

# Execution of Web-Based Crime and Criminals Tracking System to Enable Security and Quick Access

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**Abstract**— This project work automates web based crime and criminals tracking system. The system is web based application that enable user at the international hotels and at the four police office stations to communicate each other and with district police office. All user of the system are communicating through the internet service provider infrastructure. But if the internet is down, the system will work offline. The system and its database is configured or replicated to the police station's mini server computers at each woredas. Whenever the network is available the mini servers synchronize data with the central server at the district police office. Before we develop this project the international hotels daily fill form about their customers booked in and send by human labor to the nearby police station. The CCTS alleviates this challenge. Now, using our web system the hotel manager or receptionist access the customer booked in hotel registration page from the server, fills and hit submit button. The information is submitted to the police office through the network and saved to their computer at the same time. While the data is being submitted the data is checked against the criminal's list using primary key or unique number, if criminal or suspects found alert or report will be displayed to the system administrator with detail information. The prototype has been tested with data from Adama city district police office. It has been observed that the system successfully registers crime and criminals, lost property, international hotels; customer booked in hotel, generates reports and provides search facilities. In addition to these, customers are not expected to go to the four police stations or woredas if they want to register lost property. As lost property, crime and criminals registered at a station it will be shared across the network. It has also been shown that the system facilitates to view the status of cases, knowledge bases. This system promotes the manual works into digital. It reduces the time, produces accurate results and also implements security for the information.

**Keywords**— WEB, Crime, CCTV, Network, Server.

## I. INTRODUCTION

### 1.1. BACKGROUND

The Police department and its functioning is an extremely critical and important part of the state Administration in its responsibility to provide general services to the citizens, maintain law and order and security in the country.

Thakur (2003) has defined crime as an act or omission of an act, which is punishable by law. However, an act that is considered as a crime in one place and time may not be true in another place or time.

According to Andargachew (1988), a criminal is an individual person who has violated the legally forbidden act. In fact, there are some factors that have to be taken into account to convict whether a person should be

considered as a criminal or not. Among these, an individual should be of competent age in light with the law of the land; and there must be a well-predefined punishment for the particular act committed.

Crime has increasingly become as complex as human nature. Modern technological advancement and tremendous progress in communication have facilitated criminals of every corner of the world to commit a crime using sophisticated equipment in one place and then escape to another place (Thakur, 2003). These days the globe is facing the proliferation of problems such as illicit drug trafficking, smuggling, hijacking, kidnapping, and terrorism.

Crime has adversely affected the societies of both civilized as well as developing countries by declining the quality of

life, endangering human right and fundamental freedom and posing a serious challenge to the community. Although the level and intensity of the problem might vary from nation to nation no country has remained unaffected.

Availability of relevant and timely information is of utmost necessity in the operations of Police, particularly in investigation of crime, in tracking & detection of criminals. Police organizations everywhere have been handling large amounts of information and huge volume of records pertaining to crime and criminals. Information Technology (IT) can play a very vital role in improving outcomes in the areas of Crime Investigation and Criminals Detection and other functioning of the Police Organizations, such as facilitating data recording, retrieval, analysis and sharing of Information. Quick and timely information availability about different facets of Police functions to the right functionaries can bring in a sea change both in crime and criminals handling and related Operations, as well as administrative processes.

Creation and maintenance of databases on crime and criminals in digital form for sharing by all the stakeholders in the system is therefore very essential in order to effectively meet the challenges of crime control and maintenance of public order. In order to achieve this, the city should meet a common minimum threshold in the use of IT, especially for crime and criminals related functions.

### 1.2. TREND OF CRIME IN ETHIOPIA

In Ethiopia, crime statistics of the Federal Police Commission has shown that the rate of crime is increasing steadily. A sample survey conducted in the year 1996 by a research team of the Federal Police has shown that in 1986 about 51,869 crimes were reported to the police (Federal Police Commission, 1996). Taking the total population of the country during this period, this figure indicated that one crime was committed among 800 people during this year. Whereas the research report has shown that in the year 1994 about 96,995 different crimes were reported. This reveals that during this period one crime is committed among 568 people. As compared to the year 1986 the total number of crimes committed in the 1994 have shown a significant increment.

The national crime statistics report compiled by the Federal Police Commission in 2003 for the year 2002 has shown that about 219,539 crimes were reported to police throughout the country and out of this 51 percent were committed in urban area while the remaining 49 percent were occurred in rural areas. Moreover, the national crime statistics report has indicated that the Oromia regional state accounts 22.49% of the total crimes reported to the police in the entire country in the year 2002. This figure indicates

that the Oromia region is one of the crime prone regions in the country.

### 1.3. ETHIOPIAN POLICE STRUCTURE

In Ethiopia, the police organization was established in 1942 under proclamation No. 6 as autonomous institution with the responsibility of preventing and investigating crime incidents. In 1966 the police institution was put under the Ministry of Interior. Since its establishment, the police organization structure has been extended to the lower administration level, which is “woreda” and sometimes a “kebele” (Mesfin, 1999).

Today, Ethiopian police system consists of a Federal Police Service, nine Regional Police forces and the police forces of Addis Ababa and Dire Dawa, which have a special position. The Federal Police Commissioner is accountable to the Minister of Federal Affairs. The Regional States are free to organize their police as they see fit. Nevertheless, all State police forces have a structure similar to that of the Federal Police.

### 1.4. The Federal Police

The legal basis for the Federal Police is found in the “Federal Police Commission Proclamation, 313/2003”. Article 6 of this Proclamation defines the objective of the Commission as maintaining the peace and security of the public by complying with and enforcing the Constitution and other laws of the country, and preventing crime. The Proclamation also describes the duties and powers of the police organization. According to article 7 the Federal Police are responsible for crime control within designated areas of jurisdiction, all of which relate to state security. International affairs fall under their remit. They also have coordinating duties at the national level.

For instance, the Federal Police provide training, professional and technical advice and support for Regional Police Commissions. The Proclamation *assessment of each justice institution*<sup>105</sup> refers to the positions of the Commissioner and Deputy Commissioner. Broadly speaking, it also covers matters relating to the appointment and duties of police officers. These issues have been fleshed in the staff regulations. This Proclamation provided for the abandonment of military ranks within the police and ended thus the military past (Article 25(1)).

The Proclamation covers the relationship between the Federal and Regional Police. It provides for regular contact and meetings between the various police organizations (Article 23 (3)). When it deems necessary, the Federal Police Commission can delegate the powers given to it by the Proclamation to Regional Police Commissions (Article 7 (15)).

The Government appoints the Commissioner and Deputy Commissioner. The Commissioner of the Federal Police is accountable to the Minister of Federal Affairs (Article 4). This only applies, however, to aspects relating to management issues. The organization operates independently when it comes to operational police work. There is a sound management setup, with a plan and control cycle. The Federal Police is both a centralized and decentralized organization. It operates from various locations in the country, although the focal point is naturally in the capital. The organization chart reveals a line and staff organization. All task areas have been classified under directorates and departments. The largest directorates are crime investigation and crime prevention. These sections of the organization are responsible for carrying out executive police work.

### 1.5. The Regional Police

The Regional States are free to organize their police as they see fit. Nevertheless, all regional forces, broadly speaking, have a structure that is similar to that of the Federal Police. The respective state authorities appoint the Regional Commissioners. Regional forces are accountable to the Minister of State Affairs for their respective States. This accountability only relates to matters like policy making and financial matters. The regional services are also independent when it comes to administrating and implementing the actual police work. The Regional States are subdivided into a system of smaller administrative units. The police organization mirrors these administrative divisions and operates in a decentralized way. The regional forces have less capacity than their federal colleagues. Therefore, they frequently request the assistance of the Federal Police when carrying out their regional duties. The cooperation between the regions and the Federal Police is good.

#### 1.5.1. Oromia Police

Oromia police is organized under Oromia regional state as Oromia Police Commission and provide the function of the police to society.

##### 1.5.1.1. Adama City Police

Adama city police is organized under oromia regional state police commission and has four stations called woreda1, 2, 3, 4 and one police office which commands the others. The woredas police offices are located at different parts of the city to facilitate service delivery to customers and to prevent crime and track criminals. Currently, the work activities performed among them is manual and there is no network connection. In return, this leads to slow response to the crime, not satisfy the public need in city and report and instructions are delayed. To overcome such obstacles it

is not an option to modernize the city police. The hotels in the city have daily interactions with nearby police office with report of the customers booked in their hotels. This is done through human labor which is time consuming and monotonous. Therefore, the CCTS alleviates this and enables the police officers to provide service to customers within time frame.

This web-based CCTS project aims at creating a comprehensive system for enhancing the efficiency and effectiveness of policing through adoption of principles of e-Governance and creation of a citywide networking infrastructure for evolution of IT-enabled tracking system around 'investigation of crime and detection of criminals. It aims to develop web-based system and mechanism to provide the basis for evolution of an IT enabled state-of-the art workflow (Processes) automation system in a planned manner between international Hotels and police stations, and among police office. It will not only track crime and criminals but will also create facilities and mechanism to provide services like registration of lost properties, verification of suspected or criminal person or found properties, easily accessing the required data from database, list daily cases, solutions and any challenges during work and provide notification to concerned woredas police stations. These facilities are allowed to be visible or accessible to users who have only the right privileges.

### 1.6. STATEMENT OF THE PROBLEM

Crime is a complex social phenomenon and its cost is increasing due to a number of societal changes and technological advancements, and hence, law enforcement organizations like that of police need to learn the factors that constitute higher crime trends (Wilson, 1963). To control this social evil there is always a need for prudent crime prevention strategies and policies. Understanding and processing of criminal records is one method to learn about both crime and individuals who involve in misdeeds so that police can take crime prevention measures accordingly (Brown, 2003).

Adama city police office use manual systems to share and communicate information which is time consuming and may not be real time communication. Hotels in the city also use repetitive, monotonous tasks such as daily report of their customer booked in hotel information to the nearby police stations. Moreover, citizens need to go to every police station to register their lost property and also not suitable for police stations to cross-check customer booked in hotel information reported by hotels in case criminals want booked hotel. Therefore this project is developed to alleviate the above listed manual systems problems.

This project tries to answer the following leading questions:

- (1) What should have to be done to facilitate data or information sharing among police stations?
- (2) What should have to be done to enable hotels to submit customers booked information in their hotel to the nearby police station?
- (3) How lost properties registered at a station should be distributed to all police stations?
- (4) How can we develop a web based application to track crime and criminals booked in hotel?

### 1.7. OBJECTIVES OF THE PROJECT

The general and specific objectives of the project are described as follows:

#### 1.7.1. GENERAL OBJECTIVES

The general objective of CCTS is to develop a web based crime and criminal Tracking system that will help in the effort of crime and criminals tracking with the aim of supporting the crime detection and prevention activities at the Adama city Police to facilitate interactions between police district and woreda police stations, among woreda police stations and International hotels.

#### 1.7.2. SPECIFIC OBJECTIVES OF THE PROJECT

To attain the general objective the following specific objectives are set

- To develop crime and criminal, lost property registration modules,
- To construct report generation system,
- To automating back-office functions, and thereby release police staff for greater focus on core police functions,
- To create platforms at city police station and central levels for sharing crime and criminal information databases across police office and stations,
- To develop system or module that enable police officers better track crime and criminals and keep track of progress of cases,
- To facilitate sharing of lost properties across police station

### 1.8. METHODOLOGY OF THE PROJECT

For the successful completion of this project, a number of data gathering, analysis, and programming tools and techniques are put into use. The data collected focuses on issues like, what is expected from the system? What are the inputs of the system? What are the outputs of the system? What are the rules of processing the input data? How are they processed? Who requires which data in what form?

#### 1.8.1. Data Collection Methods

The data gathering method that have been used are observation, interview and document analysis. Observation supplements the interview while interviewing key commanders, information desk/center officers and inspectors used to clearly understood the system. In addition to observation and interview, there were written documents from the police office and international hotels that were important for the development of the system. These documents are seen or reviewed by group members and listed on the appendix A part of this project.

The sampling technique from non-probability sampling, purposive sampling technique is employed. The group members believed that accurate and relevant information is collected or gained from the key persons or experts. There are four woreda police stations and one police district in Adama city. The data will be collected from the police stations and international hotels.

#### 1.8.2. System Development Tools

This section describes the system development tools used to develop the system. The system is developed on Windows operating. The system development tools used are visual Basic Studio.net 2010 used as frontend to design interface and ASP.Net as server side scripting while the back end is Microsoft SQL 2008. Rational Rose Enterprise edition version 2002.05.00 and Microsoft office Visio 2003 are used to construct use cases, sequence diagrams, activity diagrams, system architecture, object relationships, class diagrams, hardware software mapping and deployment.

#### 1.8.3. Other Tools

Other tools used to develop the CCTS system are Adobe Photoshop used for designing different icon and background image for the interface, Microsoft office word to compile the project document.

#### 1.8.4. System Development Method

The system development methods used in this project is object oriented software engineering.

The core functions of the police are crime detection, crime prevention, call response and court/prosecution. The scope of the project mainly emphasized on the crime and criminal detection core functions of Adama City Police stations and office.



### 1.9. SCOPE OF THE PROJECT

The core functions of the police are crime detection, crime prevention, call response and court/prosecution. The scope of the project will mainly emphasized on the crime and criminal detection core functions of Adama City Police stations and office.

This section will provide detailed information on the scope of each of the component required for the implementation of this project.

#### 1.9.1. Geographical Scope

The table below highlights total locations which are to be considered for CCTS roll out.

Table 1: Geographical Scope

S.No.	Stakeholders of Adama city police CCTS	Total
1	Police stations	4
2	Central police office	1
3	International Hotels	10
Total number of units		15

#### 1.9.2. FUNCTIONAL SCOPE

The functional scope of this project primarily covers the functions and activities at the Adama city police stations. This can primarily be categorized into the following modules.

##### 1) Registration of

- a. Lost Property
- b. Crimes and Criminals
- c. International hotels
- d. Customer booked in hotel information

##### 2) Verification (cross-check and generate report in case customer booked in hotel information matches information recorded in criminals table).

##### 3) Manage user accounts

##### 4) Search, update and delete data

##### 5) Generate report and print

### 1.10. LIMITATION OF THE PROJECT

This project mainly focused on crime and criminal tracking that will be done in coordination with international Hotels, police office and police stations but does not involve the citizens as a primary source of the information through the system. In other words, the users are not interacting or give feedback with the system directly. Moreover, sharing of information and crime tracking is performed as long as there is internet availability and power with central server. Because of the time, human resource capacity and skill

available the project confined to Adama police stations and international Hotels.

