Report

by Fyp-Iprs Utu

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License Plate Recognition System on toll Plaza

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Introduction

1.1 Problem Statement

In this modern world the main problem in every person's life is security. Security can be of data or property or mobile device and precisely we will talk about vehicle security and there are no useful measures taken for vehicle security in Pakistan, if there are measures they are only eye-catching based. Country's law states a vehicle running on road must be registered so it can be officially recognized as owned by a person and unregistered or stolen cars are everywhere without out knowledge. There is no authentication software for vehicle's registered number plate in this region. Even if vehicle is registered there are no systems to detect if this vehicle is cleared or stolen.

1.2 Purpose

The main purpose of developing this system is to automate security measure on highway toll plazas to capture vehicle number plates and search motorway police database and police database. A real time-based camera is installed on checkpoints, software captures the video frames from camera and scans for number plate. It automatically alerts authorities if a vehicle has registered/unregistered number. If license plate has registered number, then vehicle is clear to go or if a registered number vehicle is stolen from somewhere if its case is filed. Another purpose of the system is to apply the law which states that a vehicle must use a license plate which is officially issued from excise office.

1.3 Project Goals

Our goals are to create a product which is highly responsive, so we can provide authorities an easy and fast way to check vehicles registration and provide facility to track vehicles. We are eager to create a light weight product, so it can be easily installed in any device so in future we can also provide this software to third party organizations for their security as well as in Pakistan we can also provide this software to parking lot renter/tenant as it is trend in this region. Our goal is to create a more interactive software despite it requires less interaction.

1.4 Objectives of Project

- Providing user, a friendly automated system.
- User can expand UI for detail view of information.
- Auto alert user if license plate design is not as officially issued.
- Auto alert user if license plate is not registered.

- Auto alert user if vehicle is stolen.
- User can report of location of itself to where stolen vehicle is filed.
- User can report/alert with major detail of vehicle to nearby police car with single click.
- User can report for major emergency.
- User can feed recorded video to check vehicle's status.
- Provides user authorization and authentication.

1.5 Project Limitation

- A limited distance between camera and license plate is applied which is about 2-3 meters.
- It cannot resolve distant video/image or with low resolution video/image.
- It can process only single number plate in a video feed.
- It cannot resolve night vision issue otherwise night vision cameras are installed which requires other type of image processing.
- Area of the checkpoint should be properly illuminated.
- It cannot process if camera lens is covered with water droplets in case of rain otherwise camera is installed under a shed.
- It declares other design license number plates as unidentified or unregistered as we are limited to Punjab region for now.
- It cannot process a fast-moving vehicle because we don't have advanced camera which captures hundreds of frames per second.
- A vehicle should be moving around 20-30km/h.

1.6 Project Scope

To create the boundaries of our project first we decided the subdomain in which we are going to apply our idea and we are going to develop this project for toll plaza only. This project is expandable to other domains with minimum change, such domains which require some security and surveillance. The basic feature of this project is universal which is applicable to almost every domain .

1.7 Project Scheduling

A project is scheduled according to requirements we gather and how we design and test our system. Project is scheduled w.r.t time and cost. Cost scheduling is more predictable than time scheduling. A good scheduling should be more predictive as it shows progress according to the planning. It should also be flexible so it can be adjusted if there are any ups and downs during development.

Frame work of our project is shown in table1.

Table # 1 Project Scheduling

		Tas	Task Na...	Duration	Start	End
1			**Project...**	**20 days**	**11/28/...**	**12/25/...**
2	✔		Projec...	6 days	12/25/...	1/1/2018
3	✔		Requir...	14 days	1/2/2018	1/20/2...
4			Archit...	12 days	2/19/2...	3/6/2018
5			Design	16 days	3/7/2018	3/28/2...
6			Coding	21 days	4/2/2018	4/30/2...
7			Imple...	22 days	5/1/2018	5/30/2...
8			Testing	14 days	6/1/2018	6/20/2...
9			Verific...	1 day	6/22/2...	6/23/2...
10			Docu...	5 days	6/24/2...	6/29/2...

