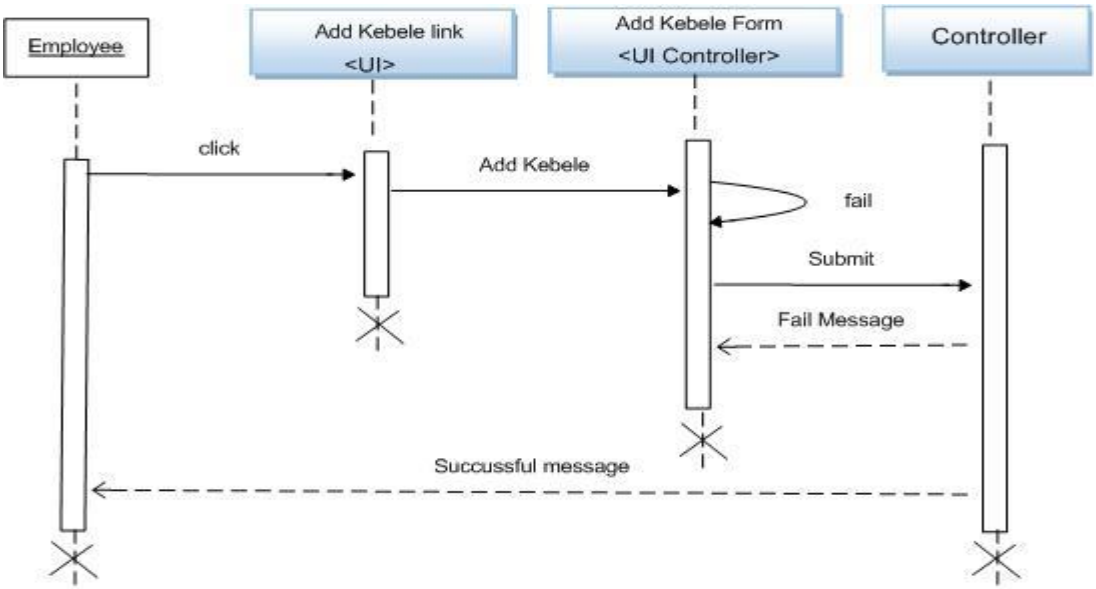
Add Category Sequence Diagram



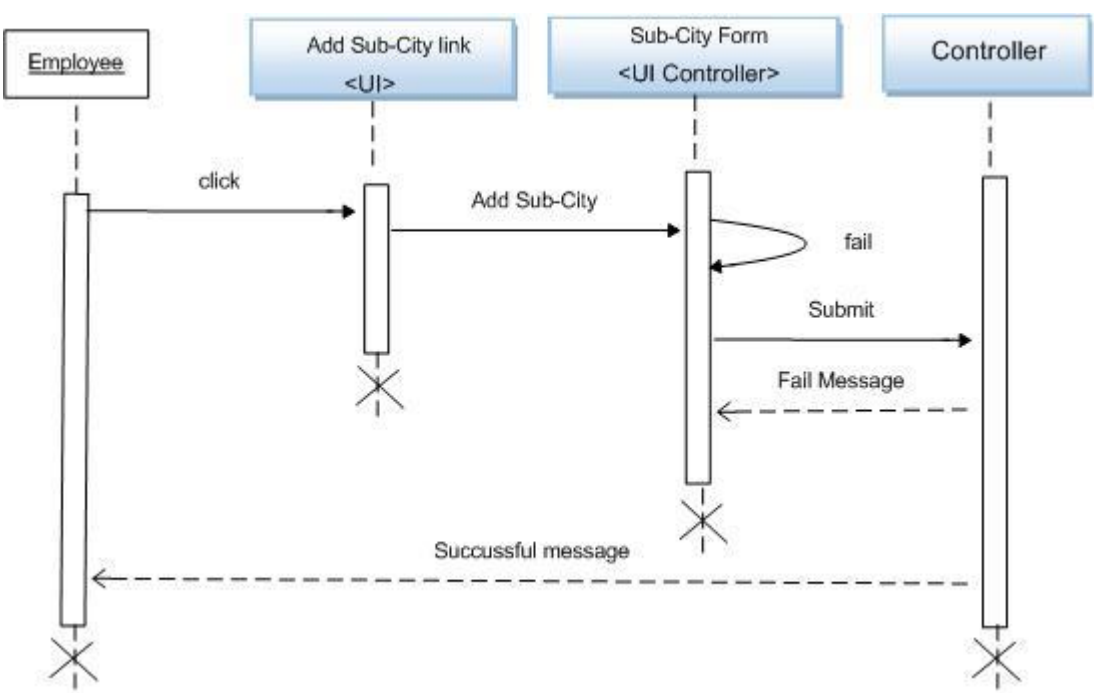
Add Woreda Sequence Diagram



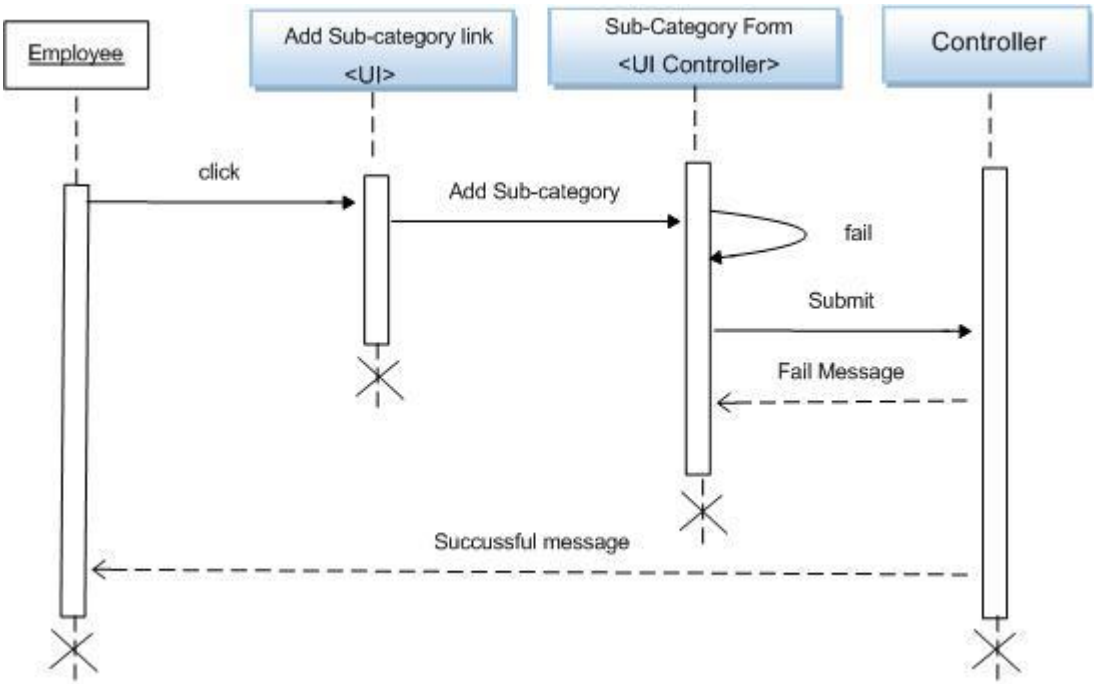
Add Category Sequence Diagram



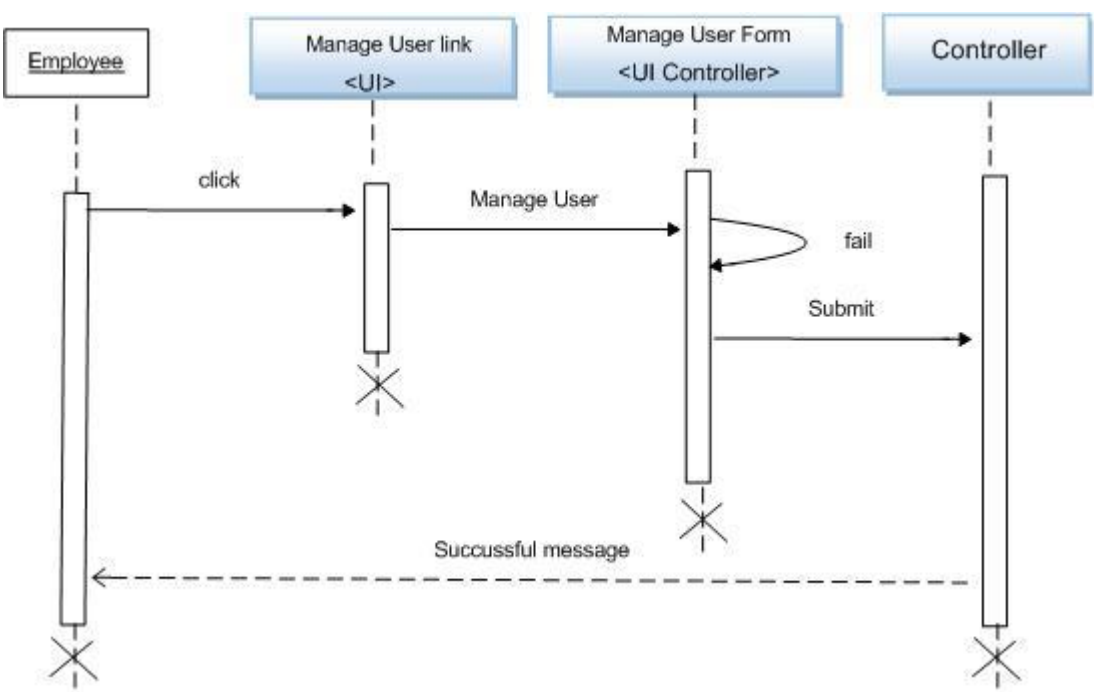
Add Sub- city Sequence Diagram



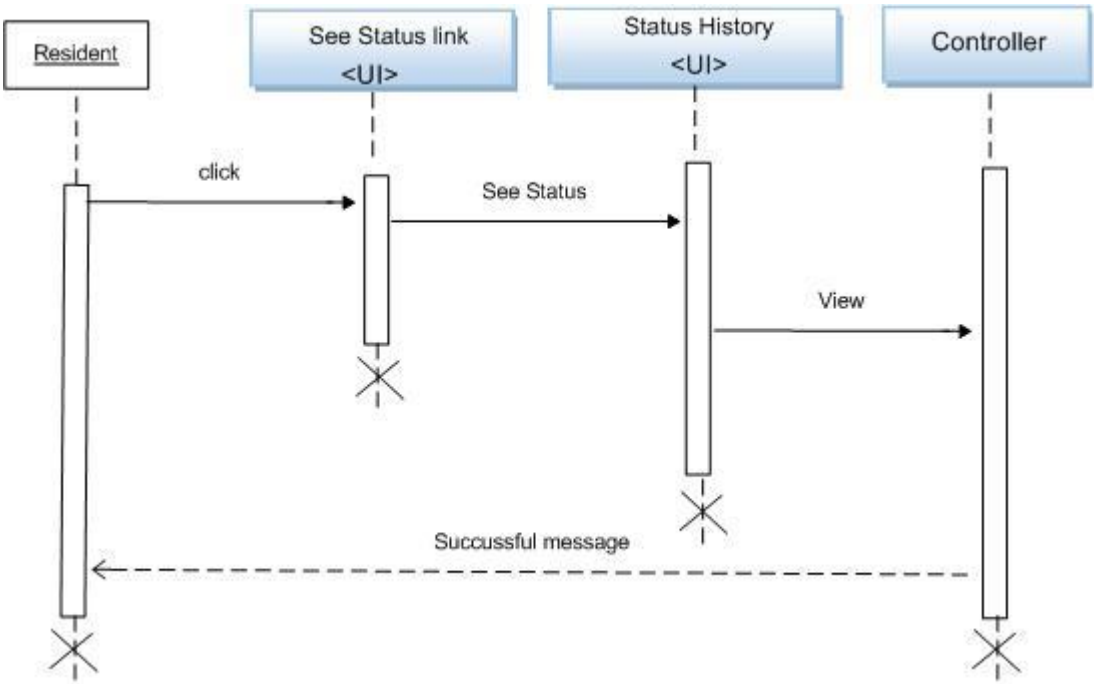
Add Sub-Category Sequence Diagram



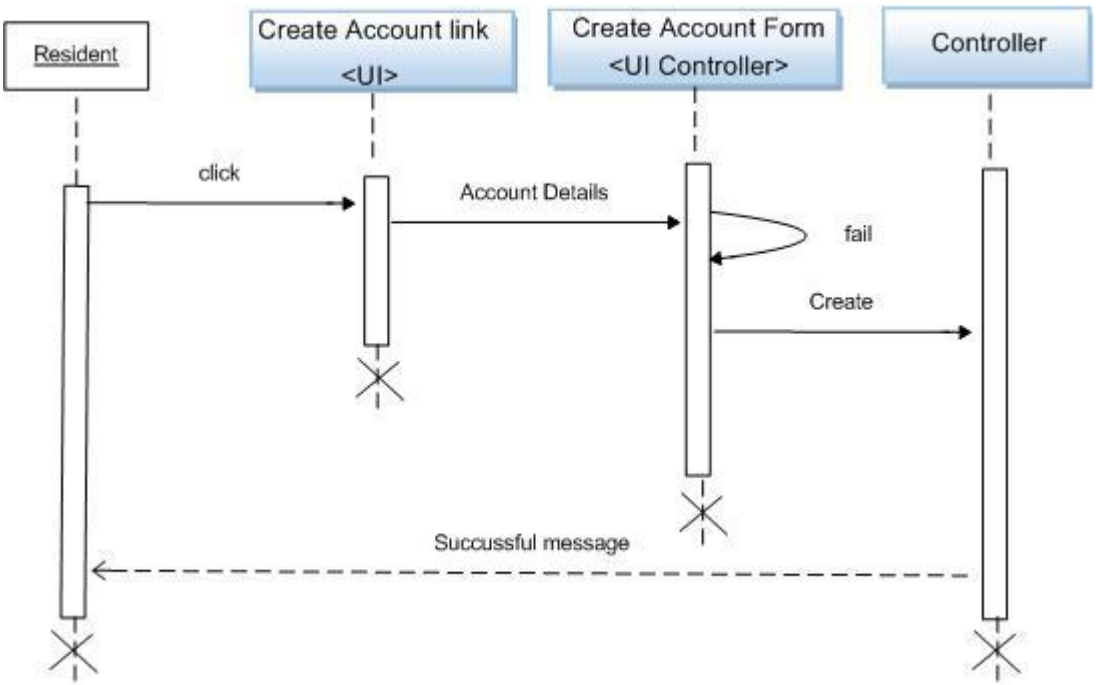
Manage User Sequence Diagram



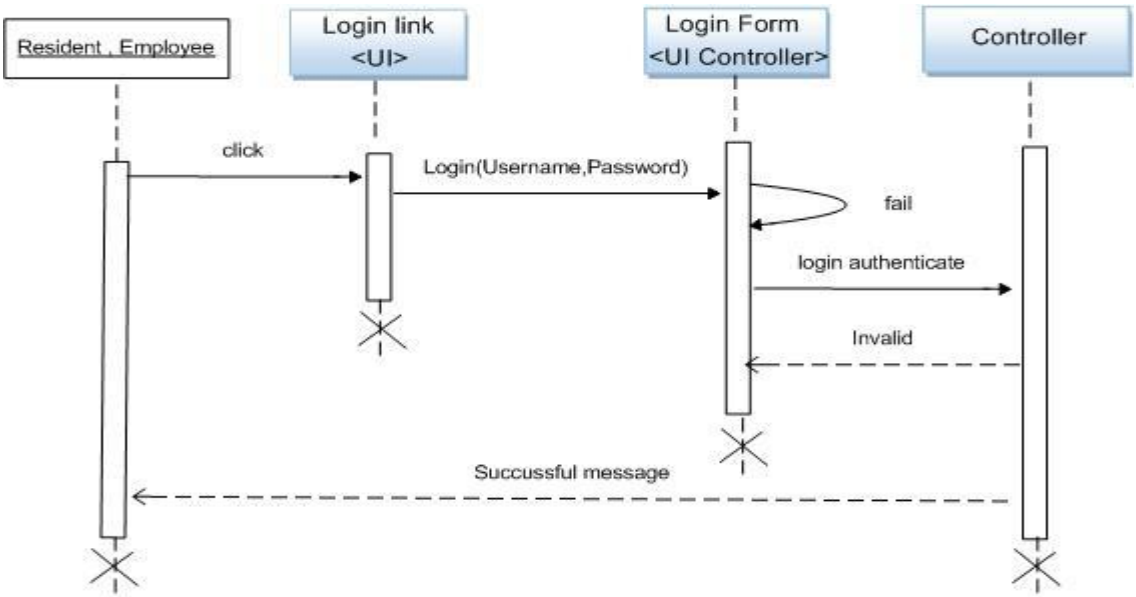
See Status Sequence Diagram



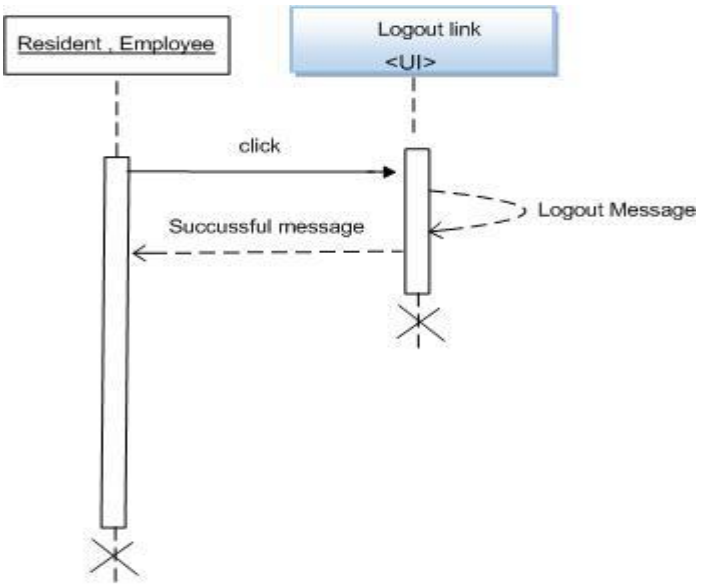
Create Account Sequence Diagram



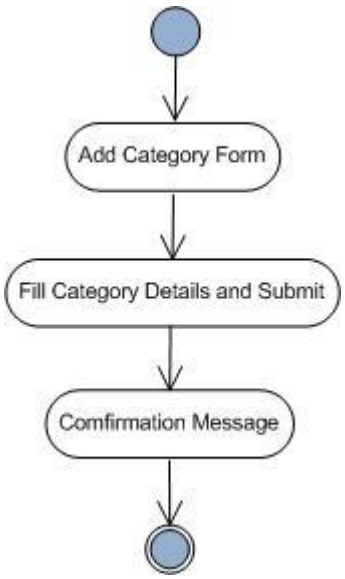
Login Sequence Diagram



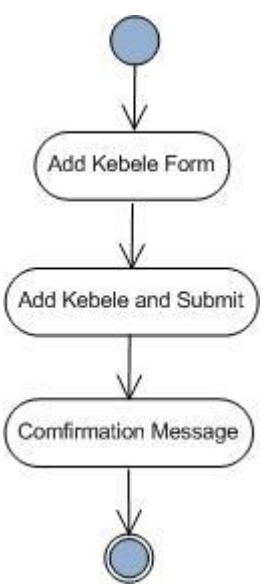
Login Sequence Diagram



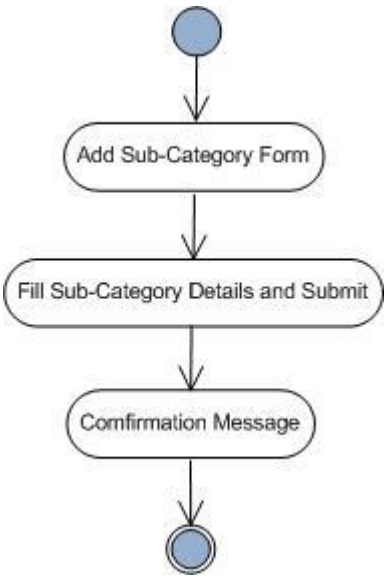
Add Category Activity Diagram



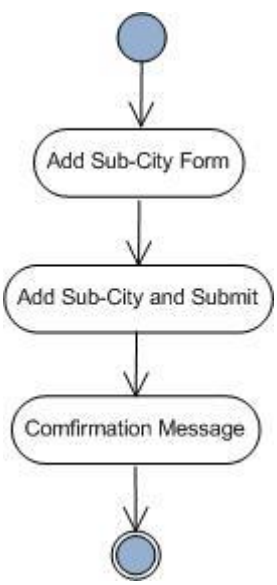