### 1.11. SIGNIFICANCE OF THE PROJECT

The web-based crime and criminals tracking system will use information technology to facilitate prevention and detection of crime and criminals and lost properties. Information is shared across all stations if it is registered at a station. This will facilitate communication among the stations and it reduces the time taken to make decision on a case. Therefore, the system improves operational efficiency and effectiveness of the police. CCTS Provide the following capabilities:-

- Enhance ability to analyze suspected criminals and cases
- Reduce workload of the police station back-office activities such as preparation of regular and organized reports and station records management
- A collaborative knowledge-oriented environment where knowledge is shared across the different stations and office.
- Better coordination and communication among stakeholders
- Provide centralized repository

## II. LITERATURE REVIEW

### 2.1. Crime and Criminals

Thakur (2003) has defined crime as an act or omission of an act, which is punishable by law. However, an act that is considered as a crime in one place and time may not be true in another place or time.

According to Andargachew (1988), a criminal is an individual person who has violated the legally forbidden act. In fact, there are some factors that have to be taken into account to convict whether a person should be considered as a criminal or not. Among these, an individual should be of competent age in light with the law of the land and there must be a well predefined punishment for the particular act committed.

Sutherland and Cressey, cited in (Andargachew, 1988), stated that an act would be considered as a crime when it is prohibited by the criminal law. Criminal law, on the other hand, refers to a body of specific rules regarding human conduct, which have been explicitly stated by political authority.

Crime has increasingly become as complex as human nature. Modern technological advancement and

tremendous progress in communication have facilitated criminals of every corner of the world to commit a crime using sophisticated equipment in one place and then escape to another place (Thakur, 2003).

These days the globe is facing the proliferation of problems such as illicit drug trafficking, smuggling, hijacking, kidnapping and terrorism. Crime has adversely affected the societies of both civilized as well as developing countries by declining the quality of life, endangering human right and fundamental freedom and posing a serious challenge to the community. Although the level and intensity of the problem might vary from nation to nation no country has remained unaffected.

## 2.2. Crime Prevention

The causes for the growing rate of crime include unemployment, economic backwardness, over population, illiteracy and inadequate equipment of the police force (Thakur, 2003).

The form, seriousness and size of the crime, may rely on the form of a society and thus its nature changes with the growth and development of the social system. In every generation it has its own most critical, new and special problems of crime, although the crime problem is as old as man himself. In addition to this, the techniques employed to commit crime are new in the sense that they make use of modern knowledge and technique.

The rise in crime both national and transnational is generally thought as the result of interplay between socio-economic changes. The circumstances surrounding the individual offender such as his personality, physical characteristics intelligence, family background, environmental surrounding such as peer groups, neighbors etc have been subject of the study of crime (Andargachew, 1988). Hence, understanding the attributes of criminals will be helpful to design and implement prudent crime prevention strategies.

Crime, so to say, is one of the most critical social evils a society can face. Hence maintaining law and order is one of the principal functions of any government (Wilson, 1963). For this reason, governments usually establish organizations such as courts, prosecutions and police, which are responsible for the maintenance of law and order in their respective country. These agencies and other related organizations are responsible to curb the rate and occurrence of crimes. To do so, crime prevention agencies need to issue and implement crime prevention strategies. Theoretically, it is argued that crime prevention is better than cure for the following reasons (Thakur, 2003):

- Prevention safeguards the life and property of the society whom the police are in duty to protect.
- It avoids a good deal of trouble to the victim both physical and mental.
- Crime prevention rules out litigation, which follows in the process of detecting a crime.
- Prevention also saves the police from the trouble of recording crime at all odd hours of the day and night and of taking immediate action for the investigation.

Thakur (2003) suggested that intent and opportunity are two major factors that lead to the occurrence of a crime. An individual cannot commit a crime unless and otherwise s/he gets an opportunity even though s/he is intended to commit a crime. Therefore, the best strategy for crime prevention is to provide a system that denies any opportunity for a criminal to commit a crime.

However, these days Law enforcement and investigating agencies have recognized the tremendous value in extracting hidden knowledge embedded in their data warehouses which could be valuable in the process of combating crimes (Megaputer Intelligence, 2002).

The police departments want to reveal frequent crime patterns from historical reports to help them investigate new cases. According to Megaputer Intelligence (2002), the analysis of crime patterns and trends is very important for police officers and analysts can learn from historical crime patterns and enhance crime resolution rate. It also helps to prevent future incidents by putting in place preventive mechanisms based on observed patterns. Another possible advantage is, it can reduce the training time for officers assigned to a new location and having no prior knowledge of site specific patterns to assist them in investigations. In light with the crime patterns extracted from previous records, police can deploy scarce resources to the right place at the right time.

## 2.3. Crime and Criminals Information System (CCIS)

CCIS is an NCRB-driven program and has been launched in 1990. Since then, it has been implemented in 35 states and union territories and spans over 700 locations. Most of the UKCOPS police headquarters and district headquarters are covered by CCIS and so are some of the 14,000+ police stations in the country. CCIS is primarily an initiative to create crime- and criminals-related database that can be used for crime monitoring by monitoring agencies such as National Crime Records Bureau (NCRB), State Crime Records Bureaus (SCRB) and District Crime Records Bureaus (DCRB) and to facilitate statistical analysis of

crime and criminals related information with the States and monitoring agencies.

CCIS data is used for publishing online reports such as Missing Persons report and is also used as the basis for online query facilities that are available through the NCRB website. In addition, it is also used by NCRB to publish an annual nation-wide Crime Report. CCIS focuses exclusively in Crime and Criminals information and does not address the other aspects of Police functioning.

The CCTNS would provide a comprehensive database of crimes and criminals in Odisha, which will be integrated with central database leading to better tracking of criminals. (TIMES OF INDIAN, Bhubaneswar P17).

In order to realize the benefits of e-Governance fully, it is essential that a holistic approach is adopted that includes re-engineering and standardizing key functions of the police and creating a sustainable and secure mechanism for sharing critical crime information across all police formations. The CCTNS has been conceptualized in response to the need for establishing a comprehensive e-Governance system in police stations across the country.

Over the decade, a lot of research work had been carried out and many computer programs had been written in order to assist the police with information on criminals and crimes. One of such development is the Ohio Department of Rehabilitation and Correction where the system (database) enables you to search for people who have been convicted in Ohio, and the information is usually about when a person is convicted, when the person was sentenced or fined, and when the person was released. Ohio Department of Rehabilitation and Correction protects and supports Ohioans by ensuring that adult felony offenders are effectively supervised in environments that are safe, humane, and appropriately secure. In partnership with communities, it aims to promote citizen safety and victim reparation. (Daniel E.S. Kawai, Dogo H. Samson 2011)

National Crime Information Center (NCIC) of Criminal Justice Information Services (CJIS), Division, located at Clarksburg, West Virginia USA, as cited in (Daniel E.S. Kawai, Dogo H. Samson 2011) is a computerized index of criminal justice information (i.e. criminal record history information, fugitives, stolen properties and missing persons). It is available to Federal, state, and local law enforcement and other criminal justice agencies and is operational 24 hours a day, 365 days a year.

The purpose for maintaining the NCIC system is to provide a computerized database for ready access by a criminal justice agency making an inquiry and for prompt disclosure of information in the system from other criminal justice

agencies about crimes and criminals. This information assists authorized agencies in criminal justice and related law enforcement objectives, such as apprehending fugitives, locating missing persons, locating and returning stolen property, as well as in the protection of the law enforcement officers encountering the individuals described in the system.

#### 2.4. CANADIAN Police Information Centre (CPIC)

The Canadian Police Information Centre (CPIC) was created in 1966 to provide tools to assist the police community in combating crime. Since 1967, CPIC is also a computerized information system available to provide all Canadian law enforcement agencies with information on crimes and criminals.

CPIC transmits requests by authorized agencies to several data banks primarily for law enforcement purposes. One of those data banks is the Criminal Records Information Management Services (CRIMS). CRIMS updates and maintains more than 600,000 criminal records annually and populates criminal record information to the Canadian Police Information Centre (CPIC) Identification Data Bank.

A clear result from a CPIC check does not necessarily mean you have a clear criminal record. There are numerous criminal record systems nation-wide and then there are the provincial courts. Consequently, your criminal record can be stored, and accessed, in any number of ways. If you know you had trouble with the law in the past, and you are contemplating a career change, or some foreign travel, you may not want to rely on just a local police check to give you piece of mind. Consult a specialist in criminal record systems, who can conduct a comprehensive, multi-level criminal record search to ensure all records held on you are uncovered, and if so, dealt with accordingly.

Canadian policing entered the electronic age in 1972 when the Canadian Police Information Centre (CPIC) went online. CPIC (pronounced see'pick) is an automated system operated by the Royal Canadian Mounted Police (RCMP) on behalf of the nation's policing community. While serving a broad range of police information needs, the RCMP summarizes CPIC's purpose as providing "tactical information on crimes and criminals" (RCMP 1995, no. 17).

In investigating crimes and criminals, the police risk making two types of errors. First, they may believe an innocent person to be guilty of wrong-doing. In the parlance of statistical hypothesis test-ing, this would be analogous to making a Type I error (see Ott, Mendenhall and Larson 1978, pp. 218-20). Conversely, police may

falsely believe a guilty person to be innocent of wrongdoing, which would be to commit a Type II error.

In addition to CPIC, the RCMP operates special-ized systems. One is the Automated Criminal Intelligence Information System (ACIIS) maintained by the Criminal Intelligence Service Canada (CISC) network of agencies from across the country. CISC gathers data on organized criminal activities such as “trafficking of illegal drugs, gambling, extortion ... and contract murder” (RCMP 1995, no. 26; Treasury Board 1995, pp. 764, 773). Another system, the Violent Crime Linkage Analysis System (ViCLAS) offers trained specialists a sophisticated analytical tool to identify similarities in crimes committed across the country (Backgrounder to Campbell 1996). Access to ACIIS and ViCLAS is highly restricted and in some areas the systems are not heavily utilized. Ontario forces, for instance, gained access to ViCLAS a few years ago but, until recently, only a fraction of murders and serious sexual as-saults were reported to the system. CPIC on the other hand, is relatively visible and widely used.

When CPIC was introduced, the police community greeted it with enthusiasm. Within two hours of going online, the Ontario Provincial Police (OPP) submitted the plate number of a burned out (stolen) vehicle and recorded the system’s first “hit” (Higley 1984, p. 492).

Maguire argues (2004) information is power and the latest communication facilities give an immediate possibility to retrieve information accurately. Thus, police departments employ information systems to increase police officers’ intellectual capacity to solve social problems and to react efficiently to crime (Maguire, 2004). The quality of work comes from the quality of workers. What can officials do in carrying out their mandate? In this respect, Herbert Simon (1997) recommends that organizations provide an environment that shapes and develops personal qualities and habits. Organizational branches would be more productive when managerial levels support rational and practical instructions. For this reason, managers need accurate information about their jurisdiction and personnel to analyze specific conditions as well as to evaluate organizational performance (Bratton & Knobler, 1998; Maple & Mitchell, 1999).

## 2.5. Police Information Retrieval System (PIRS)

PIRS is the RCMP's automated information management system used to store, update and retrieve information on case records/occurrences being, or having been, investigated. This electronic indexing system is used by the RCMP, some Municipal Police agencies, by Firearms Officers, and by other federal partners.

PIRS captures data on individuals who have been involved in investigations under the Criminal Code, federal and provincial statutes, municipal by-laws and territorial ordinances. According to the RCMP, in addition to details of an event in a brief synopsis (maximum of 240 characters), PIRS contains limited information relating to investigations and criminal histories.

Unlike CPIC, which essentially contains factual information (e.g., charges and convictions), PIRS may also contain information provided by witnesses, victims and other associated subjects that can be highly subjective, as well as the names of the witnesses, victims, and acquaintances of the accused individual.

PIRS also differs from CPIC in that it contains information on occurrences and incidents that never resulted in charges. That means you can have a PIRS record and not even know it. Entries in the Police Information Retrieval System (PIRS) are assigned codes which bear significance on whether the details on an individual are disclosed in the RCMP's standard four level criminal record check (form 3923e, Consent for Disclosure of Criminal Record Information).

The two major classifications are "Subject Chargeable" (SCH) and "Subject of Complaint" (SOC). Subject Chargeable implies a higher degree of assumed guilt of the individual in question. Subject of Complaint simply denotes that the individual has been brought to the RCMP/Police's attention in an investigation and their name and personal details had to be entered into PIRS for the purpose of maintaining a record of the incident.

Subject Chargeable entries are often revealed in the fourth category of the RCMP's four-section criminal record check; whereas SOC entries are typically not, as they generally denote information which is highly subjective.

## 2.6. Provincial and Municipal Police Information Retrieval Systems

Similar to the RCMP's PIRS database, Ontario has a police information retrieval system known as OMPACC, while Calgary has PIMS, Edmonton has PROBE, Regina has IRIS, etc. Formal and informal information sharing arrangements are in place between police services or agencies for the exchange of information in these databases.

If you have specific knowledge of your own personal experience/incident that might be included on a local or regional police information system, and you don't want to do a multi-level record search, you may want to obtain information contained on you in provincial and municipal criminal record databases through freedom of information



requests. Contact your provincial privacy commissioner for more information on how to make such a request.

### 2.7. Goa Police CCTNS

The Vision of the project (CCTNS) is “to transform the police force into a knowledge-based force and improve the delivery of citizen centric services through enhancing the efficiency and effectiveness of the police stations by creating a platform for sharing crime and criminal information across the police stations in the country”( Goa Police Government of Goa RFP Volume 1).

### 2.8. Information Technology Staffing and Responsibility

As in many police departments, Information Technology (IT) responsibility was housed, until recently, in the Information Management Bureau (IMB) organized internally under Support Services. Technology came to be located in Support Services because it was seen as an essential tool to support community policing by the command staff. Politically, the police department maintained considerable independence and autonomy from city government. This was the case for some time, as the city viewed the department as fully capable of managing its own affairs. The department did respond effectively to political, financial, and intellectual forces in growing its technology capabilities. IT decision makers began formal planning early on by coordinating the gradual phase in of new IT infrastructures related to communications, records management, and CAD systems. As the cost and complexity of technology increased, however, the city took steps to centralize all IT, police included.

In May of 1998, the city reorganized IT and centralized all departmental IT units into one city Information Technology Division (ITD). This was seen as a positive move by some in the command structure, but many patrol commanders and communications staff were not so willing to hand over control of IT. Financially, it made sense for the city to coordinate IT; the city could better integrate systems and, through economies of scale, buy in bulk more efficiently. Further, the police department appeared to be stagnant on many pressing issues, including systems coordination, management, liability, and upgrading computers. As a consequence, the city-centralized IT came at an advantageous time for the Tempe Police Department.

The police department suspects that future IT improvement projects and recommendations will receive more support, since these recommendations will come from the city and will not be seen as self-serving. The reorganization meant that the Criminal Justice Automation Committee and the Criminal Justice Operations Committee were merged. In addition, the police department is optimistic about the

changes because many needs that were left unmet will be addressed. Historically, the police department thought that certain needs were to be met by the city, and the city assumed that the police department was to meet those needs. In reality, neither group met the needs of the other. Overall, the Tempe Police Department command staff views relocating the IT function into the city as a compromise between fiscal needs and control.

