CHAPTER ONE- INTRODUCTION

1.1 Background Information

Biometrics research investigates methods and techniques for recognizing humans based on their behaviour and physical characteristics or traits. Face recognition is a biometric trait and it is something that people usually perform effortlessly and routinely in their everyday life and it is the process of identifying individuals from their faces' intrinsic characteristics. Automated face recognition has become one of the main targets of investigation for researchers in biometrics, pattern recognition, computer vision, and machine learning communities. This interest is driven by a wide range of commercial and law enforcement practical applications that require the use of face recognition technologies.

Face recognition systems have many advantages over traditional security systems: the biometric identification of a person cannot be lost, forgotten like complex passwords and PIN codes or easy to be guessed by an illegitimate user like short and simple passwords. A lot of people and organizations use facial recognition — and in a lot of different places. Here's a sampling:

U. **S. government at airports**:- Facial recognition systems can monitor people coming and going in airports. The Department of Homeland Security has used the technology to identify people who have overstayed their visas or may be under criminal investigation. Customs officials at Washington Dulles International Airport made their first arrest using facial recognition in August of 2018, catching an impostor trying to enter the country.

Mobile phone makers in products:- Apple first used facial recognition to unlock its iPhone X, and has continued with the technology with the iPhone XS. Face ID authenticates — it makes sure you're you when you access your phone. Apple says the chance of a random face unlocking your phone is about one in 1 million.

Social media companies on websites:- Facebook uses an algorithm to spot faces when you upload a photo to its platform. The social media company asks if you want to tag

people in your photos. If you say yes, it creates a link to their profiles. Facebook can recognize faces with 98 percent accuracy.

Businesses at entrances and restricted areas:- Some companies have traded in security badges for facial recognition systems. Beyond security, it could be one way to get some face time with the boss.

Retailers in stores:- Retailers can combine surveillance cameras and facial recognition to scan the faces of shoppers. One goal: identifying suspicious characters and potential shoplifters.

Marketers and advertisers in campaigns:- Marketers often consider things like gender, age, and ethnicity when targeting groups for a product or idea. Facial recognition can be used to define those audiences even at something like a concert.

Background of the Organization

On January 27,2019,Ethiopian Airlines unveild the Ethiopian Skylight Hotel in Addis Ababa,Ethiopia.His Excellency Prime Minster Abiy Ahmed and Ethiopian Airlines CEO Mr.Tewolde Gebre Mariam presided over and spoke at the grand opening.The hotel is adjacent to Bole International Airport of Addis Ababa.It's situated on about 40,000 square meters and backed by USD65 Million investment.It was built by AVIC Engineering Corporation as EPC contractor, with 373 guest room,three restaurant(inclusive of the biggest Chinese restaurant in Ethiopia at 900meter square,and 900meter square Ethiopian traditional restraint),and three lounge bars.The Grand Ballroom is designed to host 2,000 guests at once,making it the largest ballroom in Ethiopia.The hotel offers five function rooms of varying capacity,fitness center,outdoor heated swimming pool,mini golf driving range,600meter square exhibition center,boutique shop as well as ticket office and other amenities.The owner of the hotel project is Ethiopian Airlines,the largest,fastest,growing and most profitable airline company in Africa,enjoying considerable clout and renowned internationally.

Company's Mission

The Mission of Skylight Hotel is to put hospitality services on the highest level in order to satisfy the demands and expectations of guests.Their aim is to make skylight hotel a place for encounters,business success,pleasant meetings and gala ceremonies,we also want to become the leading brands in the hotel providing service around the world.

Company's Vision

The ideology of Skylight Hotel vision is to continue to apply and set the highest standards of service quality and in that way justify and uphold the reputation that we

have among the guests,partners,competitors and the wider community.We use and constantly introduce environmentally friendly technologies and processes in order to remain in balance with nature and also meet the needs of contemporary society. Tradition is a testament to their success but in the future we also want to embrace the changes that modern time brings and become more attractive in the market and more interesting to our guests and partners to be the biggest hotel in Africa.

1.2 Problem Statement

From time to time we hear about the crimes of credit card fraud,computer breaking by hackers, or security breaches in a company or government building.In most of these crimes,the criminals were taking advantages of a fundamental flaw in the conventional access control systems:the systems do not grant access by **'who we are'**, but by **'what we have'**, such as ID cards,keys,passwords,PIN numbers.Recently,technology became available to allow verification of 'true' individual identity.The current only manual way to reduce this security problem is with the need of a higher number of man power like security guards to check every and each individuals.This is a basic problem that we solved with the implementation of this system.

Due to the on going Covid 19 Pandemic(Also known as Corona Virus) the WHO has suggested that we should minimize the amount of physical contact we have between each other.So in order to minimize physical contact our team is trying to build a facial recognition system that will solve the traditional system.

1.3 Objectives

1.3.1 General objective

The general objective of this project is to examine implementing and functioning machine learning techniques for resolving security problems in hotels using face detection and recognition.

1.3.2 Specific objectives

- To Know the challenges that hotels current system faces in the absence of face recognition
- Gathering information about the current system by using data methodologies like interview, observation and document analysis.

- Understanding the problems in the current system identify what problems exist in the current system.
- Planning the solution for the problems identified.
- Identify artificial intelligence approaches suitable for facial recognition.
- Designing a database for the proposed system to store an important data of administrators and employees that is useful for altering system.
- Testing the developed system by applying testing mechanism.
- Deploying(spreading) the new system after the completion of the testing.
- Documenting the system writing and the whole process of the system development.

1.4 Scope of the Project

Our project touches areas of hotels and required to perform several researches to be able to achieve the project objectives. The area it covers include:

- organization like hotels and also any interested companies can implement the system that has security issues.
- The scope that is covered in our project includes:-
  - ✓ Detecting faces
  - ✓ Recognizing registered people
  - ✓ When the client/customer checks out his registered Face ID automatically be removed from the database system
  - ✓ Changing the Traditional Key card system by the new Facial recognition
  - ✓ Controlling the employees by detecting their faces
- System admin be able to manage the system.

The system will be available for the work time of the day respective to the organization.

Among the Scope limitations that we face. Here are some:

- There is financial limitation for implementing the system using CCTV and IP cameras. Because of this problem our team has planned to use web cameras.
- Administration of an Organization may not be willing to implement such a system because they may think spending a lot of money and resource for such system is unnecessary.

- The model may not be able to detect faces for different scenarios. Not only this reason but also most people don't see the camera directly so we need a very good face detection model.
- The model may not be able to correctly classify face images where the face is partially hidden by a person in the front.
- It may also need LAN to connect many cameras in the organization's compound to the system.

1.5 Tools and Methodologies

Methodology is the systematic, theoretical analysis of the methods applied to a field of study (project). It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. Typically, it encompasses concepts such as data collection paradigm, theoretical model for analysis and design follows, phases in software development, testing and deployment.

1.5.1 Data Collection Methodologies

We used the following methods for data collection which is needed for requirement analysis and developing the system.

Observation:

This is the process of following attentively how the existing system works. What we are going to do is that we go to different organizations and see how regulations related to security using face recognition are executed. This gives a basic understanding of the existing system.

Interview:

Interviewing the system admins so that they can briefly describe to us their existing system. This also is helpful to understand how the existing system's operation work. They will also tell us the existing security issue.

Document analysis:

This is the process of checking and reading other documents done in the scope of the project. Such documents will help us understand the problem and widen our imagination to think a solution to that problem.

1.5.2 System Development Methodology

There are many methodologies for the design and development of information systems. The two major approaches are: Structured Systems Analysis & Design and the Object-

Oriented Analysis and Design. The structured paradigm is a development strategy based on the concept that a system should be separated in to two parts: **Data** and **Functionality**. On the other hand, the main concept behind the object oriented paradigm is that instead of defining systems as two separate parts (data and functionality), we now define systems as collection of interacting objects.So that All the framework we use in the development of this project make use of Object-Oriented Paradigm. Therefore, we would be using OOSAD as a system development methodology.

1.5.3 Development Tools

Development tools are basically computer programs, and they usually run on personal computers, helping the programmer (or system developer) to create and/or modify or test website programs.The following are the hardware and software development tools that we used for our project.

Hardware Tools

Mobile Phone

For the project is related with image processing, we need mobile phone cameras to take photos of people to train and test the model.

Web camera

The live video feed is received from web cameras. To design and implement multi camera integration we need more than one web cameras.

Software Tools

Windows 10 (64X) Operating System

All the project designed and developed on Windows 10 operating system

Applications

Visual Paradigm and Edraw Max

Diagrams that are used to visualize the conceptual system are drawn using Visual Paradigm and Edraw Max

- ✓ Python 3.7 installation
- ✓ PYCharm community edition
- ✓ Python open CV frame work
- ✓ Visual Studio code

1.6 Beneficiaries

- preventing crimes
- increasing safety
- Strengthens security measures
- reducing unnecessary human interaction and labour.
- Automated Time Tracking System: entry and exit time monitoring done manually can be fully automated with facial recognition. There is no need for human intervention or physical validation.
- Touchless sign-in System: A post pandemic Requirements: pandemic like Covid 19 can be better managed by minimizing physical contact in the work environment
- Easy to Manage: as compared to the manual System, AI-based systems are highly automated. These systems store and update day-to-day records in real time.