Add Kebele Activity Diagram



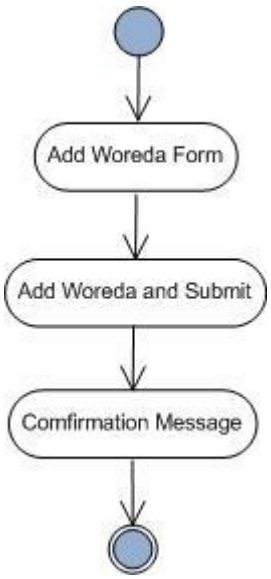
Add Sub-Category Activity Diagram



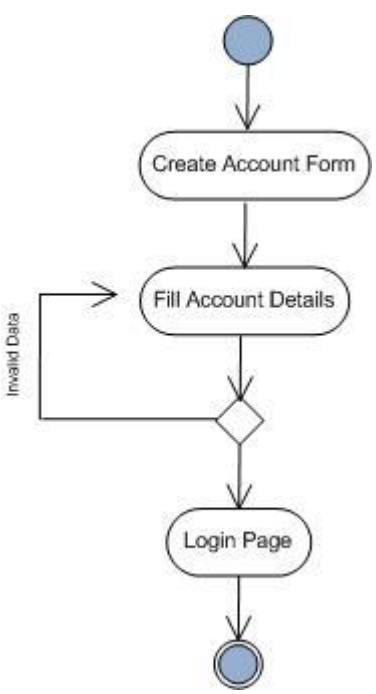
Add Sub-City Activity Diagram



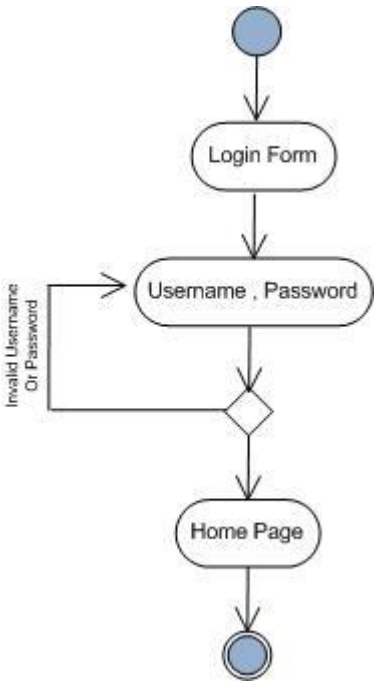
Add Woreda Activity Diagram



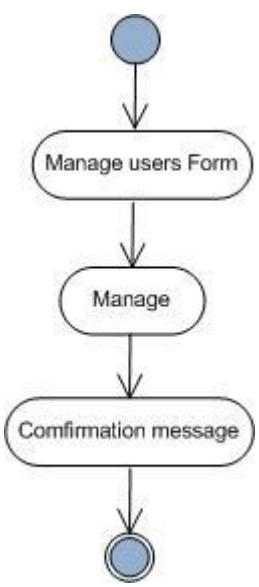
Create Account Activity Diagram



Login Activity Diagram



Manage users Activity Diagram



Annex C: Sample Code

// Complaint Register Viewing code

```
<?php
session_start();
error_reporting(0);
include('includes/config.php');
if(strlen($_SESSION['login'])==0)
  {
header('location:index.php');
}
else{

if(isset($_POST['submit']))
{
$uid=$_SESSION['id'];
$category=$_POST['category'];
$subcat=$_POST['subcategory'];
$complaintype=$_POST['complaintype'];
$state=$_POST['state'];
$noc=$_POST['noc'];