Another obvious advantage of centralizing IT responsibility is that city IT employees are more capable of handling IT decisions than police employees. They are more knowledgeable on various IT systems and platforms and hardware and software upgrades. The department also saves the costs of training sworn staff on IT systems and software. Information Systems Related to Professional-Era Policing Operations/Command and Control Systems

The department's computer-aided dispatch (CAD) system was originally acquired in 1982. The CAD architecture consists of one centralized minicomputer talking to mobile data terminals (MDTs). The system uses Public Safety Systems Incorporated (PSSI) designed and supported software. The records management system (RMS) is 32 Police Department Information Systems Technology Enhancement Project (ISTEP) about 12 years old. Both the RMS and the CAD have been updated regularly. The department uses ALERT as its primary RMS and a response CAD system; both are produced by PSSI and, therefore, communicate well with each other. ALERT has a calls for service module that is synchronized daily. ALERT users can access CAD data as little as 24 hours old. A major short-term goal is to have a stand alone RMS that will be year 2000 (Y2K) compliant.

### 2.9. Reviewed Systems Drawbacks and their Solutions

The reviews described have the following problems:

1. The system does not provide information sharing linkage between hotels and police stations. But, if there is an interconnection between them, criminals can be easily tracked or detected while they booked in hotel without the intentions of hotels or criminals.
2. Daily report of the hotel is brought to nearby police station with human labor which is time consuming and costly. The CCTS system enables hotels submit their report to the nearby police station immediately while they are recording on their computer. This reduces the cost hotels incurred to send report to police station and even save time.

3. Most system would not enable police to register lost properties. The Adama police office CCTS enables police to register the lost properties at a station and then it will be distributed immediately to other stations. No need to walk through other station of the police. This will improve service deliver to the customers, save time, cost and increase the satisfaction of the citizen.
4. The systems are online or web based but no study deals about offline functionality of the crime and criminal system. The CCTS of Adama city police should provide offline functionality. Even though there is no network available the individual computers can work alone and synchronization would be done when the network is online.

### III. SYSTEM REQUIREMENT SPECIFICATION

#### 3.1 Introduction

A requirement is a feature that the system must have or a constraint that it must satisfy to be accepted by the client. Requirements elicitation and analysis focus only on the user's view of the CCTS system. For example, the functionality provided by the system, the interaction between the user and the system, the errors that the system can detect and handle, and the environmental settings in which the system operates or utilized.

#### 3.2 Existing system of Adama city police office

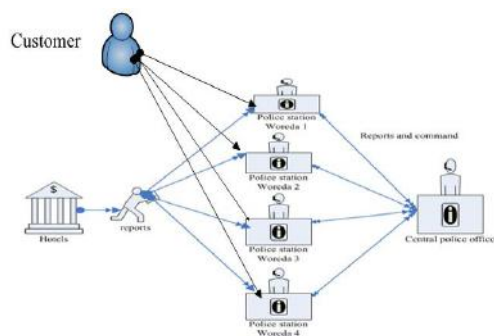


Fig.3.1 Existing system of Adama city police office

As shown on the above fig. the existing system of the Adama city police office uses manual system to exchange information or to send instructions and reports to the head office or district, they use human intermediaries or telephone. When citizens want to apply for their lost properties at police station, they need to go every station. Additionally International hotels in the city report the daily information of their customers booked to the nearby police station using human labor.

#### 3.3 ADAMA CITY POLICE OFFICE CCTS SYSTEM

The new system creates a platform user friendly interface in which police stations and central police office or district exchange information through a centralized database system and enables international hotels to report or submit customer information booked in their hotel to the nearby police station. Moreover, the system supports stakeholders to access and able to work on offline and online environment.

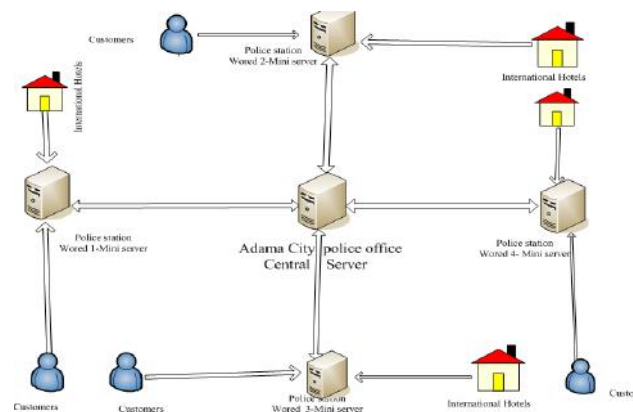


Fig. 3.2 CCTS System

#### 3.4 System Requirement Elicitation

There are different steps, approaches and the main processes involved in the crime and criminal tracking system process of the Adama city police office. In this section the functional and non-functional requirements of the new system will be described and modeled using UML models.

#### 3.5 FUNCTIONAL REQUIREMENTS ELICITATIONS

Functional requirements describe the interactions between the system and its environment independent of its implementation.

##### 3.5.1 Description of the modules and functional requirements

The functionality of the CCTNS application is focused on providing value to the police personnel, specially the officers operating at the cutting edge and simplifying the day to day operations of the police function.

The web-based CCTS system functional requirements are listed as follows:

##### 1. Login

The system has the functionality that enables users to login to the system and perform any activities according to their access privilege assigned to them. That is each actor or system user has his/her own credential stored in the

database. The system will check the keyed values against the values stored in the database.

## **2. Storing crime and criminal's detail information**

The crime and criminals registration module is proposed to register and store cognizable crime and criminals. Registration module would enable assignment of a unique number to facilitate proper monitoring. The details captured may include but not limited to missed persons, crime and criminals and suspected person.

## **3. Storing property detail information**

The property registration module is used to capture detail information about stolen, lost and found properties.

## **4. Registering International Hotels information**

The hotels Interface module of the CCTS acts as a conduit for information exchange between hotels and police stations. This module enables to register and stores detail information about international hotels found Adama city.

## **5. Recording and submitting Hotel's customer information to police station**

The system should support submission of daily customer's booked in hotel information to nearby woreda police office and retain copy of it.

## **6. Generate Report**

This module is used to generate the daily, quarterly, semi-annual and annual report by woreda police office to Adama central police office.

## **7. Enable user to access knowledge base**

This module is used to provide common information that helps the staff members to share information and any knowledge base which leads them to increase efficiency and effectiveness in their work according to their access right. Such as rules, proclamation and selected cases which are assumed to be best practice.

## **8. Provide search facilities**

The search module enables users of the system to surf or look up any data from the database depending on the privilege they have.

## **9. Manage user account**

Create, Update and delete user account module helps the system administrator to manage user accounts.

## **10. Print**

The print module is used to printout the required data or reports by commander and system administrator.

## **3.6. NON-FUNCTIONAL REQUIREMENTS**

Nonfunctional requirements describe user-visible aspects of the system that are not directly related with the functional behavior of the system.

Nonfunctional requirements include:

### **User Interface and Human Factors**

The system will have consistent interface formats and button sets for all forms in the application, will have a form based interface for all data entry and viewing formats, and will generate reports that are formatted in a table and that should look like the existing manual report formats for user friendliness. The system will be easily maintained by the developer or other authorized trained person and it shall respond as fast as possible in registering properties, crime and criminals, generating reports and working over a networked environment. There should be a short training class to explain the functionality of the interface and how to use it. The system is easy to learn, and can handle many jobs at once.

### **Hardware Considerations**

The web based Crime and Criminal Tracking System can be run on any Windows platform. The system did not require special hardware, although the suggested minimum is processor speed is 1.3GHz Pentium compatible PC with 512 MB RAM, 160GB Hard disk capacity and a Network Interface Card

### **Performance Characteristics**

The System should be able to take information from a user and enter it into the database. The speed at which this will be completed depends on the number of records currently in the database. None of the processes are time sensitive, however the response time should be relatively short (somewhere around 20 seconds). A typical load on the system would be multiple users entering information. It was tested for five computers and it works fine and we assumed that the system supports up to 20 clients without any delayness.

### **Error Handling and Extreme Conditions**

The system will be able to handle erroneous input by displaying an appropriate error message and should give only valid result, if no data is found with the specified criteria the System should not have to crash or give invalid response. All error messages produced by the System must be meaningful, so that they can be appropriately acted upon by the users who are likely to see them. If a user requests access to, or searches for, a case which he does not have the right to access, the System must provide an appropriate message

The system should be able to support offline services in case there is no network connectivity and also taken into consideration are possible extreme conditions that may occur while using this software or system, such as hardware failure (i.e. system or hard disk crash). To handle this, the database is backed up onto backup devices.

### Quality Issues

During the development of the project the participation of stake holder is required to achieve the objectives of the project. The system developers should design a prototype and provide to the system users that supports them to fully understand the users' needs and their expectations from the system. This enables the developers to gather suggestions and to conform to their expectations to successfully develop the system. Besides this, the system should be available and reliable to provide uninterrupted service for users. That is the system should support an offline service .

### System Modifications

The CCTS system is a web based system that is scalable as per the size of the stakeholders. In other words, the system will be configured by police office IT experts or developers as new branches and international hotels are launched through time.

### Physical Environment

The system will be deployed on multiple computers located in the central office of the facility, as well as in the woredas police station offices and International Hotels. Because of this, there are no external environmental factors to take into consideration. The computers will be plugged into surge protectors to prevent possible damage from power surges. Also, the temperature and humidity in the room are controlled, and always remain in an acceptable range for this system. And also it refers to the location where the system will be deployed and external constraints that may affect the system functionality. Therefore CCTS system will be deployed at Adama City police office and the stakeholders should be able to perform their normal activity in case there is no network connectivity even though there is no real interaction between the central server and other mini-servers.

### Resource Issues

If database file is too big, so it require large media like a tape drive, commonly used in large organizations..

### Security issues

Security requirements are important factors in this system as classified data will be stored in the database. User validation will be done during login to ensure that the user is valid and that the user only has access to his or her permission data. The system should be protected against

external intrusions or malicious users through user authentication and antivirus. It is the responsibility of system administrator to create all users account and to grant required privileges to each user.

### Documentation

CCTS system user documentation is prepared and attached at the end of the annex.

### SYSTEM MODELS

System models describe the scenarios, use cases, object model, and dynamic models describing the system. This section contains the complete functional specification of the system, including mock-ups and navigational charts illustrating the user interface of the system.

### Use Case Model

In its simplest form, a use case can be described as a specific way of using the system from a user's or actor's perspective. Use case provide a means to capture system requirements, communicate with the end users and domain experts, and test the system. Use cases are best discovered by examining the actors and defining what the actor will be able to do with the system.

### Actors

An actor is a set of roles that users of use cases play when interacting with the system. They are external entities which the system will provide a service for them.

The identified actors that will be participating in the system are:

- Police Stations(information desk officer)
- International Hotels(receptionist)
- System Administrator
- Commander
- Staff Users

### Use Case Diagram

A use case illustrates a unit of functionality provided by the system. The main purpose of the use-case diagram is to help development teams visualize the functional requirements of a system, including the relationship of actors to essential processes, as well as the relationships among different use cases. Use cases have descriptive names that describe what a system does but not how it does it and must be unique within a given package.

In CCTS project going to be developed, the following use cases have been identified during the requirements elicitation.

- Register crime and criminal
- Register lost Property
- Search information



- Access knowledge base
- Update record
- Delete Data
- Manage user account
- Register hotel information
- Register customer booked in hotel
- Generate Report
- Login
- Print

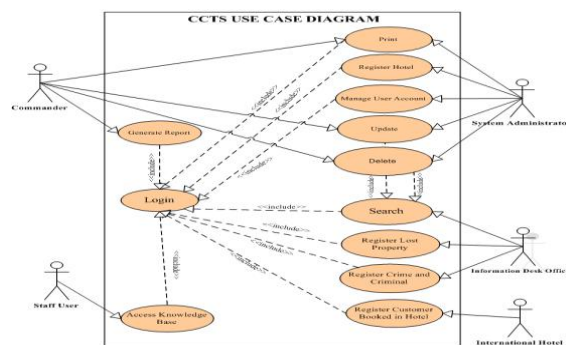


Fig. 3. 3 CCTS Use Case Diagram

The following tables show the description of CCTS use cases.

Table1 Login Use Case Description

Use case Name	Login
Description	The system functionality that enables users to login
Participating Actor	System Administrator, Hotel , commander, Information Desk Officer and staff user
Entry condition	1. User must have user account
Flow of events	2. Type the CCTS URL address on browser and press go button 3. Login Page will be displayed 4. User fills user name and password 5. click the login button
Exit condition	User profile page is opened
Alternative (flow of events)	a) if invalid user name and password entered, an appropriate control validation message displayed at the side of text box controls b) user refill his or her user name and password and press login button

Table 2.Manage User Account Use Case Description

Use case Name	Manage User Account
Description	The system functionality used to create, delete, change user account and set privilege for system users
Participating Actor	System Administrator
Entry condition	System Administrator must have user account
Flow of events	1. Type the CCTS URL address on browser and press go button 2. System Administrator Clicks on Manage User Account hover button 3. Manage User Account form displayed a. Then enter user information to create new user and press on create button b. Search user to delete or update user information and press on delete or update button

	4. Confirmation message is displayed.
Exit condition	User Account created, deleted or updated
Alternative flow of events 1	a). If Create Account page controls are empty and account name is duplicated then b). The Create Account control should display appropriate error message beside the controls c). The system Administrator enter correct information d). Clicks on Create button
Alternative flow of events 2	a). If delete account page password confirmation is invalid then, the system Administrator enter valid information and Click delete button b). If update account control confirmation is invalid then, the update account control should display error message. Then the system administrator enters correct information and press update button

*Table 3 Register Customer Booked In Hotel Use Case Description*

Use case Name	Register customer booked in Hotel
Description	The system functionality used to register customer booked in Hotel
Participating Actor	Hotel
Entry condition	1. Hotel must have a user account
Flow of events	2. Type the CCTS URL address on browser and press go button 3. Login form displayed 4. Fills user name and password and press login button 5. Customer Registration page is displayed 6. Hotel fills the customer's information 7. Clicks on submit button 8. Confirmation Message is displayed
Exit condition	customer information is submitted
Alternative flow of events 1	a) If data entry error is occurred then, the submit button control displays an appropriate message. b) Hotel enter correct data and press on the submit

*Table 4 Register Property Use Case Description*

Use case Name	Register property
Description	The system functionality used to register lost property information
Participating Actor	Information Desk Officer
Entry condition	1. IDO must have a user account
Flow of events	2. Type the CCTS URL address on browser and press go button 3. Login form displayed 4. Fill user name and password and press login button 5. Home page displayed

	6. Click on Lost property menu 7. Lost property registration page is displayed 8. Fill lost property information 9. Click on the register button 10. Confirmation message displayed
Exit condition	Property registered
Alternative flow of events	a) If data entry is invalid then the register button control displays field validation message b) adjusts the entries and press register button

Table.5: Register Crime and Criminal Use Case Description

Use case Name	Register crime and criminals
Description	The system functionality used to register crime and criminals information
Participating Actor	Information Desk Officer
Entry condition	1. Information Desk Officer must have user account
Flow of events	2. Type the CCTS URL address on browser and press go button 3. Login form displayed 4. Fill user name and password and press login button 5. Home page displayed 6. Click on Register Crime and Criminal hover button 7. Crime and Criminal page registration page is displayed 8. Fill Crime and Criminal information 9. Click on the register button 10. Confirm message is displayed
Exit condition	Crime and Criminal information is saved
Alternative flow of events	a) If data entry is invalid then the register button control displays field validation message b) adjusts the entries and press register button

Table 6 Register Hotel Information Use Case Description

Use case Name	Register Hotel
Description	The system functionality used to register International Hotel information
Participating Actor	System Administrator
Entry condition	System Administrator must have user account
Flow of events	1. Type the CCTS URL address on browser and press go button 2. Login form displayed 3. Fill user name and password and press login button 4. Home page displayed 5. Click on Hotel Registration button 6. Hotel registration page displayed

	7. Fill Hotel's information 8. Click register button 9. Confirmation message displayed
Exit condition	Hotel is registered
Alternative flow of events	a) If hotel registration data entry is invalid then register button control display error message b) System Administrator adjusts the error with correct value and press register button

Table 7 Generate Report Use Case Description

Use case Name	Generate Report
Description	The system functionality used to generate report
Participating Actor	Commander
Entry condition	Commander must have a user account
Flow of events	1. Type the CCTS URL address on browser and press go button 2. Login form displayed 3. Fill user name and password and press login button 4. Home page displayed 5. Click on Report button 6. Report page displayed 7. If printout is needed click print icon
Exit condition	Report is generated
Alternative flow of events	a. If report is not generated then b. Display appropriate message

**Use case Scenario**

A scenario is a narrative description of what people do and experience as they try to make use of computer systems and applications [Carroll, 1995].