1.7 Schedule

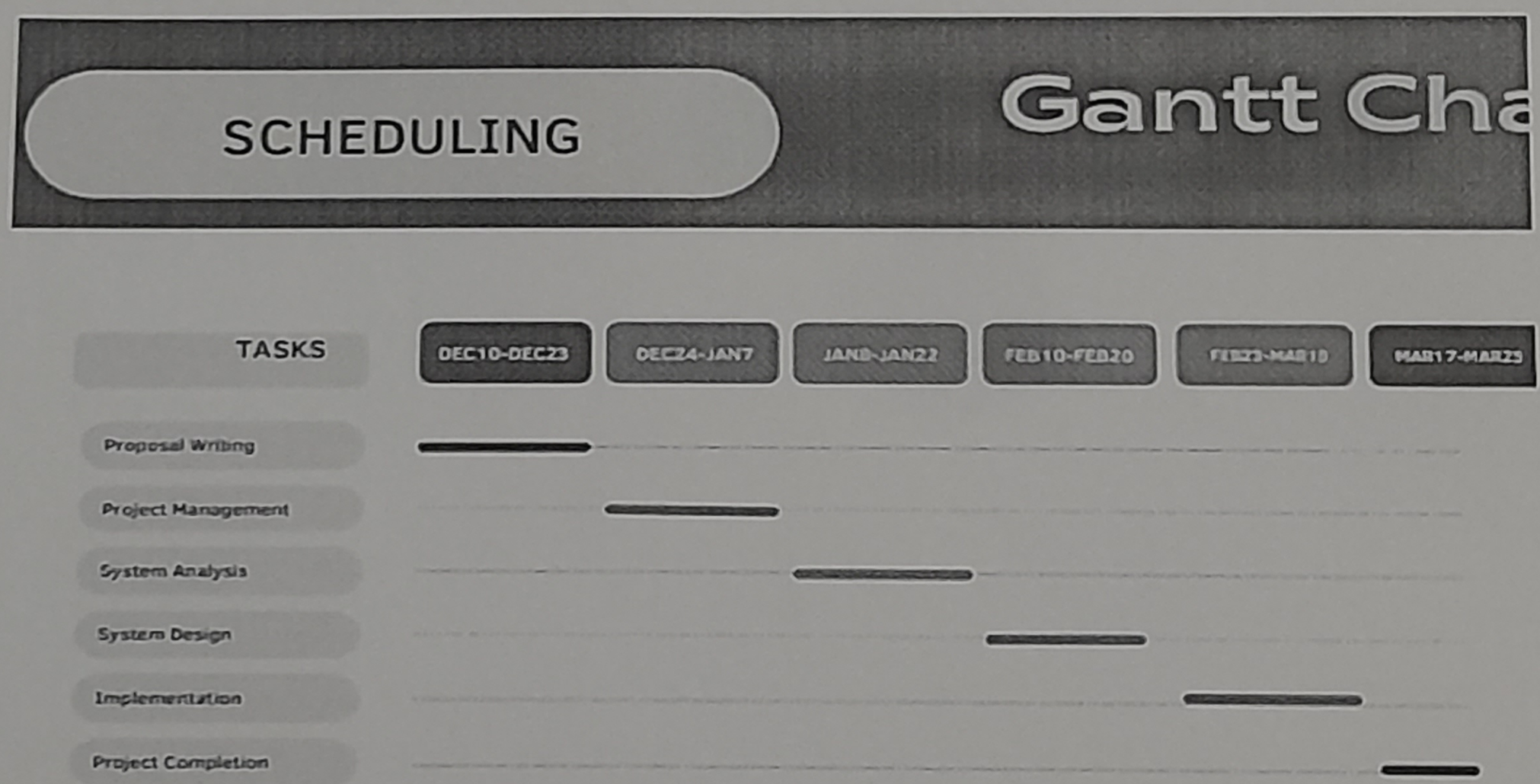


Table 1.0: project schedule

ID	Activities	Schedule
1	Proposal writing	13 days
2	Project management	14 days
3	System analysis	11 days
4	System design	10 days
5	Implementation	22 days
6	Project completion	3 days

Table 1.1: project schedule

CHAPTER TWO-PROJECT MANAGMENT

2.1 Introduction

Project management is the application of processes, methods, skills, knowledge and experience to achieve specific project objectives according to the project acceptance criteria within agreed parameters. Project management has final deliverables that are constrained to a finite time-scale and budget.

This phase helps our project in managing all the different resources and aspects of the project in such a way that the resources deliver all the output that is required to complete the project within the defined Scope, Time, and Cost constraints. These include key content such as project Roles and Responsibilities, Key Deliverance's, Schedule and Cost Management Processes, Team Organization and Risk management, and so on. These are agreed upon in the Project Initiation stage and by the time the project begins all team members would have a clear understanding and acceptance of the process, methodology and expected outcomes. It Provide information on how the development and distribution of the project is controlled and tracked.

Advantages of Our Project Management are:-

- ✓ Smarter decision
- ✓ Increase risk assessment.
- ✓ Increase quality
- ✓ Ensure that the project proceeds effectively through all the essential phases, from concept through to completion.
- ✓ Establish a structured approach for clearly defining roles and responsibilities for the delivery of the project and its work packages.
- ✓ Improved growth and development within a team.
- ✓ Better flexibility.
- ✓ Enhance End-User satisfaction.

2.2 Project Planning (WBS)

A Work Breakdown Structure (WBS) is a hierarchical outline of the tasks required to complete a project. The WBS "breaks down" the structure of a project into manageable deliverables. Each deliverable is assigned a task, or series of tasks that can be further broken down into subtasks to meet the needs of the project.The Project

Manager and project team use the WBS to develop the project schedule, resource requirements and costs.

Id	TASK NAME	Duration (days)	Dependency	Deliverable
1	**Introduction**	1	-	**Chapter 1 Documentation**
1.1	Background Information		1	
1.2	Statement of the problem	1	1	
1.3	Objective	1	1.2	
1.4	Scope	1	1.2	
1.5	Tools and Methodology	1	1.3	
1.5.1	Data Collection Methodology	-	1.3	
1.5.2	System Development methodology	-	1.3	
1.5.3	Development tools	-	1.3	
1.6	Beneficiaries	1	1.2	
1.7	Schedule	1	-	
	Review	1	All	
2	**Project Management**	-		
2.1	Introduction	1	1.7	
2.2	Project Planning(WBS)	5	2.2	
2.3	Resource Planning	4	"	
2.3.1	Human Resource		"	

2.3.2	Material and Equipment	6	"	Chapter 2 Documentation
2.4	Financial Planning	2	2.3.1 & 2.3.2	
2.4.1	Human Resource	4	"	
2.4.2	Material and Equipment's		"	
2.5	Team Organization	4	2.2	
2.6	Process Modelling	3	-	
2.7	Risk MMM Plan	5	2.3,2.4,2.5	
2.7.1	Risk Item Sheet	2	"	
2.7.2	RMMM Plan		"	
	Review	1	All	
3	**System Analysis**	-		
3.1	Introduction	1		
3.2	Existing System	3		
3.3	Proposed System	3	2.2	
3.3.1	Functional Requirements	5	3.2	
3.3.2	Non-Functional Requirements		3.2	
3.4	System Models - Requirement Determination	3	3.2,3.3	
3.4.1	Essential Use Case Modelling	1	3.2	
3.4.1.1	Use Case Diagram	1	3.4.1	
3.4.1.2	Use Case Documentation	1	3.4.2	
3.4.2	Essential User interface diagram	2	3.4.1	
3.4.3	User Interface Flow Diagram	2	3.4.1,3.4.2	

3.4.4	Supplementary Specifications	6	3.4.3	**Chapter 3 Documentation**
3.4.4.1	Business Rules	6	3.4	
3.4.4.2	Constraints		"	
3.4.4.3	Change Case		"	
3.5	System Models - Analysis	1	"	
3.5.1	System use case modelling		"	
3.5.1.1	Use case diagram			
3.5.1.2	Use case documentation		"	
3.5.2	Sequence Diagram	2	"	
3.5.3	Activity Diagram	2	"	
	Review	1		
4	**System Design**	-		
4.1	Introduction	1		
4.2	Design Goals	4		
4.3	Design Trade off's	2	4.2	
4.4	Subsystem Decomposition	6	4.2	
4.5	Design Phase Models	6	4.2	
4.5.1	Class Modelling	4	4.4	
4.5.2	Persistent Model	3	4.1, 4.2	
4.5.2.1	Mapping Class Diagram to Relation	2	4.5	
4.5.2.2	Normalization	7	4.2,4.3	
4.5.3	User Interface Design	10	4.5.1	**Chapter 4 Documentation**

4.5.4	Deployment Diagram	5	4.5	
4.5.5	Network Design		"	
5	**Implementation and Testing**	-		**Chapter 5 Documentation**
5.1	Introduction	6month		
5.2	Sample Code			
5.3	Test Report			
	Review			
6	**Conclusion and Recommendation**	-		**Chapter 6 Documentation**
6.1	Conclusion	1		
6.2	Recommendation			
	Review	7		

2.3 Resource Planning

Resource planning is a process of allocating tasks to team members based on their capacity, skill sets, and the best fit for the job. It maximizes efficiency by helping teams to manage their utilization rates, track capacity, and monitor progress, to keep projects on budget and work on track.

2.3.1. Human Resource Planning

The term human resource planning refers specifically to a project management process that involves the careful and deliberate identification, categorization, and ultimately, documentation of the entirety of all project roles assigned to all individual members of the project work team. Included among this documentation process is a careful delineation of all of the individual project team members' personal responsibilities in regards to management of the project, as well as all the specific reporting relationships among all members of the project team. One additional essential component of the project management process of human resource planning is a careful and thoroughly executed encapsulation of all members of the project team through a complete project staffing management plan. This can be done through the use of either

a formally written document, which can include a detailed graphically formatted chart, or it can be in the form of a less formalized document of sorts.

One interface designers	For designing the front end of the web site.
Two programmers	To design the database and program database related codes
Two database developers	To manage day to day activities on the database
One project manager	
One System analyst	

2.3.2. Material / Equipment Resource Planning

Hardware Resource

The major tool that we used throughout the project is the hardware resources. The hardware elements that are used in this project are the following:

Hardware Name	Quantity	Purpose	Specifications
Computers	5	-will be used for documenting gathered requirements. -For designing and coding the software. -For the development of the software	-2 HP core i7 with 8GB ram, 256GB SSD, 7th gen and 1TB hard disk storage size laptop.

Printers	1	For printing purpose.	Canon-New Laser Base MF3240
Web cameras	1	The live video feed is received from web cameras. To design and implement multi camera integration we need more than one web cameras.	
Mobile phones	1	we need mobile phone cameras to take photos of people to train and test the model.	Android 11

Software Resource

The other tool we used as a resource is the software resources. Software resource refers to the entire software component we use for writing codes and developing the web site. The softwares that are necessary in this project are the following:

Software Name	Function	Version
Python	Programming language that is used to write the entire code of the project	Version 3.7
MS-Word	For documentation purpose.	Version 19
Adobe XD	For designing wire frame.	Version 2.1.3
My Sql	Database	Latest version
Windows	Operating system	10

Other Materials

Other Resources refer to all the cost which are known and can't be determined at the beginning of the project. Some of the resources categorized under this classification are cost of paper, pen, and transport fee.

Material Name	Quantity	Purpose	Specification
Pen	1 pack	For writing purpose.	Ink pen
Paper	1 Package (500 Papers)	For writing and printing.	A4
Transport	-	For Data gathering.	Taxi
Internet	-	For searching purpose and testing our website.	Microsoft Edge

2.4. Financial Planning

In general usage, a financial plan is a comprehensive evaluation of an individual's current pay and future financial state by using current known variables to predict future income, asset values and withdrawal plans.

2.4.1. Human Resource Financial Plan

Here we listed all expenses that the project needed. Hardware, software and other (unknown) is listed below. As we do all the work here,we don't need to hire others the cost for human resource is not needed in the financial plan.

2.4.2. Material / Equipment Financial Plan

The hardware cost plan determine the cost of all the hardware that be used.

Hardware Name	Quantity	Unit Price (Birr)	Total Price (Birr)
Laptops	2	32,250	65,000
Printers	1	3000	3000
Mobile phones	1	8000	8000
Webcams	1	2300	2300
papers	1 package(500)	1	500
Total Cost			**78,300**

The software cost plan determines the cost of all the software that be used.