$complaintdetials=$_POST['complaindetails'];
$compfile=$_FILES["compfile"]["name"];



move_uploaded_file($_FILES["compfile"]["tmp_name"],"complaint-
docs/".$_FILES["compfile"]["name"]);
$query=mysqli_query($con,"insert into tblcomplaints(userId,cate-
gory,subcategory,complaintType,state,noc,complaintDetails,complaint-
File) values('$uid','$category','$subcat','$complain-
type','$state','$noc','$complaintdetials','$compfile')");
// code for show complaint number
$sql=mysqli_query($con,"select complaintNumber from tblcomplaints  or-
der by complaintNumber desc limit 1");
while($row=mysqli_fetch_array($sql))
{
 $cmpn=$row['complaintNumber'];
}
$complainno=$cmpn;
echo '<script> alert("Your complain has been successfully filled and
your complaintno is  "+"'.$complainno.'")</script>';
}
?>
```

```
                <h3><i class="fa fa-angle-right"></i> ቅሬታ አቅርብ /Lodge
Complaint </h3>


<label class="col-sm-2 col-sm-2 control-label">ምድብ /Category</label>
<div class="col-sm-4">
<select name="category" id="category" class="form-control" on-
Change="getCat(this.value);" required="">
<option value="">የቅሬታዎ ምድብ ምረጥ / Select Category</option>
<?php $sql=mysqli_query($con,"select id,categoryName from category ");
while ($rw=mysqli_fetch_array($sql)) {
  ?>
  <option value="<?php echo htmlentities($rw['id']);?>"><?php echo
htmlentities($rw['categoryName']);?></option>
<?php
}
?>
<label class="col-sm-2 col-sm-2 control-label">ንዑስ የቅሬታዎ ምድብ ምረጥ
/Sub Category </label>
 <div class="col-sm-4">
<select name="subcategory" id="subcategory" class="form-control" >
<option value="">Select Subcategory</option>
</select>
</div>
 </div>
<label class="col-sm-2 col-sm-2 control-label">ወረዳ ምረጥ /Choose