The following scenarios describe the CCTS feature system functionality from the view point of different actors (system users):

The following tables show the description of CCTS use cases scenarios.

Table 8 Login Use Case Scenario

Use case Name	Login
Description	The system functionality that enables users to login
Participating Actor	System Administrator: Inspector Mesfin
Entry condition	1. Mesfin must have user account



Flow of events	<ol style="list-style-type: none"> <li>2. Mesfin Type the CCTS URL address on browser and press Return key</li> <li>3. Login page will be displayed</li> <li>4. He fills user name and password and click the login button</li> <li>5. If his name and password is valid then User profile page is displayed.</li> </ol>
Exit condition	User profile is opened
Alternative (flow of events)	<ol style="list-style-type: none"> <li>a. If user name and password is Invalid</li> <li>b. Appropriate error message is displayed</li> <li>c. Click Ok button</li> <li>d. Login Page controls reset to empty string and</li> <li>e. user re-enter user name and password as long as counter is equal to 3</li> <li>f. Click on the login button</li> </ol>

### 3.7 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. The sequence diagrams used in the CCTS project are depicted with their descriptions as follows:

As it is illustrated in Fig. 2 Login sequence diagram below, users such as System administrator, hotel ,

commander, information desk officer and staff user can login to the CCTS with their respective login information. When the user types CCTS URL on the browse and click Go button, the login Page will be displayed, user fills user and password information and then click login button, login controller will be initiated, if the user provides the appropriate input the system display user profile page otherwise the login page is displayed till the maximum threshold is equal to 3.

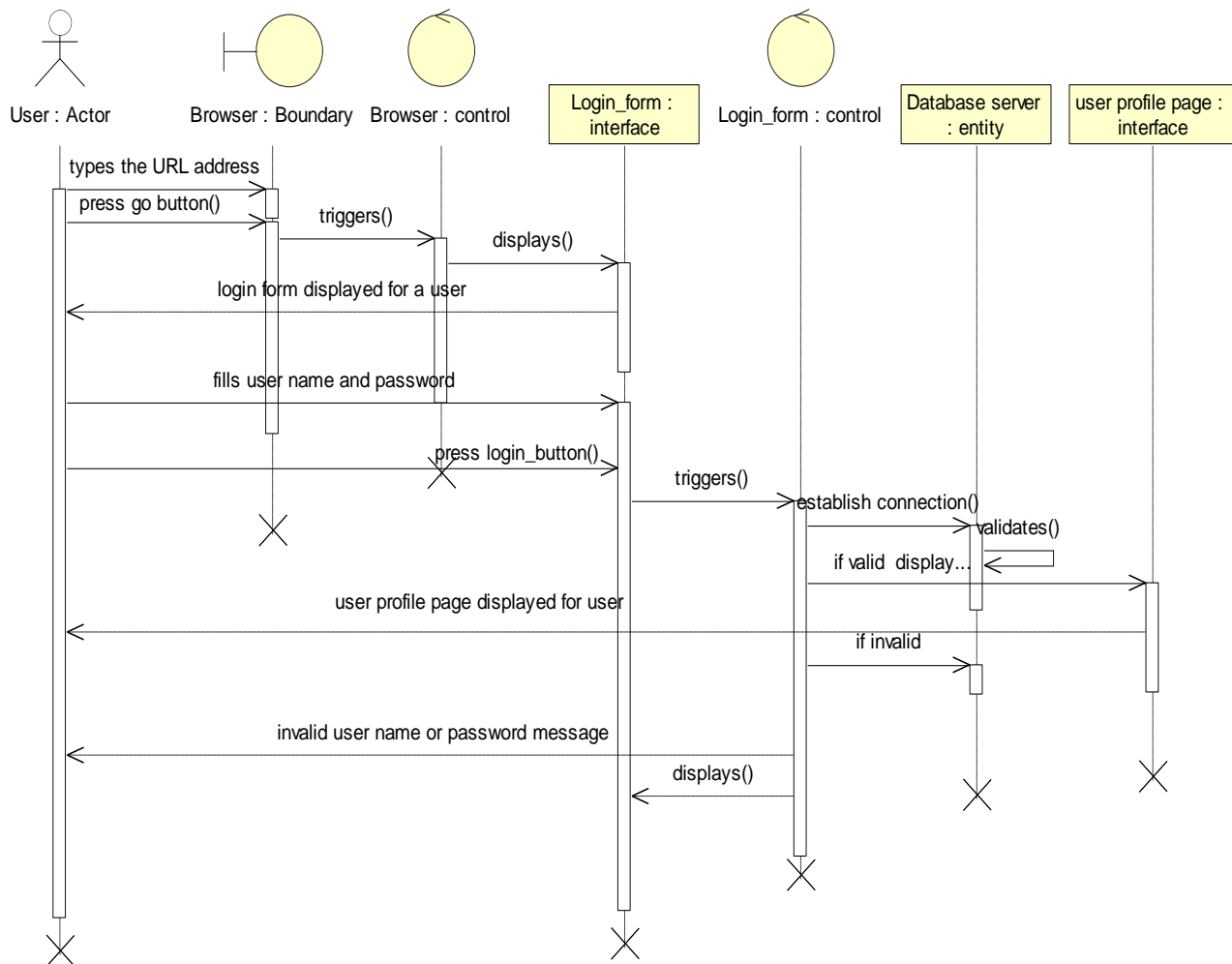
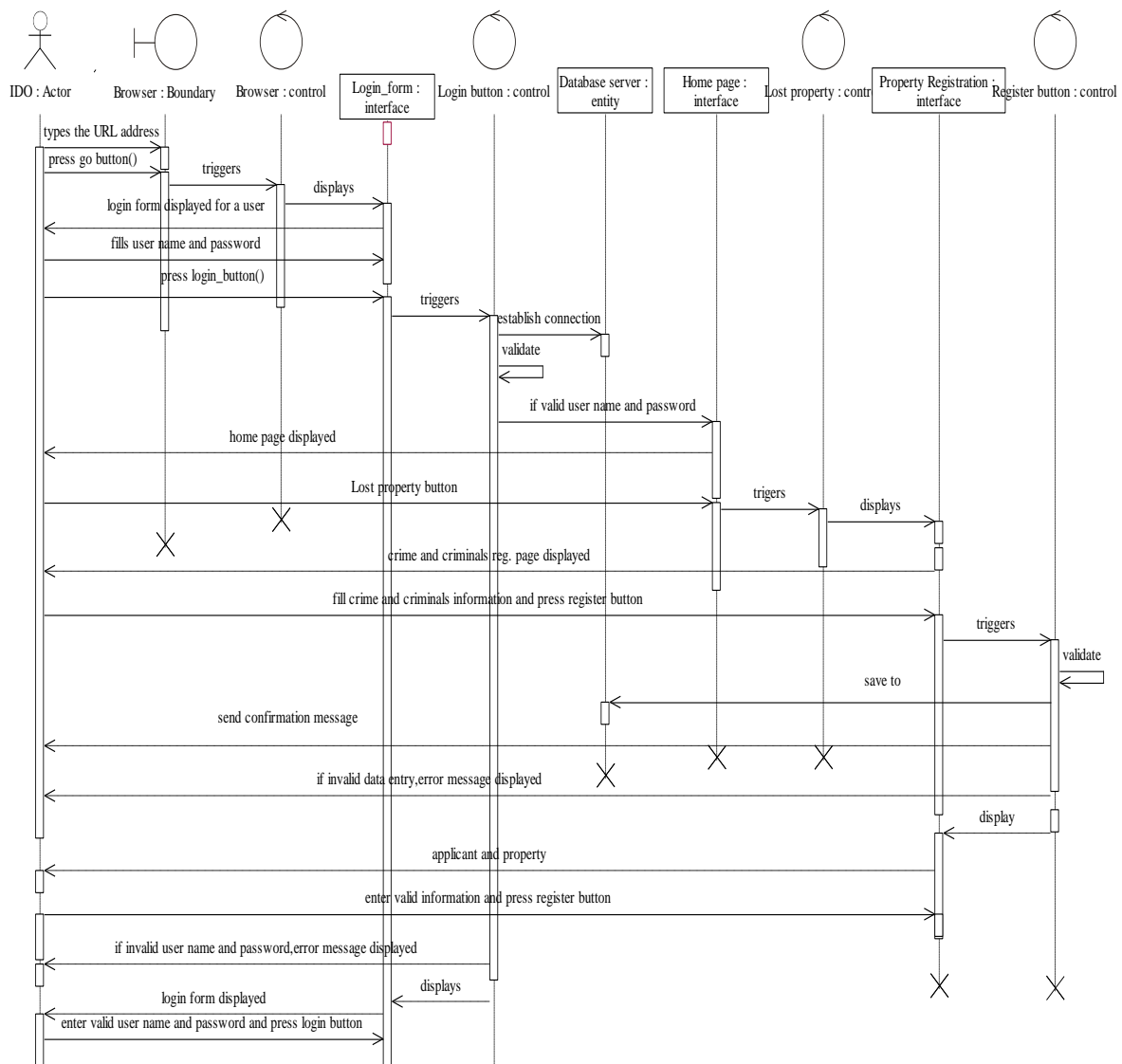


Fig.3.4 Login Sequence Diagram

As illustrated on the figure 3 below, the information desk officer starts system through typing the URL of CCTS and click Go button, login form is displayed, filling proper username and password and press login button, then login button controller validate parameters of the user, and if it is valid and correct the home page is displayed, information desk officer click lost property menu, lost property registration page will be loaded and the user fill

the correct information and click register button then the system will display registration confirmation, If data entry error occurs the system display error messages beside the lost property registration controls with red color. If invalid login information is entered, system will return to login page by resetting controls until the maximum threshold is equal to 3.



*Fig.3.5 Property Registration Use Case Sequence Diagram*

As it is illustrated in Fig. 4 customer booked in hotel use case sequence diagram, it shows how hotel can type CCTS URL address on web browser and click Go button then login page will be displayed, fill the correct the username and password, click on login button and establish connection, then customer registration controller will

authenticate and validate the parameters of the user, and if it is valid, the customer registration page will be displayed and hotel fill the customer information then the system will display registration confirmation. If not the system go to login page to reenter the correct user name and password.