Software Name	Quantity	Unit Price (Birr)	Total Price (Birr)
Python	1	Free	Free
MS-Word	1	Free	Free

Adobe XD	1	Free	Free
My Sql	1	Free	Free
Windows	1	Free	Free

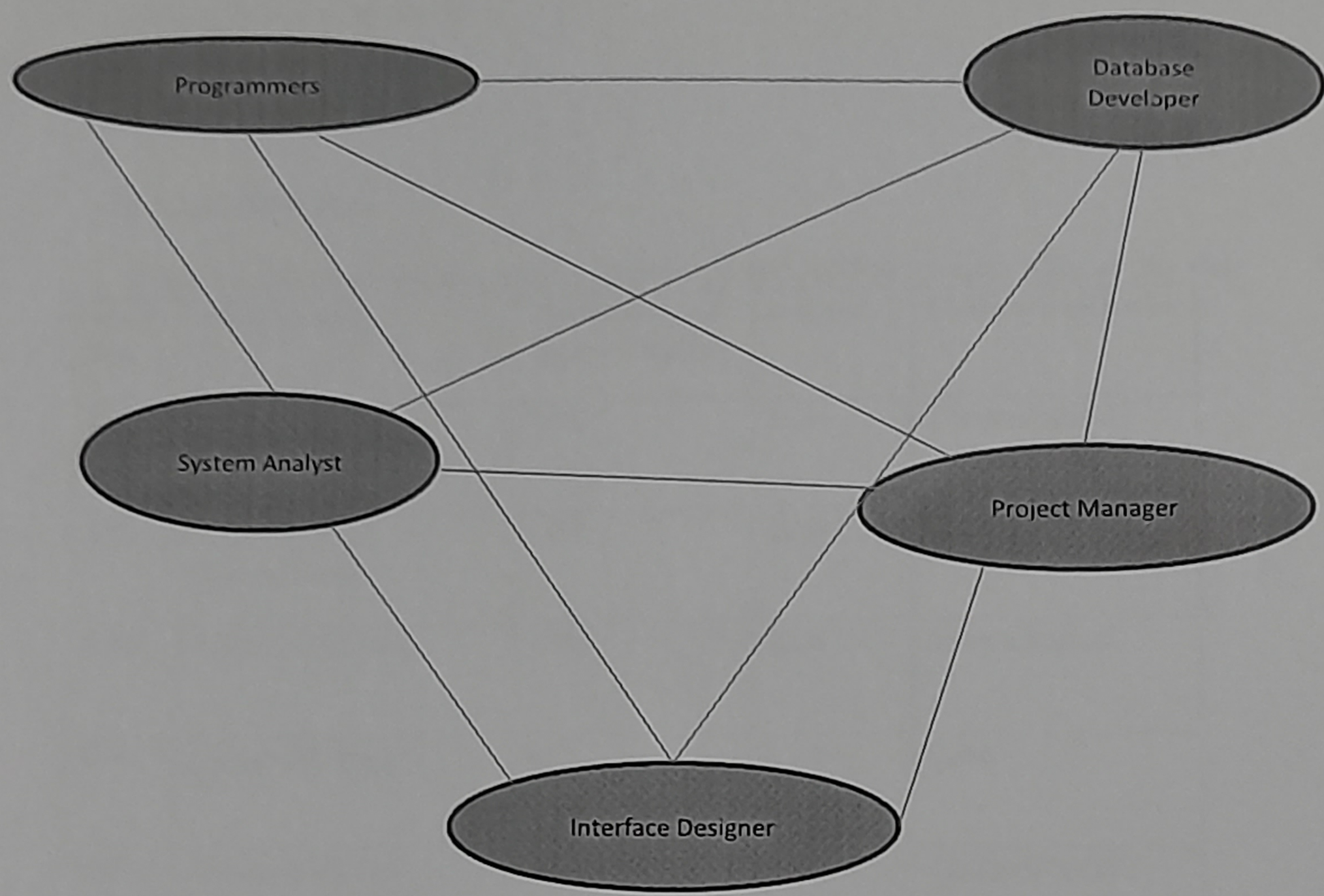
2.4.3. Project Budget

ITEM	QUANTITY	Unit Price (Birr)	Total Price (Birr)
Laptops	2	32,500	65,000
Webcams	1	2300	2300
Hard Disk	4	2200	8800
Internet Service	-	-	4200
Transportation	-		1500
Software	5	-	Free
Total Costs			81,800

2.5. Team Organization

Proper project team organization is one of the key constraints to project success. If the project has no productive and well organized team, there's an increased probability that the project will fail at the very beginning because initially the team is unable to do the project in the right manner. That's why we have invested a great deal of time working on the project team to come together and work on building a strong project team.We have chosen the decentralized team organization, since all the members are in equal standing. Horizontal flow of communication is very efficient. Every member has a right to say what they think should be done and at last decision making get to be done based on the majority's choice. The reason we chose this way is because we believe that everybody has something to bring to the table. There might of course be a disagreement here and there but since we are all standing to attain a common goal we worked through anything like professionals.

Development team members	Tasks
All	Analysis/ Requirement Gathering
All	Implementation
All	Design/Testing
All	Requirement Gathering/Testing



2.6. Process Model

A process model provides a specific roadmap for project. It defines the flow of all activities, actions and tasks, the degree of iteration, the work products, and the organization of the work that must be done.

The type of model we used in our project is Water fall model because this type model is linear and sequential approach to project management and easy to understand work on and a schedule can be set with deadlines for each stage of development and a product can proceed through the development process model phases one by one. Process modelling involves the following:

- ✓ Determine the system scope .
- ✓ Identify people and processes that transform data.
- ✓ Identify what data processing functions are performed by the current system if there is any.

2.7. RMMM (Risk Mitigation, Monitoring & Management) plan

In the risk mitigation, monitoring and management plan is to identify as many potential risks as possible.

2.7.1.Risk Item Table

2.7.2.RMMM Plan

A risk management strategy can be included in the software project plan, or the risk

Risk No	Risk Name	Probability of happening(%)	Impact	Category of Risks
R01	Technological Risk	10%	Less	Technological
R02	Poor Conflict Management	10%	Less	Staff
R03	Software Failure	15%	Less	Technological
R04	Budget Shortage	25%	Less	Cost
R05	Database Failure	25%	Less	Technological
R06	Change in Requirement	30%	High	Project Size
R07	Lack of Experience	35%	High	Staff
R08	Unreliable power	50%	High	Technological
R09	Unreliable Internet Connection	50%	High	Technological
R10	Poor Estimating time	50%	High	Business
R11	Difficulty on Implementation	60%	High	

management steps can be organized into a separate risk mitigation, monitoring and

management plan. The RMMM plan documents all work performed as part of risk analysis and is used by the project manager as part of the overall project plan.

Risk No –R01	**Name:-Technological Risk**	**Probability = 10%**
Description- There will be always be advancement in technology whether we like it or not. So the question is,are we using the latest technology or not		
Risk mitigation -We will get ourselves more acquainted with the latest technology trends		
Risk monitoring-When it is confirmed that we are using an old technology.		
Risk management – We will quickly update whatever we were behind on		
Status-The problem hasn't occurred yet.	**Assigned-Yordanos Mikiyas**	

Risk No –R02	**Name:-Poorconflict management**	**Probability = 10%**
Description- Since 5 people are working together conflict may emerge,and this will lead to failure of a project development		
Risk mitigation -While project developing project manager will be assigned to make a smooth communication between project members		
Risk monitoring-When group members are not accepting what the other is saying		
Risk management – Developing conflict free communication.		
Status-The problem hasn't occurred yet.	**Assigned-Kaleab Fekadu**	

Risk No –R03	Name:-Software Failure	Probability = 15%
Description- Using software is mandatory object while developing the project,through when a software fails it causes total project failure		
Risk mitigation-The project members uses genuine software so we can minimize the percentage of project failure.		
Risk monitoring-when software malfunctions		
Risk management – Having backup files,saving every sub-process while working and restoring files.		
Status-The problem hasn't occurred yet.	**Assigned-Yeabrham Zerihun**	

Risk No –R04	Name:-Budget Shortage	Probability = 25%
Description- Most of our work need money in order to have smooth working progress,therefore if budget shortage occurs it may lead us to partial failure.		
Risk mitigation -We will carefully schedule our project and use it properly.		
Risk monitoring- Amount of budget not meeting with the need.		
Risk management – Choosing the shortest and cheapest way to finish the project.		
Status-The problem hasn't occurred yet.	**Assigned-Alemdagn Awgechew**	

Risk No –R05	Name:-Database failure	Probability = 25%
Description- Database is where all of our information we gathered is stored and saved,so failure of our database is crucial.		
Risk mitigation -We will have backup databases.		

Risk monitoring-When our system faces database failure errors	
Risk management – restoring the backup database.	
Status-The problem hasn't occurred yet.	**Assigned-Surafel Solomon**

Risk No –R06	**Name:-Change in requirement**	**Probability = 25%**
Description- Requirement is one of building block of our project losing one will seriously lead our project to fail.		
Risk mitigation -In this phase of requirement gathering we will take things seriously and gather the mostly needed requirement.		
Risk monitoring-When we cant meet the end user need.		
Risk management – We will update our project to the latest requirement meeds.		
Status-The problem hasn't occurred yet.	**Assigned-Yordanos Mikiyas**	

Risk No –R07	**Name:-Lack of Experience**	**Probability = 35%**
Description- Since most of us are new to working(inexperienced),there will most probably be a lack of experience in certain areas during the course of the project execution		
Risk mitigation -Getting and developing experience by talking and working with other project teams who work on the same fields as ours		
Risk monitoring-When the final project output has a low quality of standard and not meeting expectation of end users.		
Risk management – By asking and talking advises and tips from other experienced project managers and teams.		
Status-The problem hasn't occurred yet.	**Assigned-Yeabrham Zerihun**	

Risk No –R08	Name:-Unreliable power	Probability = 50%
Description- While having unreliable power it causes partial failure of the project development.		
Risk mitigation -Using chargeable laptops will give us some life time to save what we did throughout the project development.		
Risk monitoring-Power lose happening while working or implementing.		
Risk management – We will manage power saving methods.		
Status-The problem hasn't occurred yet.	**Assigned-Alemdage Awgachew**	

Risk No –R09	Name:-Unreliable internet Connections	Probability = 50%
Description- our project is a composition of connected process, so if we lose connection the objects won't co-operate and will lead us to partial failure.		
Risk mitigation -we will try to connect software and objects of our project with Intranet connection.		
Risk monitoring-when database can't connect with our system.		
Risk management – assigning maintenance professional.		
Status-The problem hasn't occurred yet.	**Assigned-Surafel Solomon**	

Risk No –R1 0	Name:-Poor Estimating Time	Probability = 50%
Description- time is the main constraint of a project if it isn't used properly the project closing time will not meet the schedule.		
Risk mitigation		

-while scheduling we will take every time-consuming process, we will see the difficulty.	
Risk monitoring-when the time we scheduled is not enough to finish or implement the project.	
Risk management – if this difficulty occurred, we will speed up the work progress.	
Status-The problem hasn't occurred yet.	**Assigned-Yordanos Mikiyas**

Risk No –R1 1	**Name:-Difficulty on Implementation**	**Probability = 60%**
Description- Before finishing the project we must implement and check whether the project is fully operating or not, if it can't implement it's a waste.		
Risk mitigation -we will carefully work on the project so as to make the system applicable.		
Risk monitoring-when error happens while trying to implement.		
Risk management – having detailed info about the system and how it works.		
Status-The problem hasn't occurred yet.	**Assigned-Kaleab Fekadu**	

CHAPTER THREE-SYSTEM ANALYSIS

3.1 Introduction

System analysis is the process of determining user expectations for a new or modified product.It is a process of collecting and interpreting facts, identifying the problems, and decomposition of a system into its components.System analysis is a team effort that demands a combination of hardware, software and a communication skill that deals with people. System analysis has an essential part in system development as it provides the following benefits:

- Better management and better control
- Better quality
- Reduced cost of development
- Better control of risks
- Higher levels of satisfaction from users
- Less unused features
- Reduced project chaos

This chapter covers the overall System analysis part of the project which includes the functional and non-functional requirements, system model, CRC model, constraint, change case and business rules of the project.