Woreda</label>
<div class="col-sm-4">
<select name="complaintype" class="form-control" required="" on-
Change="getCat(this.value);" >
                <option value="">Select Woreda</option>
<?php $sql=mysqli_query($con,"select id,categoryName from woreda ");
while ($rw=mysqli_fetch_array($sql)) {
  ?>
  <option value="<?php echo htmlentities($rw['id']);?>"><?php echo
htmlentities($rw['categoryName']);?></option>
<?php
}
?>
<div class="form-group">
<label class="col-sm-2 col-sm-2 control-label">የአቤቱታው ዝርዝር  /Com-
plaint Details (max 1000 words) </label>
<div class="col-sm-6">
<textarea  name="complaindetails" required="required" cols="7" rows="7"
class="form-control" maxlength="1000"></textarea>
</div>
</div>
<div class="form-group">
<label class="col-sm-2 col-sm-2 control-label">Add Image /ፎቶ ያስገቡ </la-
bel>
<div class="col-sm-6">
<input type="file" name="compfile" class="form-control" value="">
</div>
</div>
```

```
<?php $query=mysqli_query($con,"select tblcomplaints.*,category.catego-
ryName as catname from tblcomplaints join category on category.id=tbl-
complaints.category where userId='".$_SESSION['id']."' and complaint-
Number='".$_GET['cid']."'");
while($row=mysqli_fetch_array($query))
{?>
                <div class="row mt">
            <label class="col-sm-2 col-sm-2 control-label"><b>Complaint
Number : </b></label>
                        <div class="col-sm-4">
                        <p> <font color="#0066FF"><b><?php echo htmlen-
tities($row['complaintNumber']);?> </b></font></p>
                        </div>
<label class="col-sm-2 col-sm-2 control-label"><b>Reg. Date :</b></la-
bel>
              <div class="col-sm-4">
              <p><?php echo htmlentities($row['regDate']);?></p>
              </div>
               </div>


<div class="row mt">
            <label class="col-sm-2 col-sm-2 control-label"><b>የቅሬታዎ
ምድብ /Category :</b></label>
              <div class="col-sm-4">
              <p><?php echo htmlentities($row['catname']);?></p>
              </div>
<label class="col-sm-2 col-sm-2 control-label"><b>ንዑስ የቅሬታዎ ምድብ /Sub
Category :</b> </label>
              <div class="col-sm-4">
              <p><?php echo htmlentities($row['subcategory']);?></p>
              </div>
            </div>
```

Declaration

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

Declared by:

Name: Endashaw Wolde

Signature: _____

Date: _____

Confirmed by advisor:

Name: **Fekade Getahun (PhD)**

Signature: _____

Date: _____