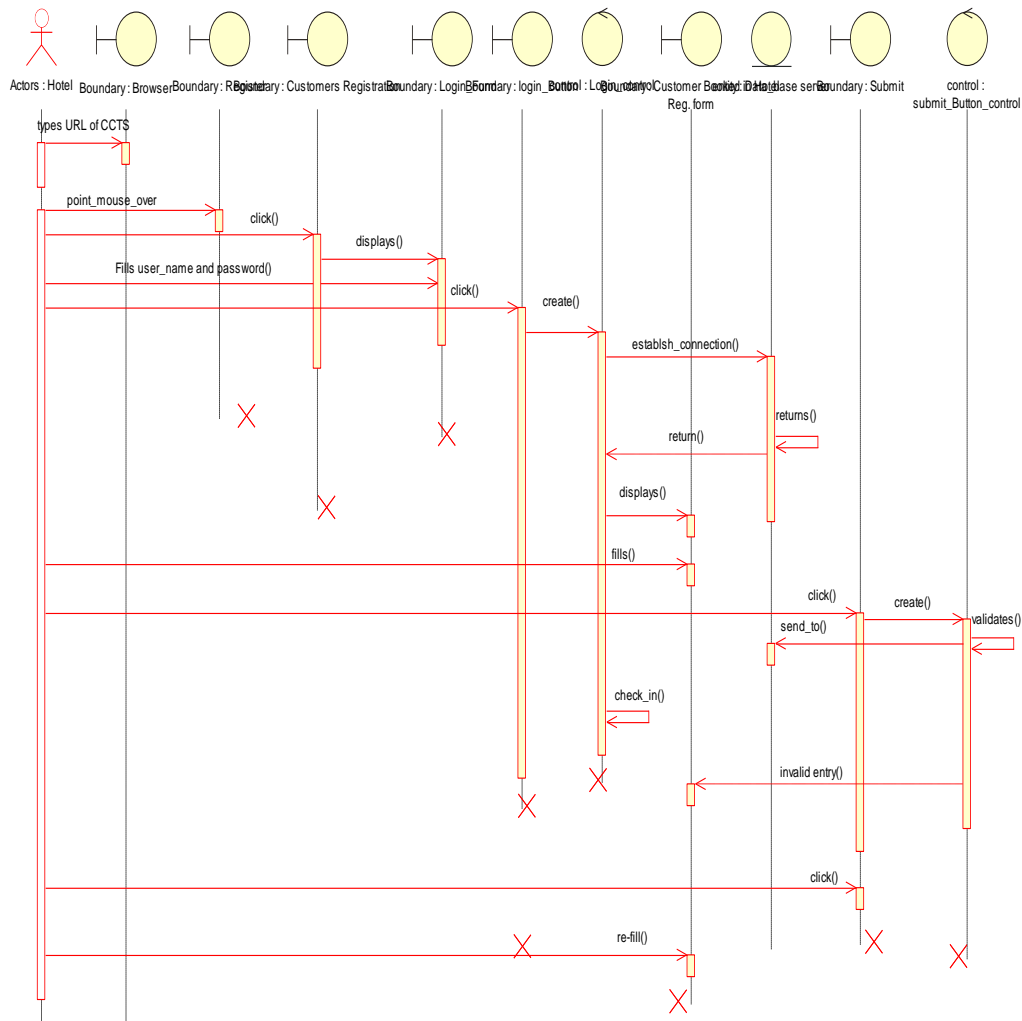
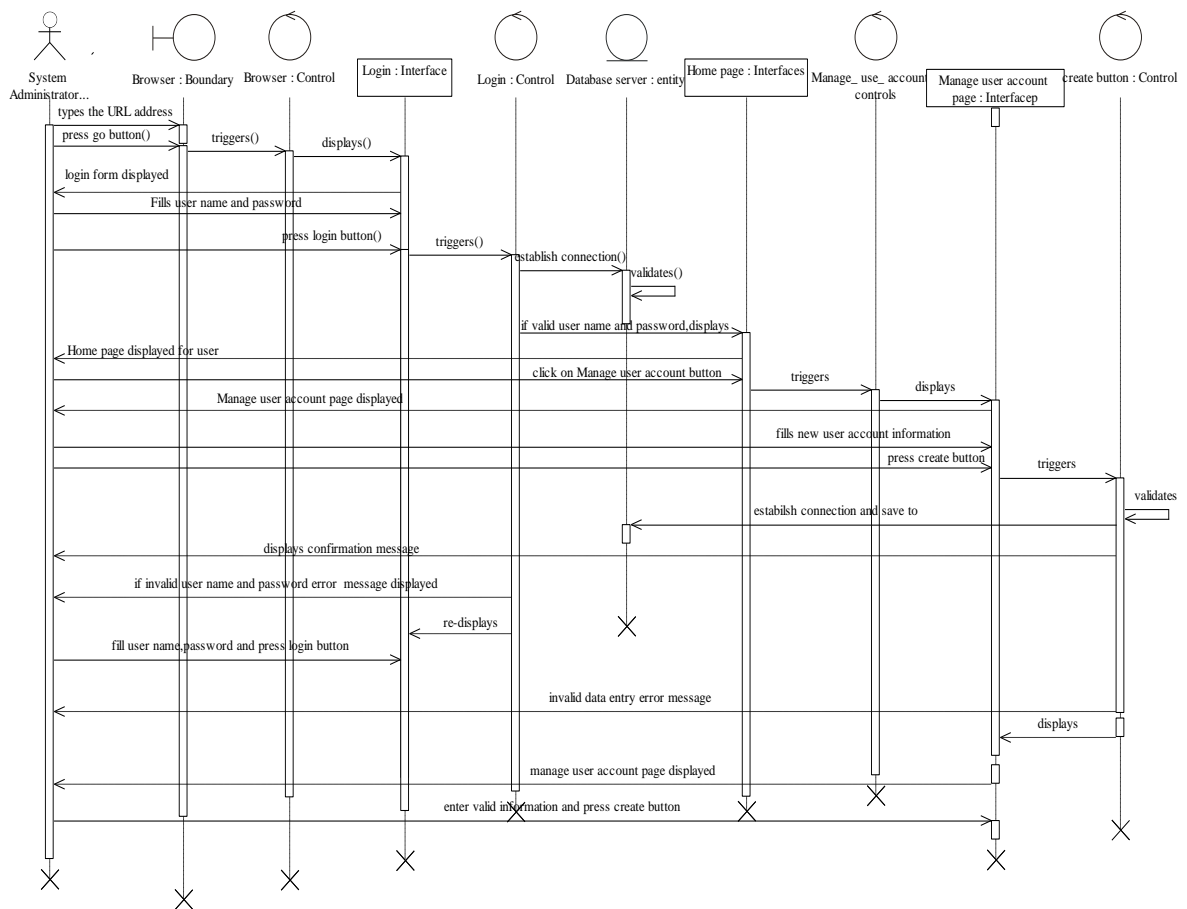


Fig.3.6 Customer BookeFig.4 customer booked in Hotel Use Case Sequence Diagram

As it is illustrated in Fig. 5 Create User Account Sequence Diagram shows how System Administrator manages user account. The user types the URL of the CTS on web browser and press enter key, the login Page is displayed, user fills user and password information then click on the login button, controller will be initiated, and will authenticate and validate the information of the user,

and if it is valid click manage user account button from home page, Manage user account profile is loaded, then user enter valid information and click on the create account button. Finally, system replies the user account creation confirmation message, if data entry is incorrect, refill correct information. If login information is invalid the system return the user to login page.





*Fig.3.7 Create User Account Sequence Diagram*

### Crime and Criminal Registration Sequence Diagram Description

The IDO types the CCTS URL on web browser and press Go button, the login page is displayed, the IDO fills login information and hit login button then the login button control instantiate and validation are done. If the validation is correct, the home page will be displayed. The IDO clicks crime and criminals registration button, crime and criminals registration page is displayed, fill the information required and hit register button. If all controls are properly filled the data will be saved to the database and confirmation message is returned.

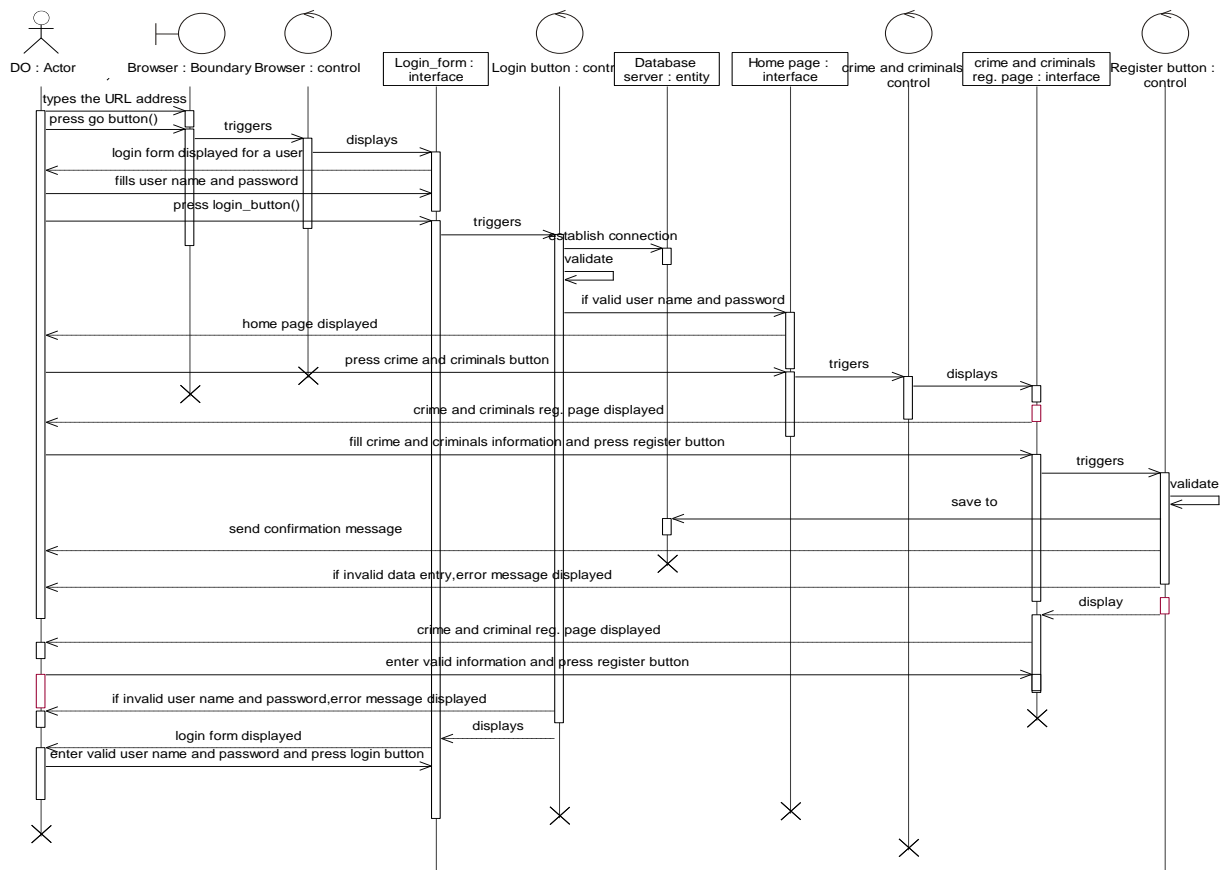


Fig.3.8 Crime and Criminal Registration Sequence Diagram

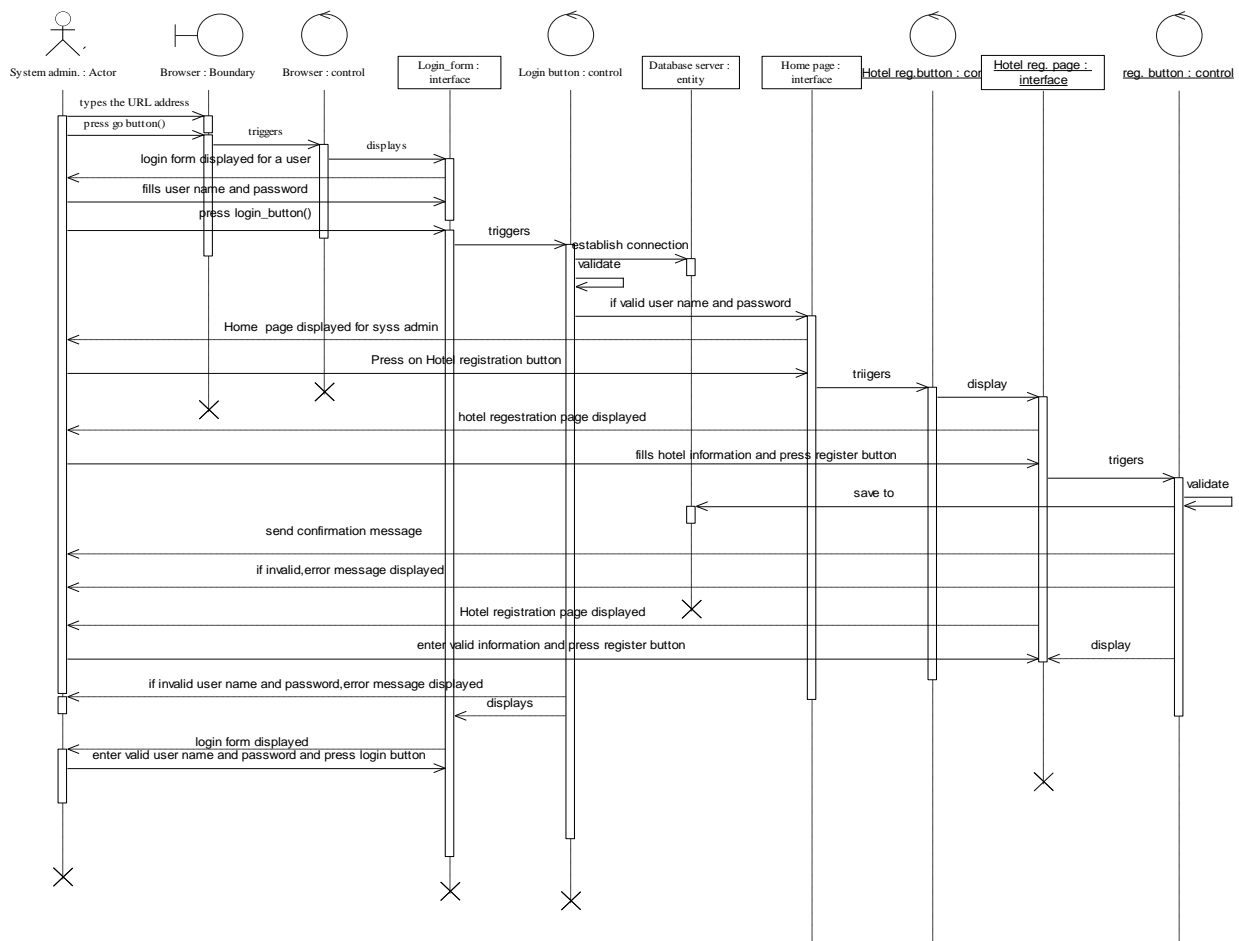


Fig. 3.8 Hotel Registration Sequence Diagram

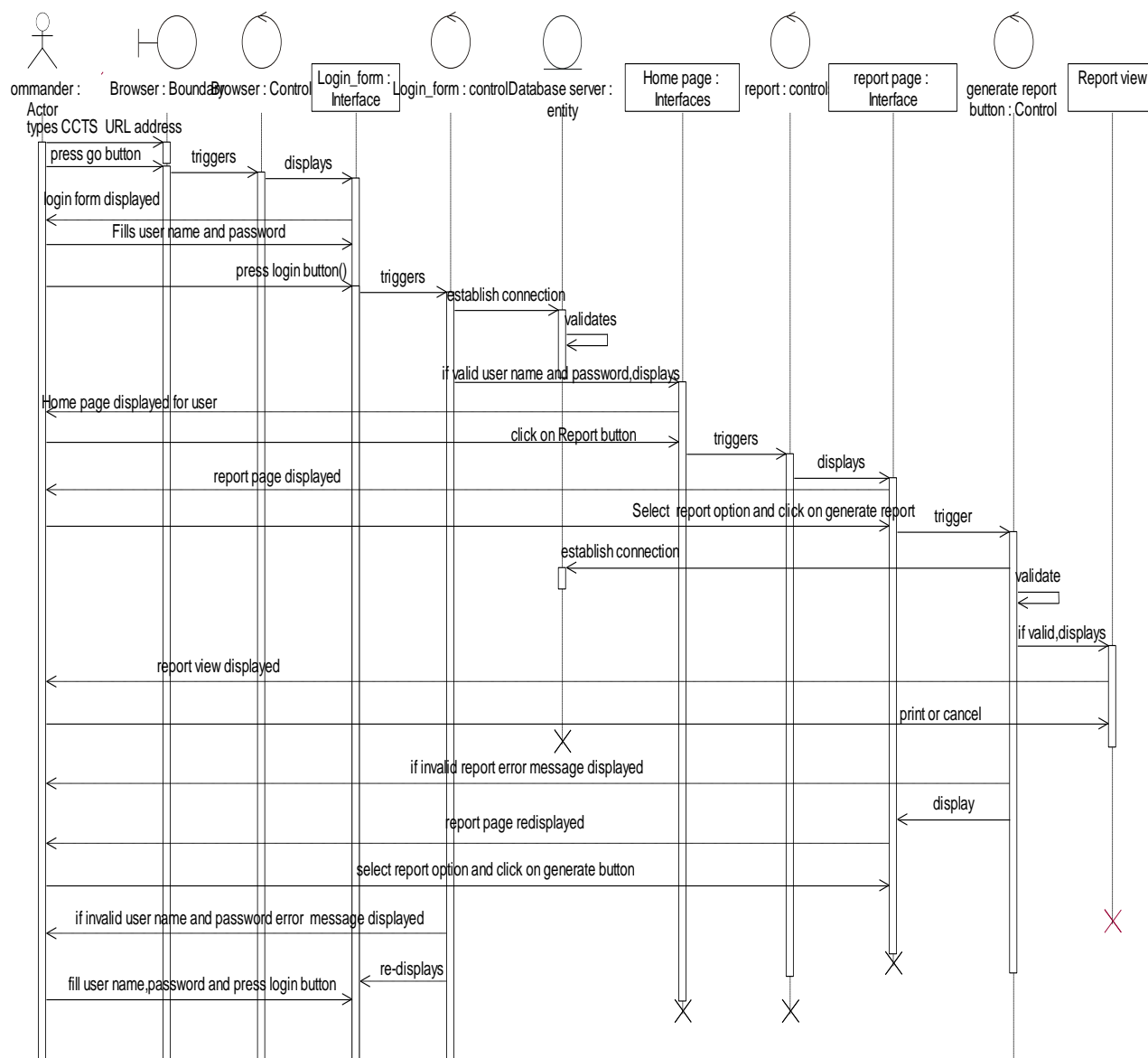


Fig.3.9 Report Sequence Diagram

### 3.8 SYSTEM REQUIREMENT ANALYSIS

Once requirements have been gathered, the work products noted earlier form the basis for requirements analysis. Analysis categorizes requirements and organizes them into related subsets, explores each requirement in relationship to others, examines requirements for consistency, omissions, and ambiguity, and ranks requirements based on the needs of customers or users.