3.2 Current system overview

Currently it is clear that skylight hotel uses manual recognition system which is done by the gatekeepers and some other assigned staff members.when someone comes the gatekeepers let him pass with out a doubt.We have seen that there is no any computerized system to control face recognition in our country.According to the current system we have seen some strength and weakness.

Strength Of The Current System

- ✓ Fast Response
- ✓ No System Failure
- ✓ Not Dependant On Power Source Or Connections.

Weakness Of The Current System

- ✓ Needs a lot of Man Power
- ✓ It is Tiresome and Boring.

3.3. Proposed System Overview

Our proposed system is a web based face detection and recognition system based on computer vision and deep learning.our system detects the face of people coming to the hotel whether they are already registered to the database,if yes then that person is already known by the system.

3.3.1. Functional Requirements

In software engineering and systems engineering, a functional requirement defines a function of a system or its component, where a function is described as a specification of behaviour between outputs and inputs. The new system takes care of the following functional requirements:

1. The system incorporate mechanism to authenticate its users.
2. The system has to take pictures .
3. The system has to detect and recognize face.
4. The Admin has to Delete or Add Customers.
5. The Admin has to control the employees through the system.

3.3.2. Non-Functional Requirements

Non-Functional Requirements describes aspects of the system that are concerned with how the system provides the functional requirements. The following are the Non-functional requirement of our system

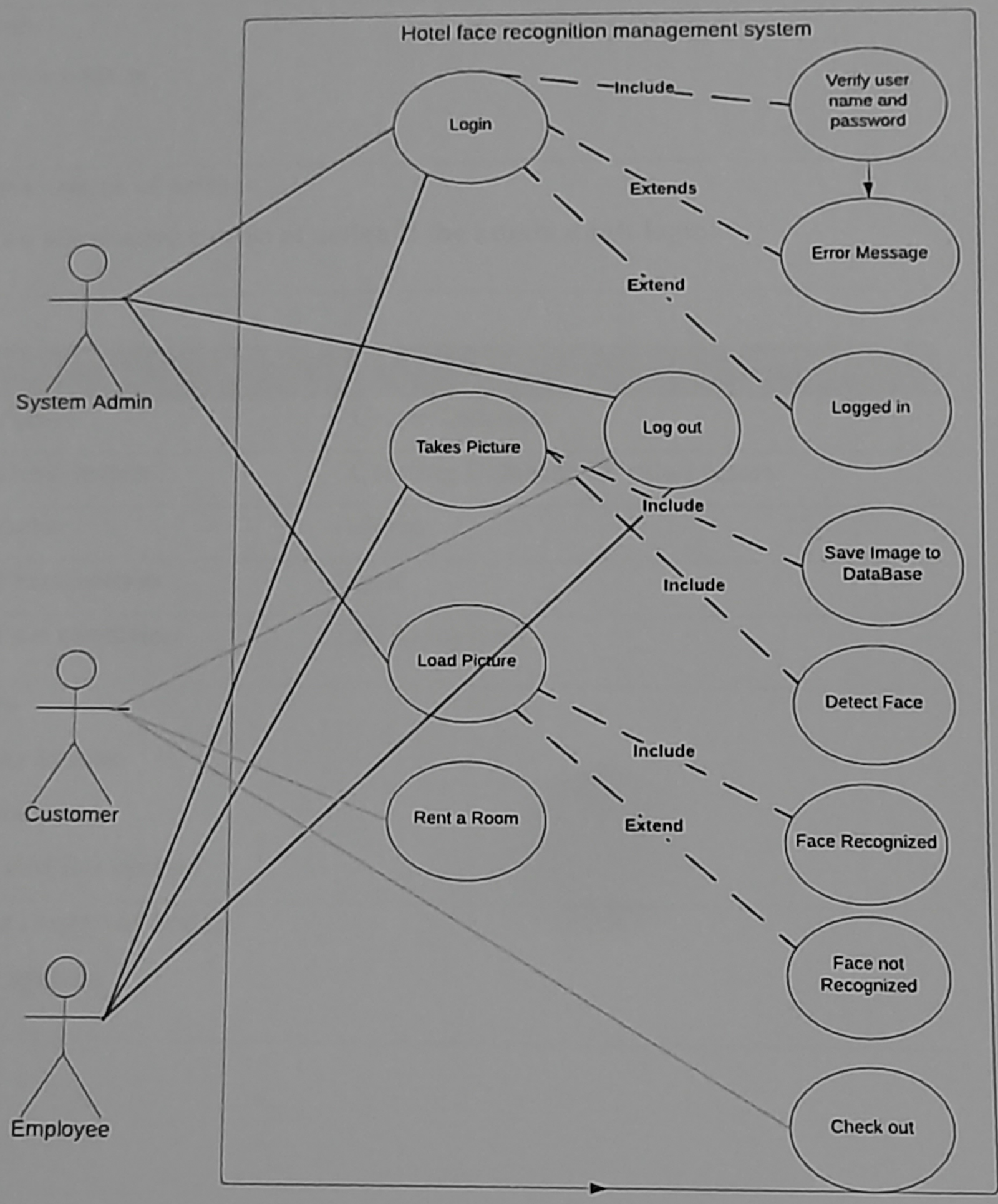
1. **Security:** - The subsystem provides a better level of security and integrity of the data held by the system as compared to the current system, only authorized person of the system gain access to the company's secured page on the system.
2. **Error handling:** - Error should be considerably minimized.
3. **Availability**: -This system should always be available for access at 24 hours, 7 days a week unless in the occurrence of any major system malfunctioning, the system should be available in all working days, so that the business process is not severely affected.
4. **Ease of use**: - Considered the level of knowledge possessed by the users of this system, which should be user friendly and consistent.
5. **Error handling Exception**: - The system must recover immediately when a user enters incorrect (error) data.

6. **Integrity**:-Only authorized users of the system can able to update, modify, delete or access data. Access is denied for unauthenticated users of the system.
7. **Maintenance:**-The system should be easy to maintain and update.

3.4. System Models - Requirement Determination

3.4.1. Essential Use case Modeling

3.4.1.1 Use case Diagram



3.4.1.2. Use case Documentation

Use case Number	UC0
Use case Name	Login
Use case Description	Admin login to the system
Use case Actor	Admin
Use case Precondition	None
Use case Post condition	Edit or add vendors
Main flow- **Login to the system**	
Alternative course of action- **There is no alternative course of action if the admin don't login**	

Use case Number	UC1
Use case Name	Create Database
Use case Description	Creating Database for other actors
Use case Actor	Admin
Use case Precondition	Login
Use case Post condition	Exit the system
Main flow- **Login to the system** **Create Databases** **Logout or exit the system**	
Alternative course of action **Stay in the system**	

Use case Number	UC2
Use case Name	Logout
Use case Description	Exiting the system
Use case Actor	Admin
Use case Precondition	Update and add vendors
Use case Post condition	Exit the system
Main flow- Login to the system Update and add vendors Logout or exit the system	
Alternative course of action Stay in the system	

Use case Number	UC3
Use case Name	Load Picture
Use case Description	Loading the inputed image
Use case Actor	Admin
Use case Precondition	Take image
Use case Post condition	Exit the system
Main flow- Login to the system Update and add vendors Logout or exit the system	
Alternative course of action Stay in the system	

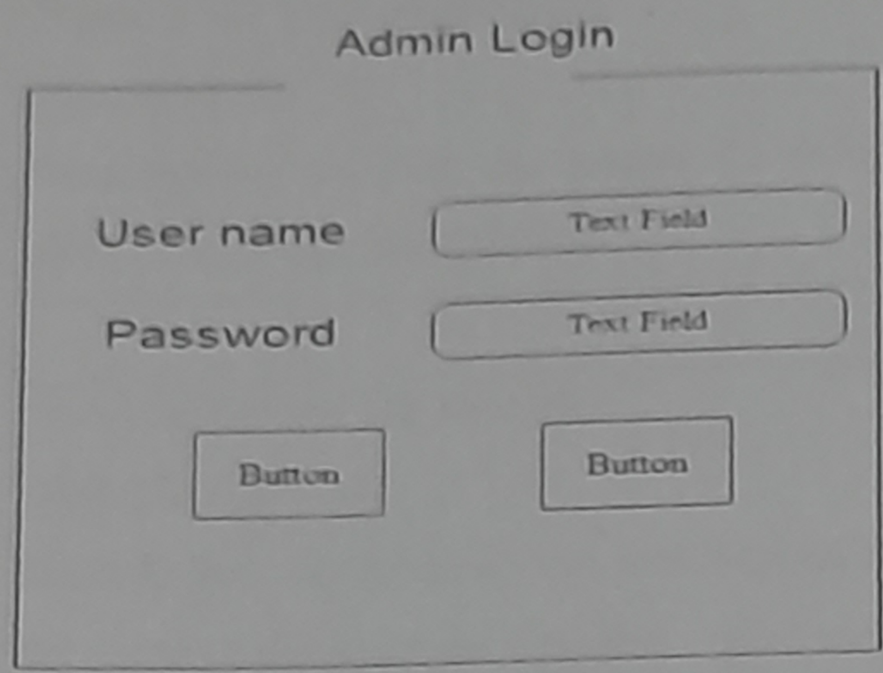
Use case Number	UC4
Use case Name	Vertify user name and password
Use case Description	Check whether the admins password and name matchs
Use case Actor	Admin
Use case Precondition	none
Use case Post condition	Exit the system
Main flow- **Login to the system** **Update and add vendors** **Logout or exit the system**	
Alternative course of action **Stay in the system**	

Use case Number	UC5
Use case Name	Save Image to Database
Use case Description	After taking the picture it saves it in database
Use case Actor	Admin
Use case Precondition	Create Database
Use case Post condition	Exit the system
Main flow- **Login to the system** **Update and add vendors** **Logout or exit the system**	
Alternative course of action **Stay in the system**	

Use case Number	UC6
Use case Name	Detect Face
Use case Description	Detect the face
Use case Actor	Admin
Use case Precondition	Takes Picture
Use case Post condition	Exit the system
Main flow- **Login to the system** **Update and add vendors** **Logout or exit the system**	
Alternative course of action **Stay in the system**	