#### REQUIREMENTS SPECIFICATION

The System Specification is the final work product or output going to be developed by the system and requirements engineer. It serves as the foundation for identifying what types of tools are required for the development of the new system. In case of CCTS system

project, a written document, the combination of natural language descriptions and graphical model and usage of scenarios are selected approaches that are used in the identifications of the requirements specifications.

#### ENTITY OBJECTS

Participating objects form the basis of the analysis model. In requirements elicitation, participating objects are found by examining each use case and identifying candidate objects.

The following are entities involved in CCTS projects:

Table 9 Entity List

Entity Name	Description
-------------	-------------

<b>Crime Table</b>	Store crime information
<b>Criminal Table</b>	Store Criminal information
<b>Property Table</b>	Hoard lost property information
<b>Hotel Table</b>	Holds Hotel's detail information
<b>Applicant Table</b>	Used to store applicant or owner information
<b>Hotel Customer Table</b>	Used to store Hotel's customer booked information
<b>User account Table</b>	Used to store user account information
<b>Employee Table</b>	Used to store Adama City Police

	office employee information
<b>Police Station Table</b>	Hoards police stations woreda 1,2,3,4

### Boundary Objects

Boundary objects represent the system interface with the actors. In each use case, each actor interacts with at least one boundary object. The boundary object collects the information from the actor and translates it into an interface neutral form that can be used by the entity objects and also by the control objects. Boundary objects model the user interface at a coarse level. They do not describe in detail the visual aspects of the user interface.

Table10 Boundary Objects List

Entity Name	Description
Submit Button	Used to submit form values in to data base
Register Button	A form where system create user name and password for user
Create Button	A button that would be pressed to create user accounts.
Search Button	An interface on which data or information filled or entered
Login Button	Used to trigger login events after login form has been filled
Reset Button	A button to be pressed to clear text box contents
Update Button	A button to be pressed to modify data base contents
Delete Button	A button to be pressed to delete data base contents
Exit/cancel Button	A button to be pressed to logout active user
Browser	Boundary that links actors with interfaces or controls

### CONTROL OBJECTS

Control objects are responsible for coordinating boundary and entity objects. Control objects usually do not have a concrete counterpart in the real world. There is often a close relationship between a use case and a control object. A control object is usually created at the beginning of a use case and ceases to exist at its end. It is responsible for collecting information from the boundary objects and dispatching it to entity objects.

Table 11 Control Objects List

Entity Name	Description
Create_account_control	Used to validate account creation process
Lost_Property_Register_control	Used to validate register process
Update_control	Used to validate or control the update process
Delete_control	Used to validate or control the delete process
Login_control	Used to authenticate login process
Generate_report_control	Used to validate generate report process



CrimeandCriminal_control	Used to check crime and criminal process
Submit_control	Used to verify the information of customer booked hotel room with recorded criminal tables.
Home_Page_Control	Used to access the source of knowledge for the employers
Browser_control	Display login form for users
Report_control	Displays report type page
Hotel_registration_button	Used to display hotel registration form
Manage_User_Account_Control	Displays user account page
Reset_control	Used to reset controls to empty string

Table 12 Data Dictionary

Actor Name	Description
Information Desk Officer	Information Desk Officer is a person who register Lost property and crime & criminals at police stations
Commander	Login ,Generate report, search information and View knowledge bases
System Administrator	A person who manage user account, register Hotel, search information, updates records and knowledge bases.
Hotel	A person who logs into the system and register customers' information who booked in the hotel on the behalf of hotel
Staff User	A person who are member of the police office, woreda and able to login into the system and access knowledge base

### 3.9 Class Diagram And Their Relationships

#### Class diagram

The class diagram shows how the different entities like crime, criminal, applicant, lost property, hotel, police station, employee, and user account relate to each other. The CCTS class diagram is depicted below.

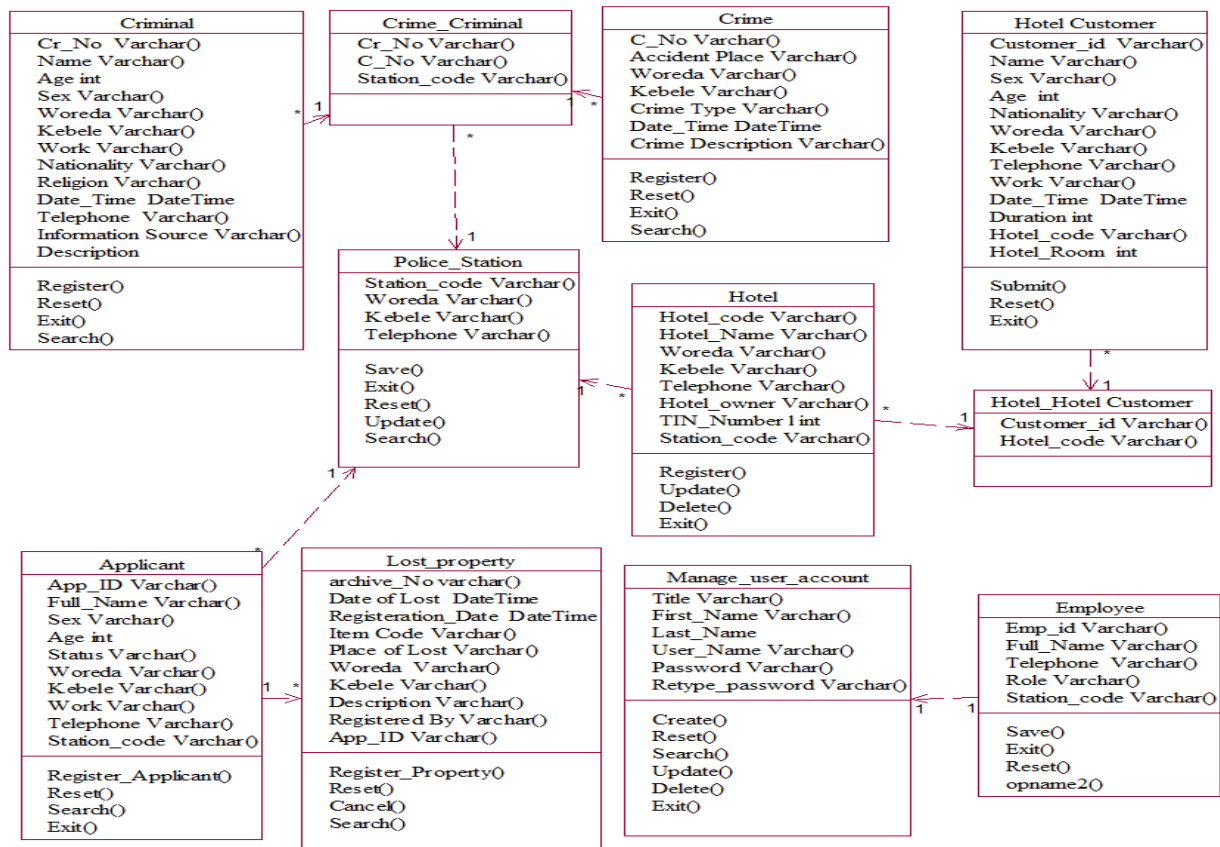


Fig.3.10 Class diagrams with relationships

Since the above entities need further refinement, two conjunction or intermediate tables are used to normalize namely called Crime\_criminal and hotel\_customer to normalize the relationship between crime and criminal entities and Hotel and hotel\_customer entities respectively.

### CCTS Entities Relationship

A dependency of any kind between tables in a data model is called a relationship and shown as:

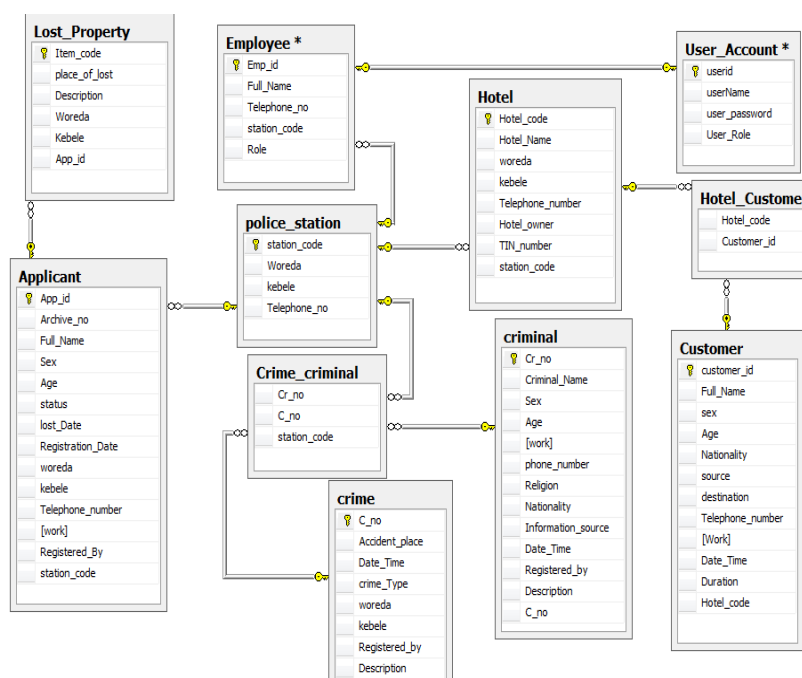


Fig. 3.11 CCTS class diagram with their relationships

The entity relationship figure illustrated above uses some naming convention, description, primary and foreign key as shown below.

Table 13 Naming convention

Entity	Primary Key	Description	Naming Convention	Foreign Key
Crime	C_no	Crime Number	C-no starts with C001.....	-
Criminal	Cr_no	Criminal Number	Cr-no starts with Cr001.....	Station_Code
User Account	User_ID	User identification Number	Auto number	-
Hotel	Hotel_Code	Hotel Unique Code	Starts with three letter followed by three numbers	-
Customer	Customer_ID	Customer booked in Hotel Identification Number	It depends on customers ID numbering format	Hotel Code
Applicant	App_ID	Applicant Identification Number	It depends on applicants ID numbering format	-
Lost_Property	Item_Code	Lost Property serial number or unique identifier	It depends on property's serial number	App_ID, station_Code

### 3.10 Object Diagrams

Object Diagrams, sometimes referred as Instance diagrams are very similar to class diagrams. As class diagrams they also show the relationship between objects but they use real world examples. Because there is data available in the objects they are often used to explain complex relationships between objects. The object diagram is depicted as:

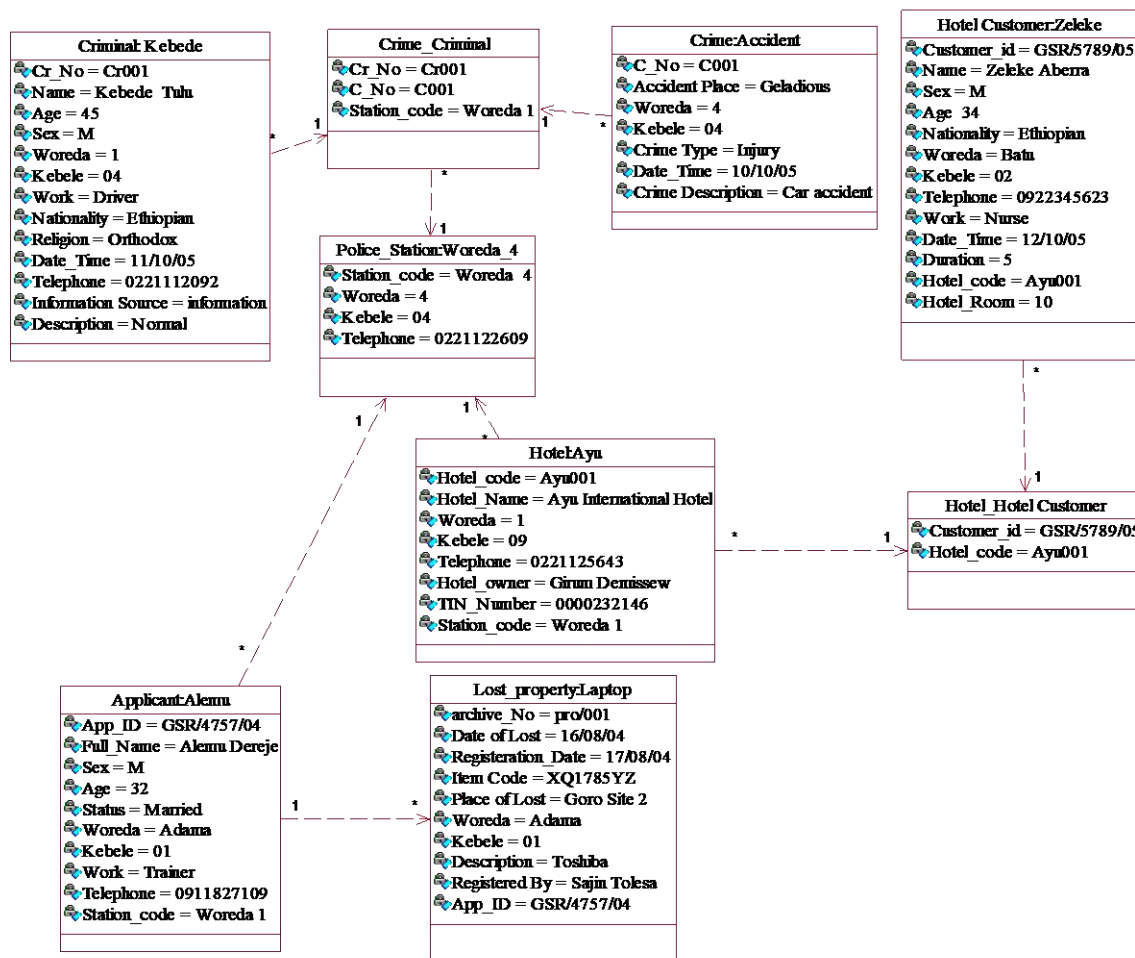


Fig. 3.12 Hotel Customers and Hotels registration object diagram

### 3.11 ACTIVITY DIAGRAM

Activity diagram is another important diagram in UML to describe dynamic aspects of the system. It is basically a flow chart to represent the flow from one activity to another activity.

Description of the basic notation

- **Initial node:** the filled circle is the starting point of the diagram. An initial node is not required although it does make it significantly easier to read the diagram.
- **Activity final node:** the filled circle with a border is the ending point. An activity diagram can have zero or more activity final nodes.
- **Activity:** the rounded rectangles represent activities that occur. An activity may be physical.
- **Flow/edge:** the arrow on the diagram representing the flow of activities.

The following figures are activity diagrams of the CCTS system project:

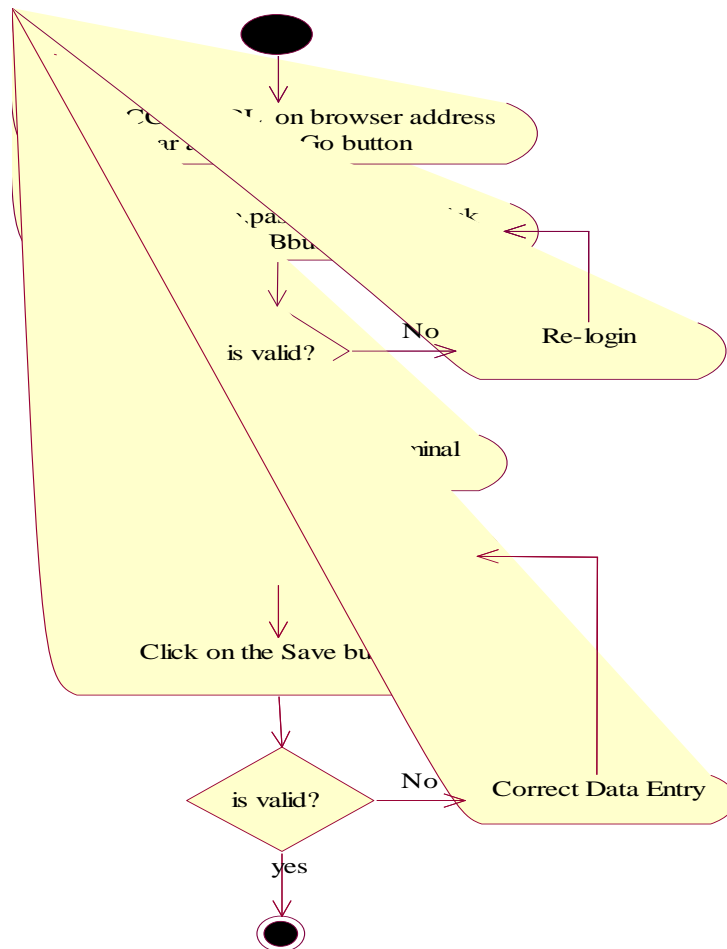


Fig.3.13 Crime and Criminal's Registration Activity Diagram

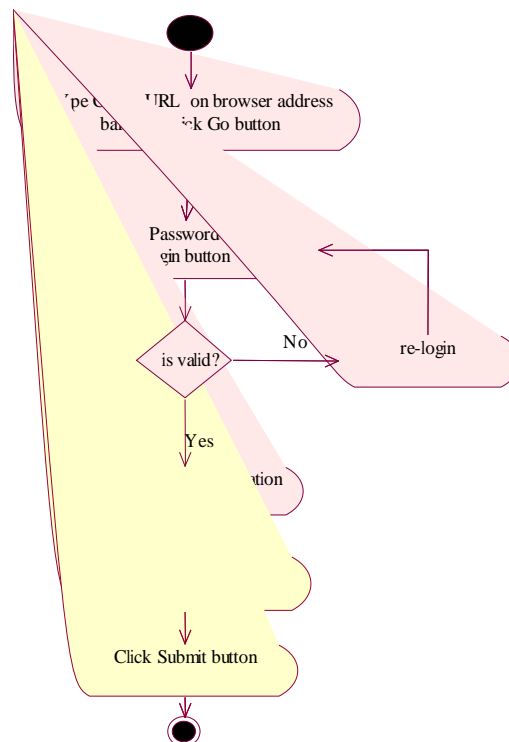


Fig.3.14 Hotel Registration Activity Diagram



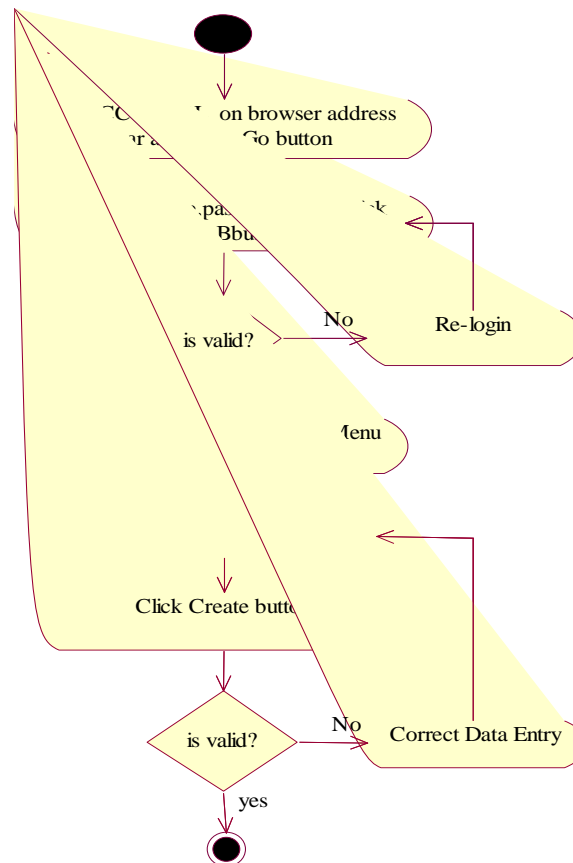


Fig.3.15 Create User Account

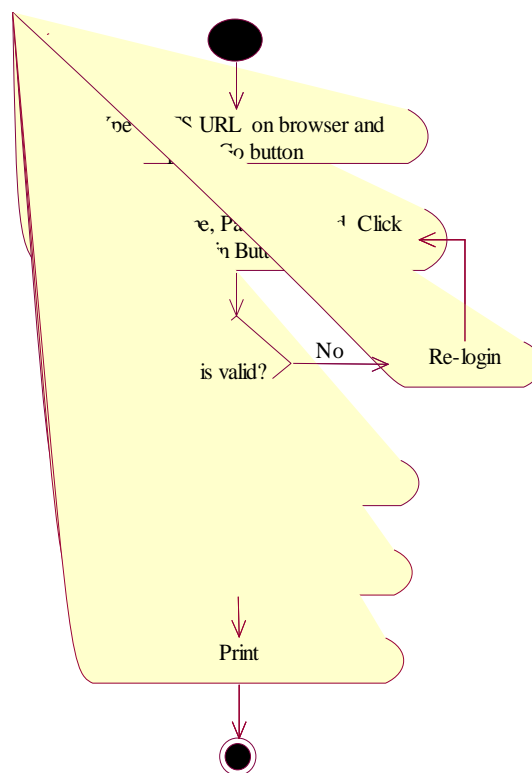


Fig.3.16 Generate Report Activity Diagram

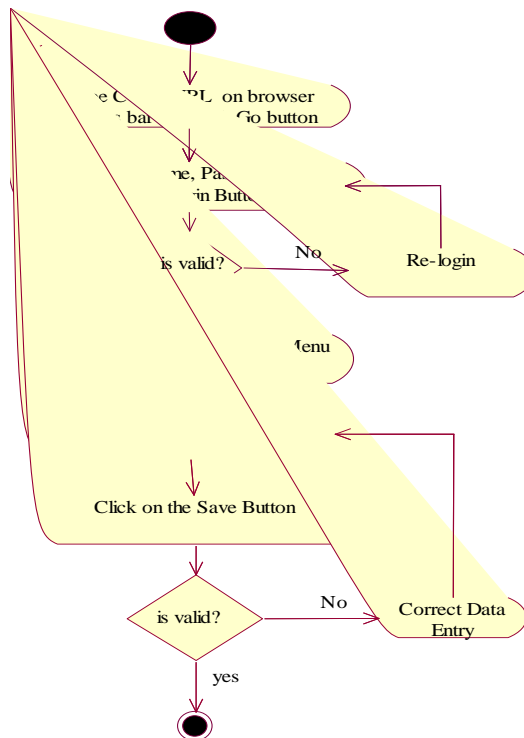


Fig.3.17 Property Registration Activity Diagram

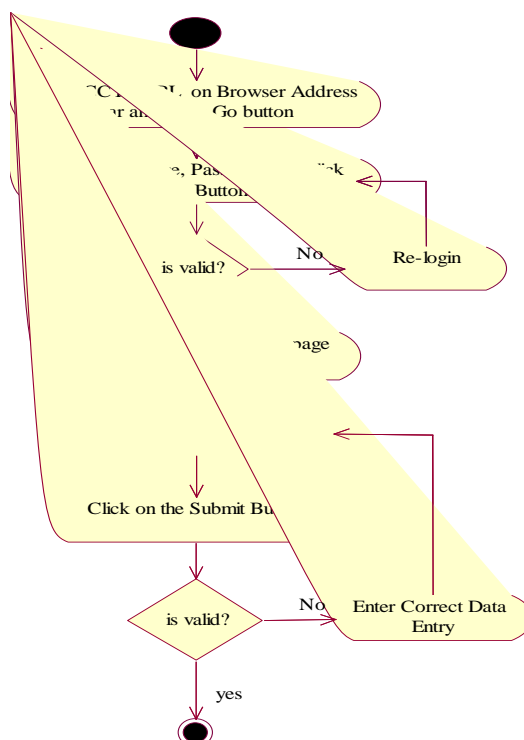


Fig.3.18 Customer's Registration Booked in Hotel Activity Diagram

#### IV. SYSTEM DESIGN

System design is the transformation of the analysis model into a system design model. Up to now we were in the

problem domain. System design is the first part to get into the solution domain in a software development. This chapter focuses on transforming the analysis

model into the design model that takes into account the nonfunctional requirements and constraints described in the problem statement and requirement analysis sections discussed earlier.

#### 4.1. System Goal

Design goals describe the qualities of the system that the developers should consider.

These goals can be inferred from the nonfunctional requirements already discussed in Chapter 3.

The design goals can be generally grouped into five categories. These are: Performance Criteria, Dependability Criteria, Cost Criteria, Maintenance Criteria, and End User Criteria.

**Performance:** - The system should respond fast with high throughput, i.e. it should provide search capability and add new records to database within minimum time.

**Dependability:** - The police office needs the system to be highly dependable. The system should be robust i.e. it should be able to survive invalid user inputs, fault tolerant, reliable and available. Since the system stores sensitive data, high emphasis is given to security to withstand malicious attacks. The system shouldn't allow non- authorized users to access to access the system.

**Cost:** - The system should be developed with minimum cost possible. Even though the CCTS requires huge budget, the different cost minimization mechanisms are employed such as maintaining malfunctioned materials or equipment's and using existing machines.

**Maintenance:** - The system should be easily extensible to modify the government rules and regulations criteria, add new functionality, portable to different platforms. The code for the system should be easily readable, understandable and should be easily mapped to specific requirements.

**End User Criteria:** - The system should have simple and understandable graphical user

interface such as forms and buttons which have descriptive names. It should give reliable response for each user request at least before the session expires.

#### 4.2. System Architecture

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

The system uses dynamic web technology, i.e., adding and retrieving data to and from the data store whenever requested is possible. It requires a client side program which is accessed by the information desk officer, by hotels, by the commanders, staff user and by the system administrator. It needs server side functions that implement the functional requirements and the database system that stores data.

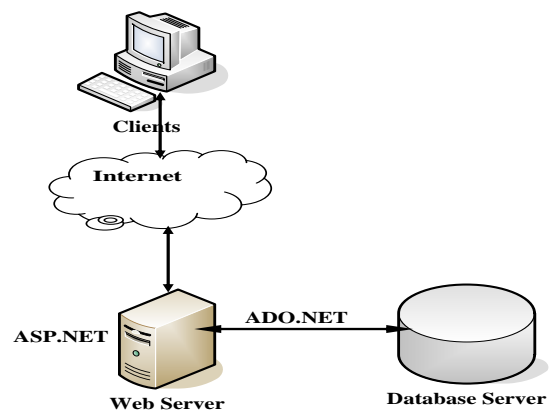


Fig.4.1 Overall CCTS system architecture

#### 4.3. Subsystem Decomposition

From the functional requirements that identified in the system analysis section, the envisaged system consists of the two systems. These are Police System and Hotel System.

Police subsystem package includes the following subsystems:

- Lost Property Registration Subsystem
- Crime & Criminals Registration Subsystem
- Hotel Registration Subsystem
- Generate Report Subsystem
- Search Subsystem
- Access knowledge base Subsystem
- Login Subsystem
- Manage User Account subsystem
- Print Subsystem

Hotel subsystem package includes the following subsystems:

- Login Subsystem
- Customers booked in hotel Registration Subsystem
- Submit subsystem

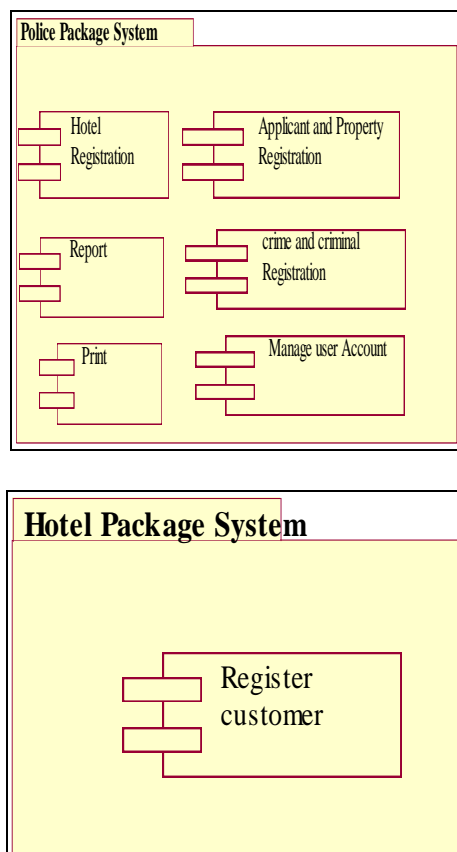


Fig. 4.2 CCTS Package diagram

The description of these subsystems is as follows

#### 4.3.1. Property Registration Subsystem

The property registration subsystem is used to capture and store detail information about stolen, lost and found properties.