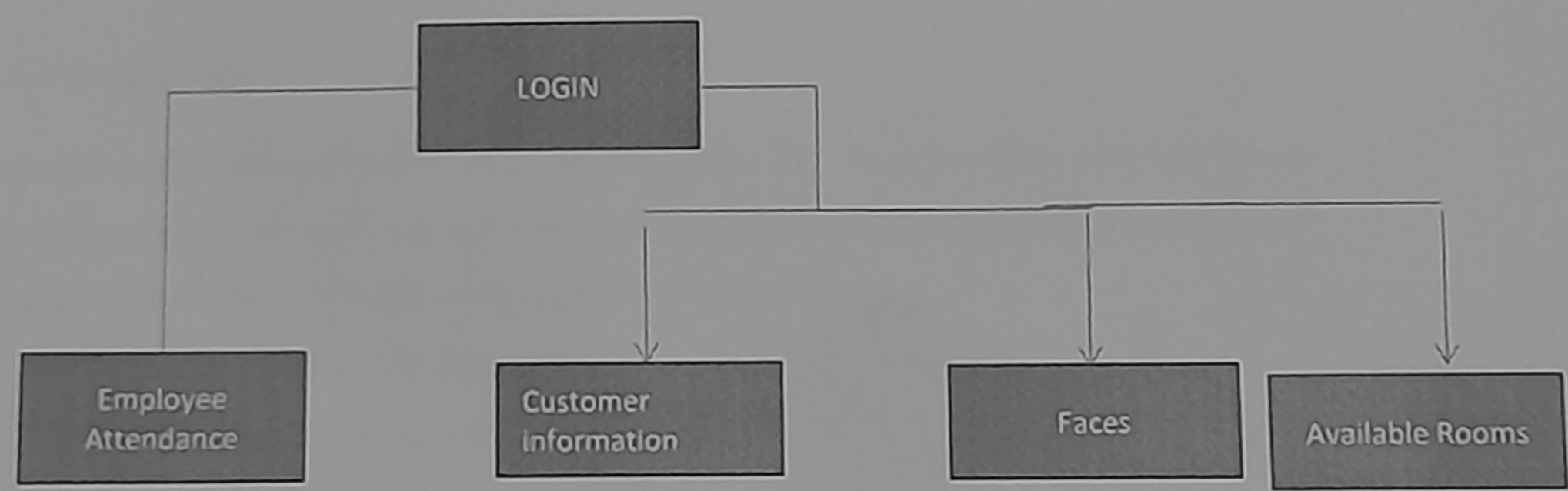
Use case Number	UC7
Use case Name	Face Recoginzed
Use case Description	After taking the picture the system checks it in the database and recognized the picture
Use case Actor	Admin
Use case Precondition	Detect picture
Use case Post condition	Exit the system
Main flow- **Login to the system** **Update and add vendors** **Logout or exit the system**	
Alternative course of action **Stay in the system**	

3.4.2 Essential UI Prototype



3.4.3 User Interface Flow Diagram

User interface flow diagram depicts the user's interaction with the system which are defined with use cases. They are used to model the interactions that users have with the system and enable us to gain a high-level overview of the user interface for the system. The flow diagram for activities in the system will look like the following



3.4.4 Supplementary Specifications

3.4.4.1 Business rules

A business rule defines one aspect of our business that is intended to assert business structure or influence the behaviour of our business. Business rules often focus on access control issues. Here is a list of business rules for our system:

Name: User's access privilege **Identifier**: BR-01 **Description**: the user can access the information provided by the admin but not allowed to access the database
Name: Database administrator **Identifier**: BR-02 **Description**: the database administrator will insert new information with the detail for the cattle in the database, and also give user name and password, update information change, remove the information as needed
Name: Restriction on the user to access the database **Identifier**: BR-03 **Description**: the user can access the information provided by the admin but not allowed to access the database

3.4.4.2 Constraints

Every project is constrained in different ways, often by its scope, time, and cost goals. To create a successful project, a project manager must consider constraint and balance its goals. The basic constraint in our project are the following:

- Budget,Time,Cost Shortage
- Change Of Technology
- Difficulty or Conflict among Team
- Software Failure
- Unreliable internet service

3.4.4.3 Change Case

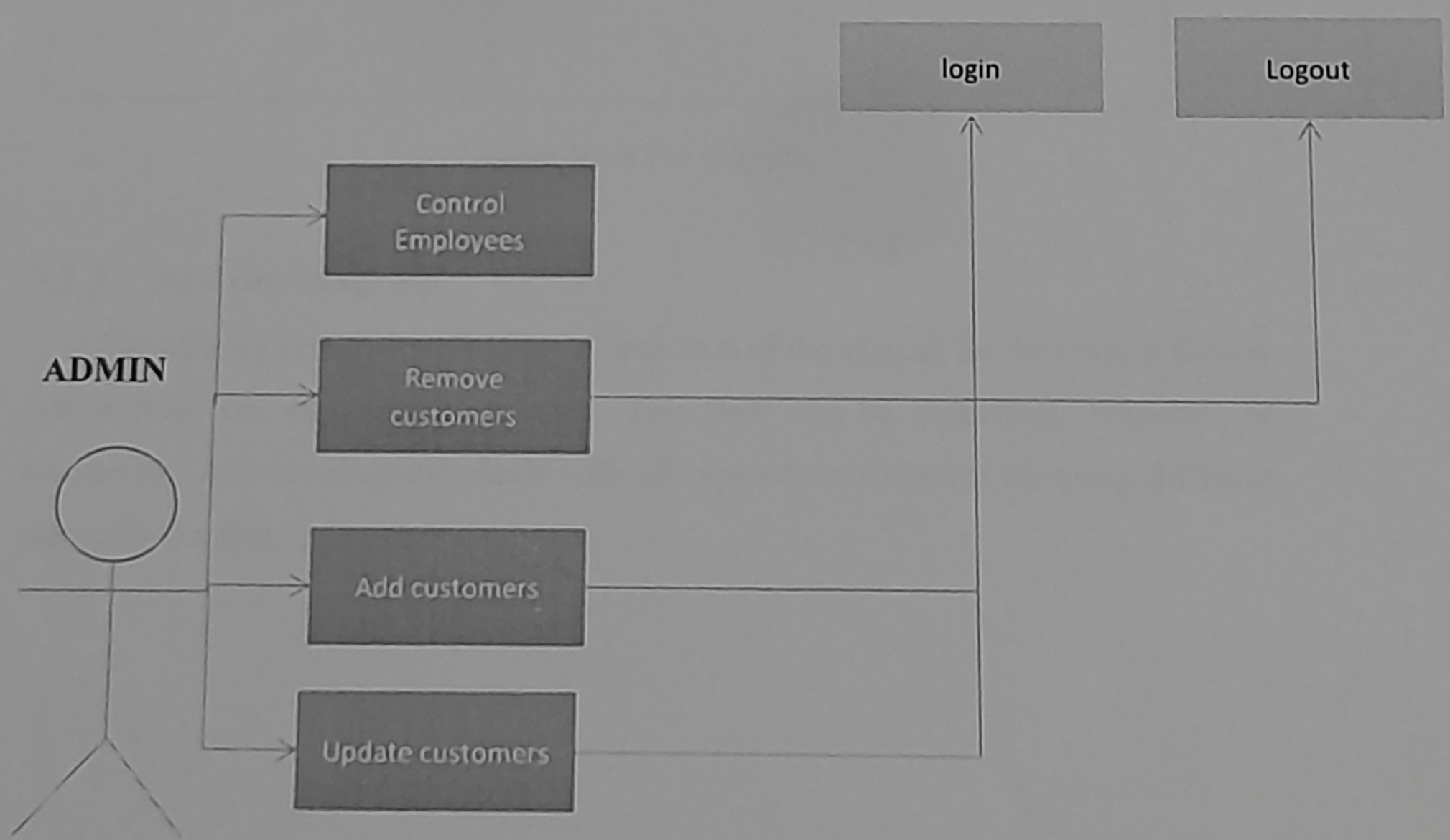
Change cases are used to describe new potential requirements for a system or modifications to existing requirements. Change cases can be identified throughout the course of our overall development efforts.

Case ID	Change Case	Likely Hood	Impact
UC0	The username or the password of the admin can be changed	This is very likely to happen when admin forget username or password	Large,This change in case impact is admin can't login to the system
UC1	Since new technologies are developing faster nowadays	Modern world technology is moving on a very high	Large, we need to update our system or overlook the whole system
UC2	If people doesn't use our system	Certain, if people have other choices	Large, the system will be designed in order for the user to use our system