#### 4.3.2. Crime & Criminals Registration Subsystem

The crime and criminals registration subsystem is proposed to register and store cognizable crime and criminals. Registration module would enable assignment of a unique number to facilitate proper monitoring. The details captured may include but not limited to missed persons, crime and criminals, suspected person and unidentified dead body.

#### 4.3.3. Hotel Registration Subsystem

This subsystem is used to register new international Hotels in the system database in their nearby police station.

#### 4.3.4. Customers booked in hotel Registration Subsystem

This subsystem should support submission of daily customer's information that booked in hotels to nearby police office woreda and retain copy of it.

#### 4.3.5. Generate Report Subsystem

This subsystem is used to generate the daily, quarterly, semi-annual and annually report by police office woredas to central Adama city police office.

#### 4.3.6. Search Subsystem

The search subsystem enables users of the system to surf or look up any data from the database depending on the privilege they have.

#### 4.3.7. Access knowledge base Subsystem

This subsystem is used to provide common information that helps the staff members to share information and any knowledge base which leads them to increase efficiency and effectiveness in their work according to their access right. Such as rules, proclamation and selected cases which are assumed to be best practice.

#### 4.4. Hardware/Software Mapping

One of the major tasks in system design deals with hardware/software mapping which deals with which components would be part in which hardware and so on. The CCTS is system that performs many functions as described in previous chapter. It consists of web based system used by police stations to record/register criminal and property. The web based system also assists the polices and officials to get or view status and report on cases' achievement and progress and also the web based part is expected to run on a networked environment on different Operating System platforms. The client/server architecture of the system enables different clients to connect to the server remotely through Internet connection. The system has two nodes such as the Web server and Clients. These nodes are shown as UML Deployment diagrams in Figure below.

The nodes can represent specific instances or workstations or a class of computers or web server, which is a virtual machine. The applications of the system will run on the web server connected to the database server by ado.net. Users merely need to start their browsers and enter the URL of the application Web site. The server hosting the Web site is responsible for allocating all the resources the Web application requires.

#### 4.4.1. Deployment Diagrams

Deployment diagrams are used to visualize the topology of the physical components where the system software components are deployed. So they are used to describe the static deployment view of a system. The CCTS web based application is assumed to be deployed in clustered stations (environment) using mini-servers. The users are connected

to the application using internet. The control is flowing from the main server to the clustered or mini-servers.

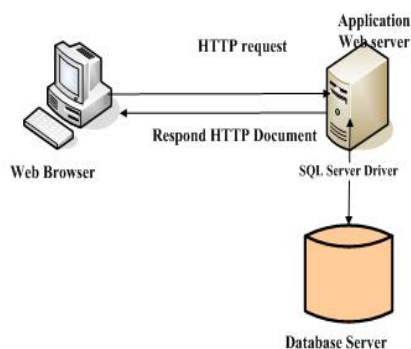


Fig. 4.3 Hardware/Software Mapping

The following diagram shows the CCTS deployment diagram.

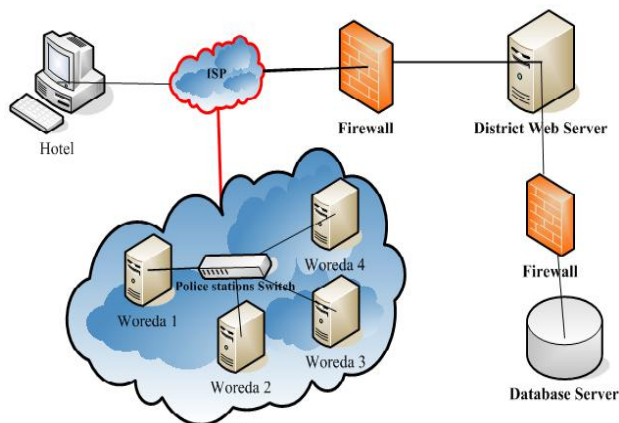


Fig. 4.4 CCTS Hardware deployment diagram

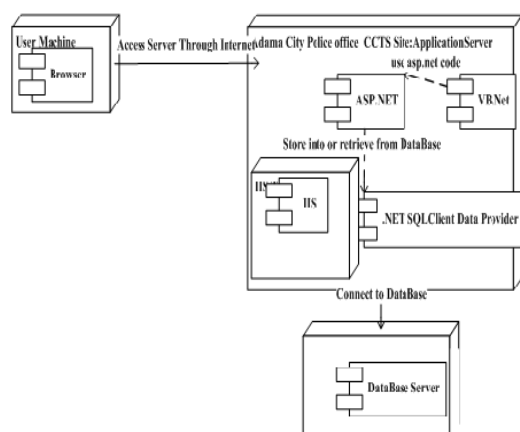


Fig.4.5 CCTS software deployment diagram

#### 4.5. Component Diagrams

A component diagram displays the structural relationship of components of a software system. Components communicate with each other using interfaces. The interfaces are linked using connectors. The following figure shows the component diagram of the CCTS system project.

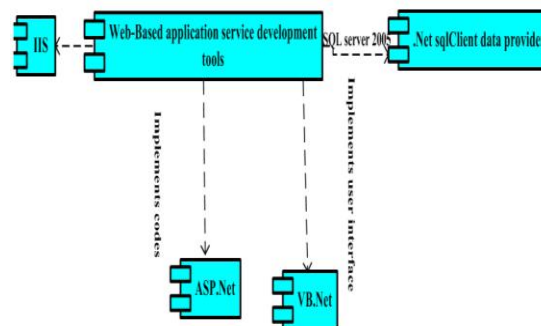


FIG.4.6 COMPONENT DIAGRAM

##### 4.5.1. Persistent Data Management

As it is discussed in the previous sections, the Adama City police office CCTS system consists of a number of sub systems. Property Registration Subsystem, Crime and Criminals Registration Subsystem, Hotel Registration Subsystem, Customers booked in hotel Registration Subsystem, Generate Report Subsystem, Search Subsystem, Access knowledge base Subsystem, Update record Subsystem, and Login Subsystem are web based subsystems that run over a LAN or WAN, and the persistent data of these subsystems will be stored in an SQL Server database.

#### 4.6. Object Relation Mapping

In order to store information persistently we map objects into relations and the attributes into fields to the specific table based on the objects found on the system. Therefore, we identified the major tables that will be implemented on the selected DBMS. For this reason, the mapping of objects to relations is shown as follows:





Fig.4.7 Object Relation Mapping Diagram

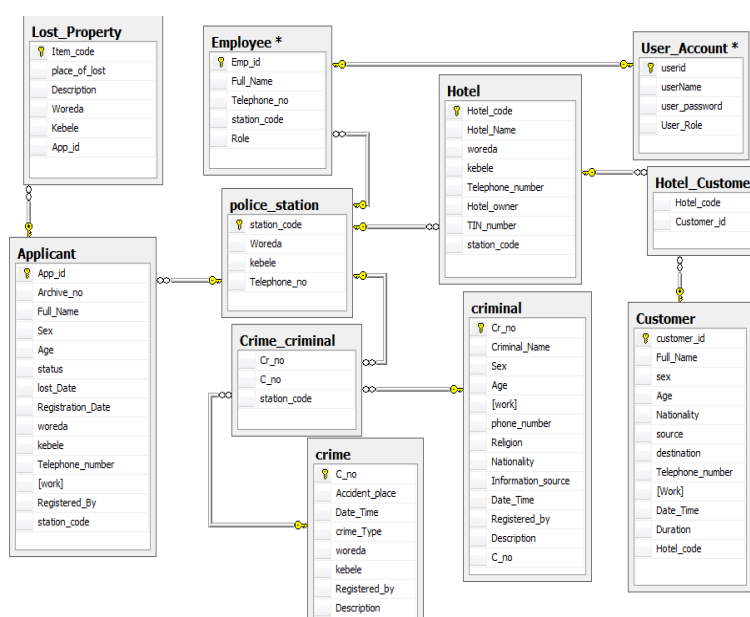


Fig. 4.8 Tables Relationship Diagram

## V. SYSTEM IMPLEMENTATION

In this chapter, the tools used in developing the prototype and the developed system are described.

### 5.1. Programming Tool

The Web application is developed using Active Server Pages (ASP .NET 4.0).

### 5.2. The CCTS Prototype

Here, the implemented system is described. How the user interacts with the system and some of the results of interaction with the system along with the screen shots are described. When a user types CCTS URL address on web browser, login form is displayed as shown in Figure 5.1 to authenticate the user. If the user has typed the correct user name and password to the login form, the system displays user profile page as shown in Figure 5.1 and then a window containing the main menus of the system is displayed to all users except the hotel as shown in Figure 5.2.

#### 5.2.1. Login Page

The users start Adama city police office web based CCTS system through a login screen displayed as shown below.

Fig.5.1 Login Form

#### 5.2.2. CCTS Home page

Fig. 5.2 Home page

#### 5.2.3. Manage User Account

The manage user account is used to create, delete, update user accounts for users of the system. The system

administrator has all privilege to manage the user account and make system wide changes.

Fig.5.3 Manage User Account Form

#### 5.2.4. Property Registration Form

It is used to register detail information about property lost or stolen or found. The form consists of mainly two sections. These are the applicant detail information section which has the attributes archive number, property owner identification numbers, applicant name, sex, age, status, address (woreda, kebele), date of registration, work and telephone number and property detail information section which consists of the attributes Item Code, Property Type (Stolen, Lost or Found), Place of lost, Date of lost, address (woreda, kebele), and Registered by. The form has Register applicant, register property, Reset and Quit buttons. The Information desk Officer (IDO) at each police station accesses this form by providing appropriate user name and password. Once the form is accessed the IDO fills the detail and hits the save button then the data will be inserted to the database. If error occurs in data entry the system prompts appropriate messages to the IDO and rejects the process. The Clear button is used to reset the value entered to the fields if some misplaced or error occurred and the Exit button is used to exit the form. The graphical user interface is depicted as follow:

Fig. 5.4 Lost Property Registration Form

### 5.2.5. Crime and Criminals Registration Form

This form is used to register criminals or suspected persons when they are committed crime. The criminal registration form consists of the following attributes. These are Diary number or archive number, Criminal name, mental status, last known address, date and time of registration, sex, Criminal description and photo of the criminal. Crime registration is a form on the same page which is used to register crime details with attributes Crime identification number (CID), Crime Type, address (kebele, woreda), date and time, crime description. The form also includes three buttons namely Register, Reset, cancel and Search button.

Fig. 5.5 Crime and Criminal Registration Form

### 5.2.6. Hotel Registration Form

This form is used to register hotels detail information. It is filled by the system administrator. The form or page consists of Hotel code, Hotel Name, Address (Woreda, Kebele), TIIN number, hotel owner and Telephone number attributes and four buttons. The button are Register, Update, Delete and Exit. The Register button is used to insert new hotel information into the hotel database. The Update button is used to alter attributes of the table when required, for example, when the TIN number is modified or its name is changed. Exit button is used to exit the registration form.

Fig. 5.6 Hotel Registration Form

### 5.2.7. Customers booked in hotel Registration Form

This form is used to register customers booked in international hotels. While hotels register their customers the data will be submitted to the nearby police station.

Fig. 5.7 Customers Booked in Hotel Registration form

### 3.2.8. Report Subsystem

This subsystem is used to generate daily, monthly, semiannual and annual reports. When generate report button is clicked the following page is displayed. Select the report type and data source you want to generate from and then click generate button.

For example, the data source selected is user account table.

Fig. 5.8 Generate report page

The following report will be displayed when user clicks on generate report button.

Report View page					
Title	First Name	Last Name	userName	user_password	Con_password
Insp. Tola	Bekele	betesfa	Tola	Tola	Tola
Insp. Tesfaye	Bekele	betesfay	x45@er	x45@er	x45@er
Insp. Mesfin	Bekele	mesfin	mesfin	Mesfin	Mesfin
comm. Tufa	Bekele	tfa200	password	password	password

Fig. 5.9 Daily report generated

### 3.2.9. Access knowledgebase Subsystem

It is the subsystem in which only accessed by internal user of the system (Adama city police staff) to easily exchange information such as news, best practices, proclamation and etc. The interface varies according to the type of information to be posted to the site.

## VI. CONCLUSION AND RECOMMENDATION

### 6.1. CONCLUSION

Crime is a complex social phenomenon, particularly; technology advancements now a day make more complicated and its cost and impact on the society is increasing. Hence, law enforcement organizations like that of police need to learn the factors that constitute higher crime trends. To control or track this social evil there is always a need for prudent crime prevention strategies and policies. Understanding and processing of criminal records is one method to learn about both crime and individuals who involve in misdeeds so that police can take crime prevention measures accordingly.

In this project so as to combat such challenges the CCTS helps to keep data of customer's booked in international hotels, applicants and their lost or stolen properties details at district and police office stations or woredas. These data is used to facilitate crime and criminals tracking for future or at the time of recording. The system provides comparison facilities about suspects or criminals when the hotel submits daily report to the nearby police station and provides notification to the system administrator.

The other issue that is being addressed in this project is sharing of information among the four police stations and the district so that best practice, stolen properties, news, and progress of the cases are commonly available to stations. Reports are generated by clicking button.

In addition to this, the system enables hotels to send or submit report through network which reduces the cost they incur for human labor, paper, and to save time.

### 6.2. RECOMMENDATION FOR FUTURE WORK

Since the system on crime and criminal tracking system in Ethiopia is in its infant age it is more recommendable for future work to be further be researched in the area. The CCTS is mainly emphasized on crime and criminal, lost property registration and linking international hotels to police station at Adama city police office and crime prevention and detection core police function. The recommendation for

#### A) Future researchers

- May develop for a region or a nation.
- The crime and criminal tracking IT tools used by police should need further investigation.
- May develop system on other core police functions
- May develop system that enables citizens to give and receive services directly through the system

#### B) Adama Science and Technology University

We would like to suggest Adama Science and Technology University to provide assistance for projects that are very important for the region or nation through timely financial services, material provision, journals shortage and preparing curriculum relevant to the specified qualification levels and occupation. The timetable for projects was not posted prior to date. These reduce the quality of the project. We would like to suggest the university to closely see such obstacles for successful completion of projects.

#### C) Adama City Police Office

The CCTS is developed based on the data gathered from the city police office and the prototype is tested with the actual data used in the office and it has seen that successfully facilitate crime and criminal tracking or detecting. It is suggested that the police office to deploy and use it.

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