3.5 System Models - Analysis

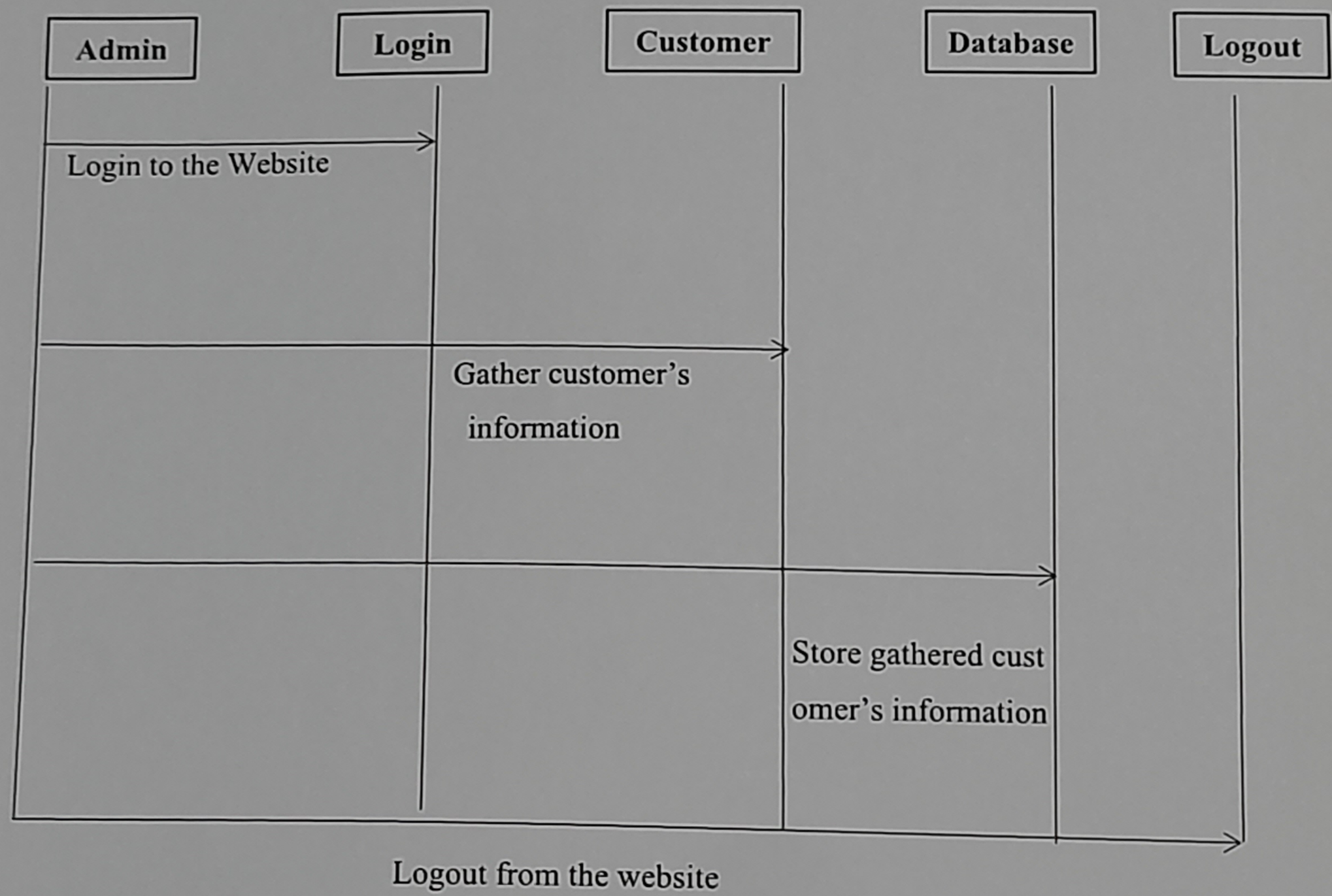
3.5.1. System Use case Modeling

3.5.1.1. System Use case Diagram



3.5.2. Sequential Diagram

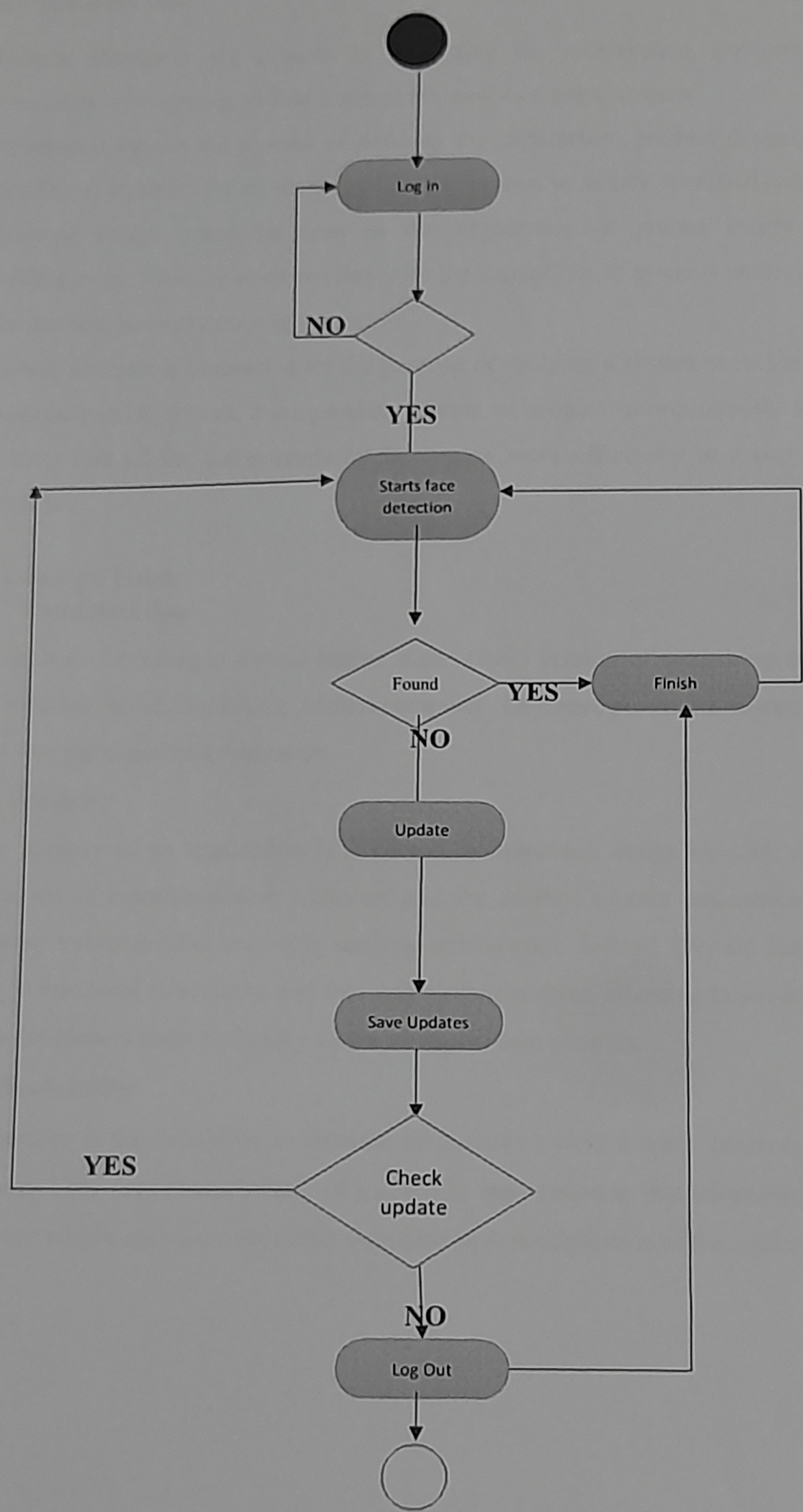
A sequence diagram is a UML diagram that models the sequential logic, in effect the time ordering of messages between classifiers. It is an interaction diagram that shows how processes operate with one another and in what order. It is a construct of a Message Sequence Chart.



3.5.3. Activity Diagram

The activity can be described as an operation of the system. So the control flow is drawn from one operation to another. This flow can be sequential, branched or concurrent. Activity diagrams deals with all type of flow control by using different elements like fork, join etc.

Admin Activity Diagram



CHAPTER FOUR -SYSTEM DESIGN

4.1 Introduction

System Design is the process of designing the architecture, components, and interfaces for a system so that it meets the end-user requirements.

Systems design is the process of defining the architecture, product design, modules, interfaces, and data for an electronic control system to satisfy specified requirements. Systems design could be seen as the application of systems theory to product development. There is some overlap with the disciplines of systems analysis, systems architecture and systems engineering.

System analysis is conducted for the purpose of studying a system or its parts in order to identify its objectives. It is a problem solving technique that improves the system and ensures that all the components of the system work efficiently to accomplish their purpose.

4.2 Design Goals

1. Virtualization

is the act of creating a virtual (rather than actual) version of something at the same abstraction level, including virtual computer hardware platforms, storage devices, and computer network resources.

2. Security

The security of an application is impacted by numerous design choices, such as the selection of communication protocols and the method of user authentication. Most security vulnerabilities are not in security-related code. Instead, they are found in code that is unrelated to security and that was written without attention to security. This is why developers must be keenly aware of application security.

3. Scalability

Scalability is the capability to increase resources to yield a linear increase in service capacity. The key characteristic of a scalable application is that additional load only requires additional resources rather than extensive modification of the application itself.

4. **Usability**

Usability is a measure of the interactive user experience associated with a user interface, such a website, mobile or software application. A user-friendly interface design is easy-to-learn, supports users' tasks and goals efficiently and effectively, and is satisfying and engaging to use.

5. **Functionality**

Our system will address all requirements we agreed up on the beginning of this system

6. **Maintenance**

Extensibility – Client application and system should be flexible enough to add additional functionality if needed.

Modifiability – Client application and system should be modifiable with little effort by trained professionals

Readability – Code should be easy to understand

7. **Dependability**

Client Application should be able to prevent invalid user inputs by providing users with easy and interactive display.

In terms of availability, the system will work for almost 24*7. The target customers can gain the required customer service during any time in a day.

The system should be able to report errors to an admin and should have exceptions to handle simple errors.

The system should have an authentication process to avoid malicious attacks.

Client application should be protected from unauthorized access to the database by limiting the request ability of the application.

8. **Portability**

Server can be accessed and installed from and on a variety of networking environments

9. **Cost**

Cost is the amount of resources that is going to be sacrificed for the project, whether the cost being in money or materials. What we intend on achieving is building the application at a minimal cost.

4.3 Design Trade offs

System designers may also try to achieve a balance to resolve conflicting requirements. Such a balancing act sacrifices and weakens one aspect of the software to strengthen another. This is what we refer to as a design trade-off.

Security vs. Usability

Although more security checks improve security assurance, they may negatively impact user experience by making it harder to use the system. Given that security can never be fool proof, designers can only raise the bar. Both Security and usability are competing requirements, designing software with right balance based on acceptable levels is the key trade-off.

Space vs Speed

The system will require substantial amount of memory and storage and it will prioritized speed over storage constraints to provide a better performance.

Security vs. Functionality

we will always make sure the functionalities we will be introducing in our system wouldn't distort the security or create a hole in the system

Functionality vs Usability

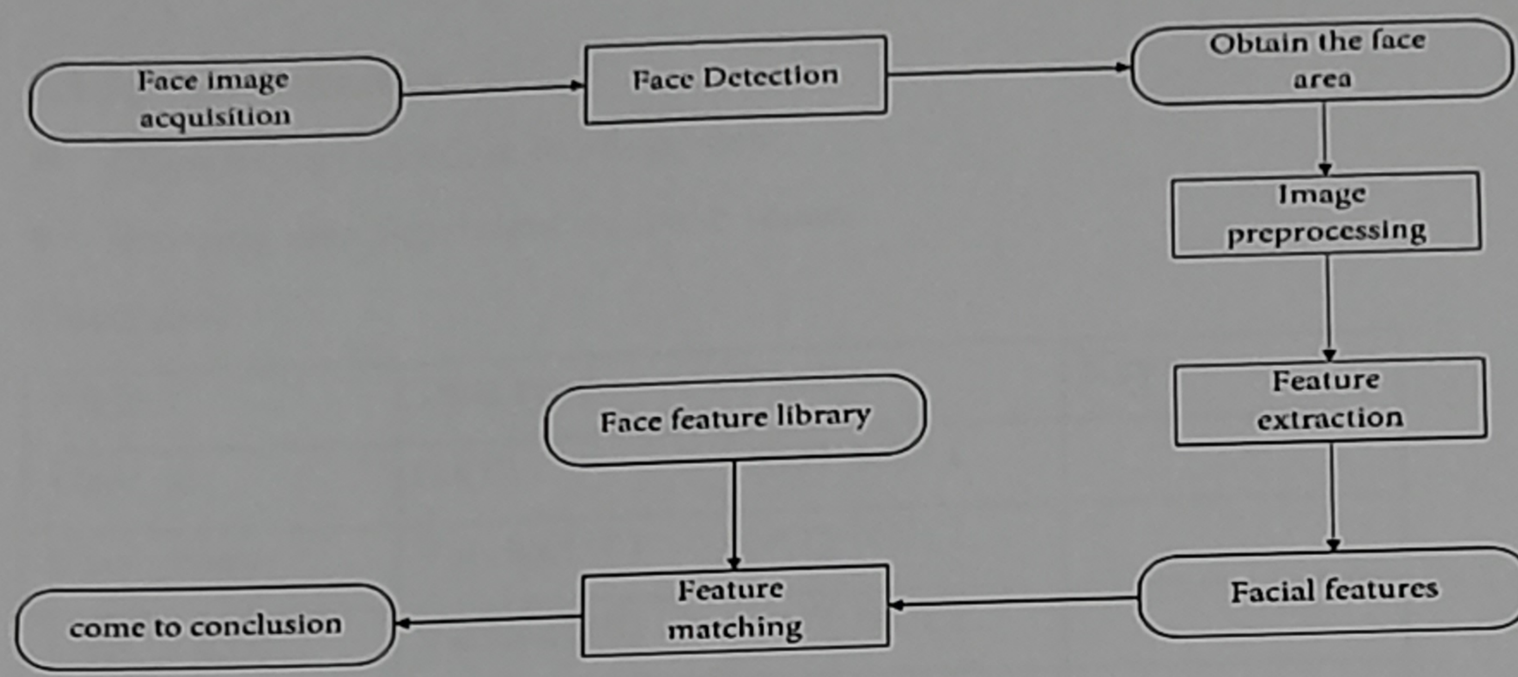
In this case functionality should be prioritized b/c there will be a user-friendly user guide that can help with usability.

Capacity vs. Performance

The more medical products we store the more space we consume. The more medical products we have the more seek time we require. Thus, the system performance may be reduced.

4.4 Subsystem Decomposition

system decomposition, the system is divided into smaller subsystem parts. In system inter dependency, all the parts must be working or else the system will fail. The systems rely on the functioning of other parts and they are not self-contained.



4.5 Design Phase Models

4.5.1 Class Modeling

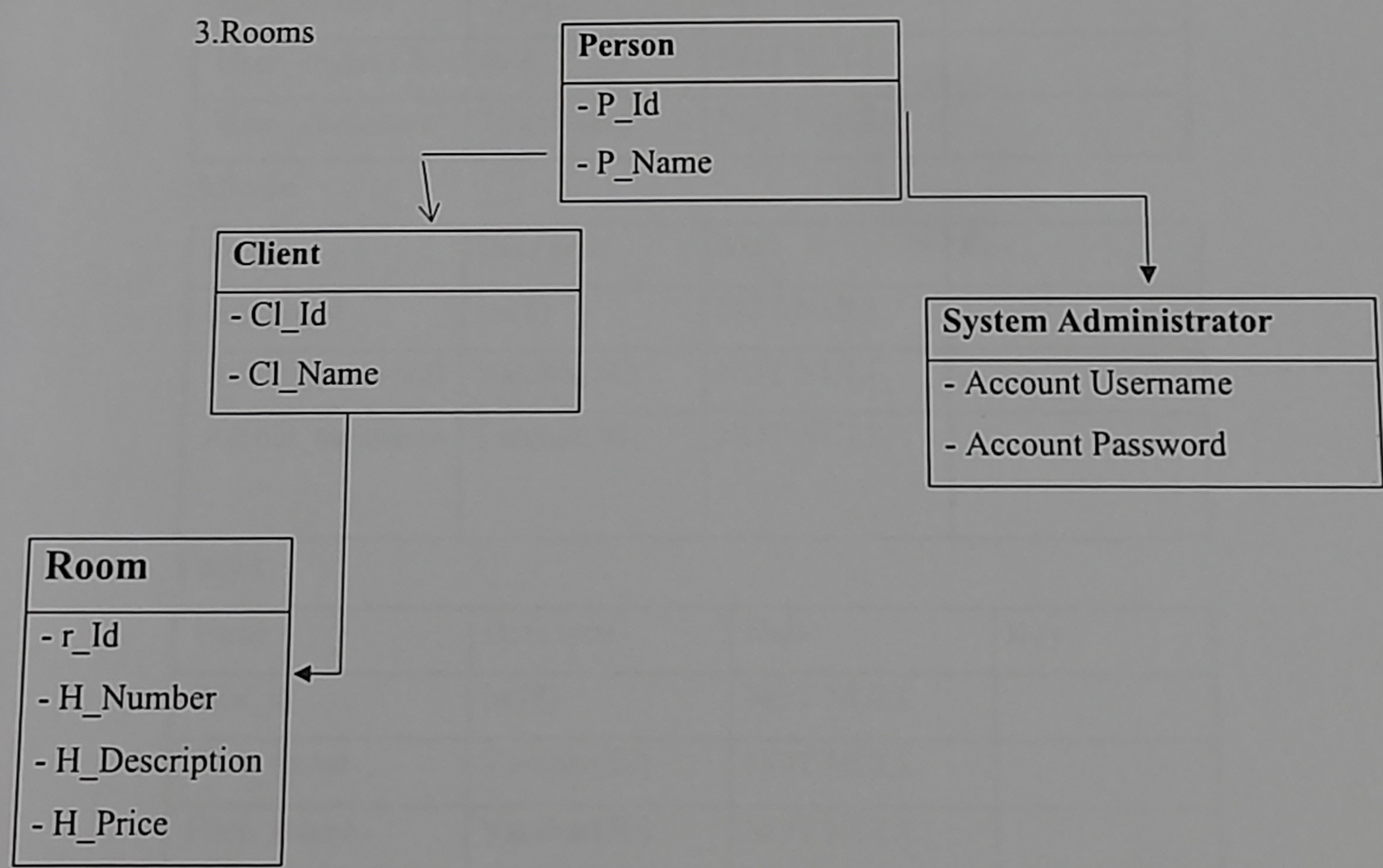
class modeling is to model the static structure of how our software will be built. The class Modeling describes the attributes and operations of a class and also the constraints imposed on the system. The class diagrams are widely used in the modeling of object oriented systems because they are the only UML diagrams which can be mapped directly with object oriented languages.

These are the major class for our system:

1.Admin

2.Customer

3.Rooms



4.5.2.2 Normalization

- Eliminating redundant (useless) data.
- Ensuring data dependencies make sense.

Customer

Field	Data type	Null	Key
User_id	int(8)	NOT NULL	
User _name	Varchar(30)	NOT NULL	
User_fname	Varchar(30)	NOT NULL	
User_lname	Varchar(30)	NOT NULL	
User_email	Varchar(50)	NOT NULL	
User _dob	date	NOT NULL	
User _gender	Char(6)	NOT NULL	
User_sex	Char(6)	NOT NULL	
User_address	Varchar(30)	NOT NULL	
User _country	Varchar(30)	NOT NULL	
User_nationality	Varchar(35)	NOT NULL	
User_subcity	Varchar(30)	NOT NULL	
User_kebele	Varchar(15)	NOT NULL	
User_wereda	Char(2)	NOT NULL	
User _registerdate	date	NOT NULL	
User _cheackout	TimeStamp	NOT NULL	

Admin

Field	Data type	Null	Key
Admin_id	int(8)	NOT NULL	
Admin_password	Varchar(50)	NOT NULL	
Admin_username	Varchar(50)	NOT NULL	

Faces

Field	Data type	Null	Key
face_id	int(8)	NOT NULL	
Face_name	Varchar(50)	NOT NULL	
Face_fname	Varchar(50)	NOT NULL	

Face_lname	Varchar(50)	NOT NULL	
face _registerdate	date	NOT NULL	

Rooms

Field	Data type	Null	Key
room_id	int(8)	NOT NULL	
room_number	Int(8)	NOT NULL	
Room_price	money	NOT NULL	
Room_discription	Varchar(100)	NOT NULL	

First Normal Form (1NF)

User

Field	Data type	Null	Key
User_id	int(8)	NOT NULL	Primary key
User_fname	Varchar(30)	NOT NULL	
User_lname	Varchar(30)	NOT NULL	
User_email	Varchar(50)	NOT NULL	
User _dob	date	NOT NULL	Foreign key
User_sex	Char(6)	NOT NULL	

Admin

Field	Data type	Null	Key
Admin_id	int(8)	NOT NULL	Primary key
Admin_password	varchar(50)	NOT NULL	
Admin_email	varchar(50)	NOT NULL	Foreign key

Rooms

Field	Data type	Null	Key
room_id	int(8)	NOT NULL	Primary key
room_number	Int(8)	NOT NULL	
Room_price	money	NOT NULL	Foreign key

5.3 User Interface Design

The user interface design should use the common UI design issues and the UI requirements of the organization. The major criteria for judging quality of a UI are its usability. User interfaces should be designed to match the skills, experience and expectations of its anticipated users.

4.5.4 Deployment Diagram

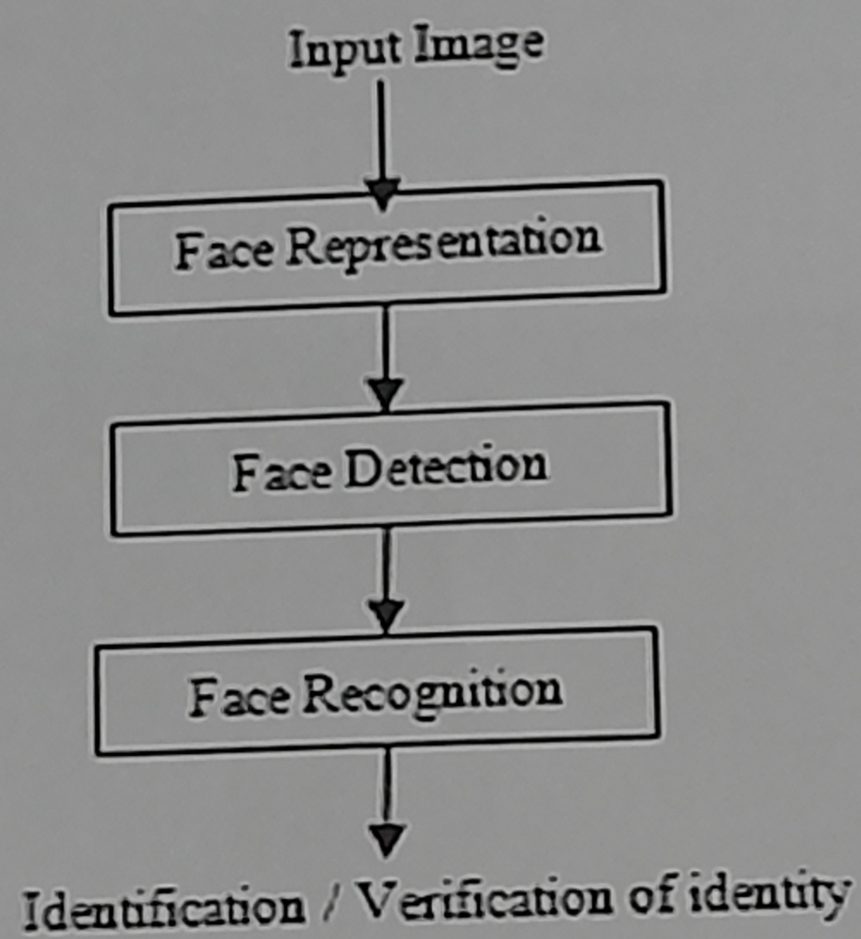
Deployment diagrams is a UNL Diagram are used for describing the hardware components where software components are deployed. Component diagrams and deployment diagrams are closely related.

Component diagrams are used to describe the components and deployment diagrams shows how they are deployed in hardware. UML is mainly designed to focus on software artifacts of a system. But these two diagrams are special diagrams used to focus on software components and hardware components.

So most of the UML diagrams are used to handle logical components but deployment diagrams are made to focus on hardware topology of a system. Deployment diagrams

are used by the system engineers. The purpose of deployment diagrams can be described as:

- Visualize topology of a system.
- Describe the hardware components used to deploy software components.



CHAPTER FIVE-IMPLEMENTATION AND DESIGN

5.1 Introduction

Implementation is the stage where the theoretical design is turned into a working system. The most crucial stage in achieving a new successful system and giving confidence on the new system for the users that it will work efficiently and effectively. Direct implementation are popular and standard way of implementation which is used most of time by system designers. We use direct implementation procedure (i.e. coding the system after preparation of project proposal) to design and implement our system.

5.2 sample code

```
import cv2
import mediapipe as mp
import sqlite3

cap = cv2.VideoCapture(0)
if not cap.isOpened():
    raise IOError("Cannot open webcam")
mpFace = mp.solutions.face_detection
mpDraw = mp.solutions.drawing_utils
facedet = mpFace.FaceDetection()

while True:
    ret, frame = cap.read()
    frame = cv2.resize(frame, None, fx=1.5, fy=1.5,
interpolation=cv2.INTER_AREA)
    results = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)
    result = facedet.process(results)
    if result.detections:
        for id, detection in enumerate(result.detections):
            mpDraw.draw_detection(frame, detection)
    cv2.imshow('Input', frame)

    c = cv2.waitKey(1)
    if c == 27:
        break
    if c == 65 or c == 97:
        filename = "myimg.jpg"
        cv2.imwrite(filename, frame)
        filename = "myimg1.jpg"
        cv2.imwrite(filename, frame)

cv2.waitKey(0)


def createDatabase():
    faceDatabase = sqlite3.connect("Hotel face rec.db")
    data = faceDatabase.cursor()

    data.execute("CREATE TABLE IF NOT EXISTS projects "
                 "(id integer PRIMARY KEY,name text NOT NULL,face
```

```
blob) ;")
    data.execute("INSERT INTO PROJECTS(id,name) values ('1','hulu')")
    faceDatabase.commit()
    faceDatabase.close()


createDatabase()
```

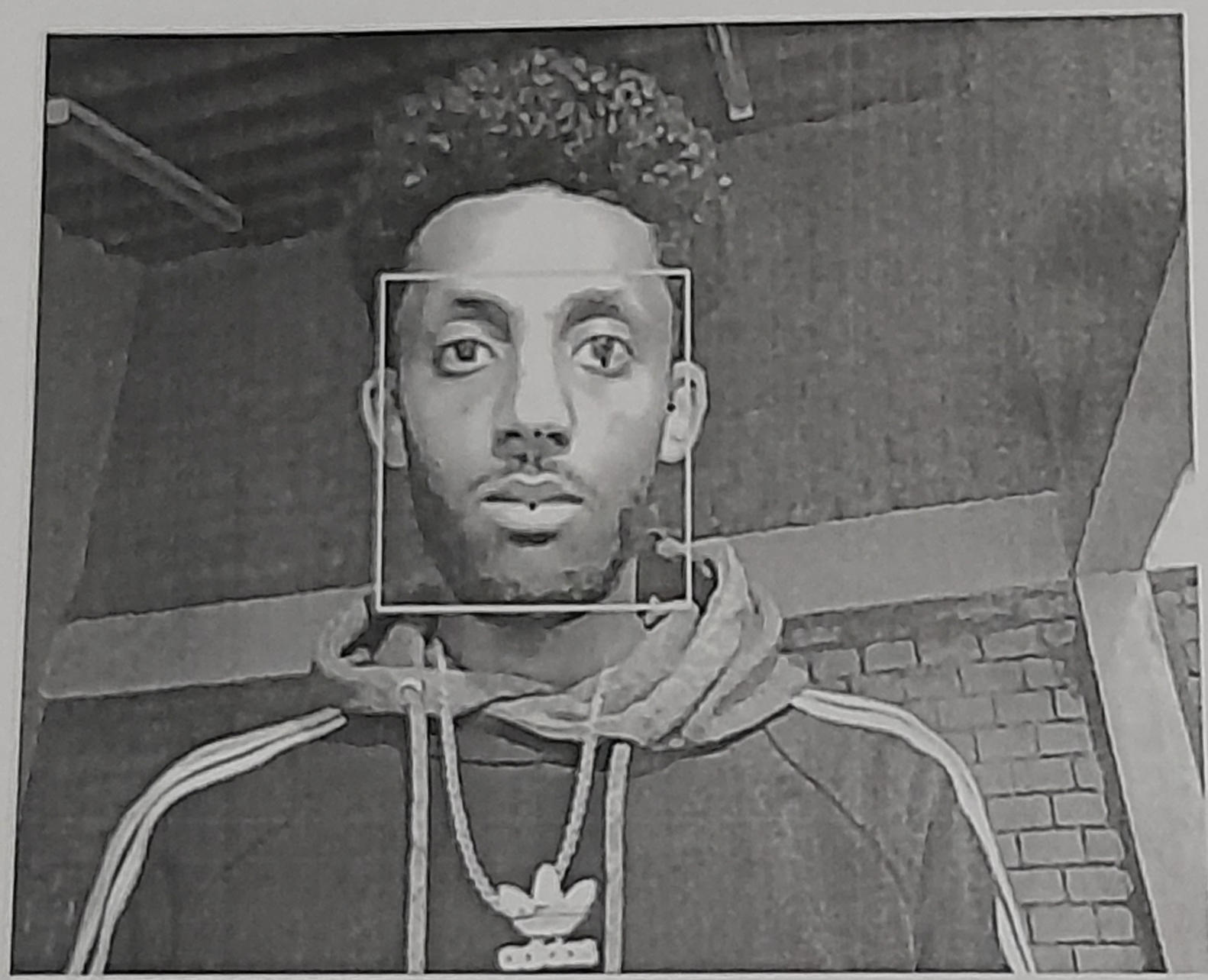
```
from PySide2.QtCore import *
from PySide2.QtGui import *
from PySide2.QtWidgets import *


class Ui_page1(object):
    def setupUi(self, page1):
        if not page1.objectName():
            page1.setObjectName(u"page1")
        page1.resize(567, 519)
        page1.setAutoFillBackground(False)
        page1.setStyleSheet(u"background-color: rgb(0, 0, 0);")
        self.label1 = QLabel(page1)
        self.label1.setObjectName(u"label1")
        self.label1.setGeometry(QRect(10, 10, 551, 111))
        font = QFont()
        font.setFamily(u"Footlight MT Light")
        font.setPointSize(72)
        self.label1.setFont(font)
        self.label1.setStyleSheet(u"rgb(255, 255, 255)")
        self.plainTextEdit = QPlainTextEdit(page1)
        self.plainTextEdit.setObjectName(u"plainTextEdit")
        self.plainTextEdit.setGeometry(QRect(210, 230, 341, 51))
        self.plainTextEdit_2 = QPlainTextEdit(page1)
        self.plainTextEdit_2.setObjectName(u"plainTextEdit_2")
        self.plainTextEdit_2.setGeometry(QRect(210, 350, 341, 51))
        self.pushButton = QPushButton(page1)
        self.pushButton.setObjectName(u"pushButton")
        self.pushButton.setGeometry(QRect(70, 450, 101, 41))
        font1 = QFont()
        font1.setFamily(u"Segoe Print")
        font1.setPointSize(18)
        font1.setBold(True)
        font1.setWeight(75)
        self.pushButton.setFont(font1)
        self.pushButton.setStyleSheet(u"background-color: rgb(85,
170, 0);\n"
"")
        self.label1_2 = QLabel(page1)
        self.label1_2.setObjectName(u"label1_2")
        self.label1_2.setGeometry(QRect(20, 190, 171, 111))
        font2 = QFont()
        font2.setFamily(u"Footlight MT Light")
        font2.setPointSize(24)
        self.label1_2.setFont(font2)
        self.label1_2.setStyleSheet(u"background-color: rgb(0, 0,
0);")
        self.label1_3 = QLabel(page1)
        self.label1_3.setObjectName(u"label1_3")
        self.label1_3.setGeometry(QRect(20, 320, 171, 111))
        self.label1_3.setFont(font2)

        self.retranslateUi(page1)
```

```
        QMetaObject.connectSlotsByName(page1)
    # setupUi

    def retranslateUi(self, page1):
        page1.setWindowTitle(QCoreApplication.translate("page1",
u"Form", None))
        self.label1.setText(QCoreApplication.translate("page1",
u"<html><head/><body><p align=\"center\"><span style=\"
color:#ffffff;\">Admin Login</span></p></body></html>", None))
        self.pushButton.setText(QCoreApplication.translate("page1",
u"Sign In", None))
        self.label1_2.setText(QCoreApplication.translate("page1",
u"<html><head/><body><p><span style=\"
color:#ffffff;\">UserName</span></p></body></html>", None))
        self.label1_3.setText(QCoreApplication.translate("page1",
u"<html><head/><body><p><span style=\"
color:#ffffff;\">Password</span></p></body></html>", None))
    # retranslateUi
```



CHAPTER SIX-CONCLUSION AND RECOMMENDATION

6.1 Conclusion

We proposed to build a high performance, scalable, agile, and low cost face recognition system. We divide the proposed approach into several small sub projects.

In this paper,we have proposed an improved methodology for face detection and recognition for various challenges such as different pose angles,various facial expression,complex background,and illumination etc.We proposed a pre-processing step including image enhancement and noise removal.At last,we identify the human face correctly.It is not yet suitable for face recognition in video surveillance.Future works will be to find out the solutions to overcome these limitations and this work will continue for better work.and we have tried our best to integrate skylight hotel with our system.

6.2 Recommendation

The project title we have chosen is a very timely and important and it is done based on one of the emerging fields of study which is AI (Artificial Intelligence). We have stated what we are going to do, taking consideration of our educational level and the time given to do the project. The features of the system are explained well in the proposed system description and in the system features part.

The scope of this project can be expanded in the future by including the following features.

- Temperature alerting: Temperature detection can be included in the future work. People with measure of temperature greater than the normal body temperature will be alerted too.
- Integrating to entrance gates and only people Who have permission to give their face picture will enter

REFERENCE

- www.w3school.com
- **"SoftwareDevelopmentMethodologies"https://www.geeksforgeeks.org/softwa re development-methodologies** (accessed April 15, 2021)
- Z. Abidin, A. Harjoko, "A Neural Network based Facial Expression Recognition using Fisherface", International Journal of Computer Applications, Vol.59– No.3, 2012
- **https://mobidev.biz/blog/custom-face-detection-recognition-softwaredevelopment#nav0** (accessed April 20,2021)
- "SoftwareEngineeringArchitecturalDesign", https://www.geeksforgeeks.org/software
- engineering-architectural-design/ (accessed May 26, 2021)
- □"DataTypesinDatabaseDesign" https://docs.microsoft.com/en-us/sql/reporting
- services/report-design/data-types-in-expressions-report-builder (accessed May 26, 2021)
- "Improvement of an Online Education Model with the Integration of Machine Learning