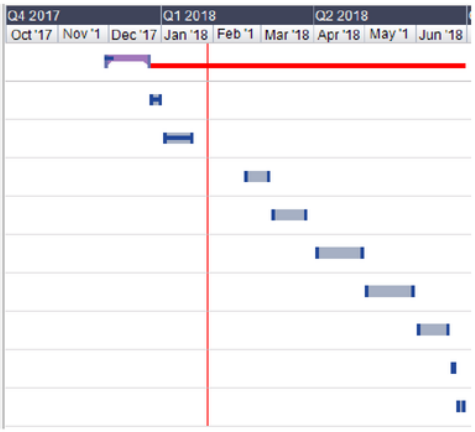

Table 1-1 Gant Chart caption up

1.8 Risk Management

Risk management is an important part of the project as it reduces risks which can harm project development in any way. As we are adopted Agile iterative methodology then it is upon us to manage risks on every step of project development. Risks can be of many types which includes cost, performance, schedule and design etc. other risks are unforeseen and unavoidable which may occur. Risk can be different on different work scale as we are developing this project on university scale some other risks may include which might not be present in field of work.

1.8.1 Types of Risks.

In this section we explain the

1.8.1.2 Cost Risk

In project development estimation of cost is undefined it is always approximate. Cost analysis is done before starting of project. To minimize cost risk in future we have to further divide our project in small parts and analyze cost of each part. Categorize the project such that management cost, hardware cost etc. so that we can precisely divide the total cost.

1.8.1.3 Performance Risk

Performance risk is very dangerous type as it found in final result and we have to repeat every step to reduce this risk. It occurs when our final product do not meet our estimated performance. As we are developing a license plate reader through image processing , here performance parts in image processing as processing requires time so less performance means more processing time . If our system takes insufficient time to scan a license plate, then our final product is totally useless.

1.8.1.4 Scheduling and Time Risk

Carefully dividing a project development step by step and adding time required to develop modules of whole project, we can acquire a proper schedule. Scheduling risks occurs due to many factors such as team members are nonserious or some avoidable circumstances occurred which postpone small tasks.

1.8.1.5 Change of Requirements

On university scale change of requirement occur when our system do not fit in our required subdomain for which we are developing our project or team members feels we cannot fulfill this requirement in our required time. On market scale change of requirements depends on vendor and how technology is changing w.r.t time.

1.8.1.6 Unforeseen Circumstances

These risks are most undefined as no one knows about future. Unforeseen circumstances include technical difficulties/failures, revolutionary change in technology or any natural disasters. These risks may or may not effect on our project. Most unfortunate possibility is death of all team members in a car crash.

1.8.2 Risks in Steps of Development

Developing a project step by step keeps the project from making a mess. Every step requires different specialists who always try to keep project on track. A project manager as a root , keep all the specialists unite and make them better communicate with each other. Risks can occur anywhere and affect on every step of development.

1.8.2.1 Requirement Gathering

Major risk caused during requirement gathering is continuous change of requirements as we are not sure about our final decision other factors include team capabilities. improper scheduling and time estimation may also occurred in our project and cause project to take more time in development.

1.8.2.2 Architecture and Design

Every risk on previous step impacts on next step of development. During architecture and designing the major risk which can occur is cost risk. It is the basic step of how our project is going to work and how much cost is required to build it in working form.

1.8.1.3 Coding and Implementation

During coding and implementation time scheduling is crucial. Poor team management of coders is also affectable during the time of code integration. Such risks extends the time capacity of development.

2 Literature Review

2.1 Related Work

There are many applications including mobile applications and many desktop applications for the license plate recognition of vehicles this includes Automatic License Plate recognition, Automatic License plate readers, Automatic Vehicle identification, car plate recognition, Mobile License plate reader. But they are all not Video based. ANPR (Automatic Number Plate Reader) was first developed in 1976 for police branch in UK but still it was not perfect at all with many complications. Many of the applications uses different techniques and works on colour images techniques include Neural Networks, Pattern Matching, Segmentation and many.

Some of the Project mentioned below was recently developed.

License plate recognition (LPR) system is a desktop application that use segmentation of character algorithm for the extraction of license plate. This application is only limited to Saudi Arabia. This system works very perfect.

Automatic license plate recognition (LPR) but however it works under restricted conditions like fixed illumination, limited vehicle speed, the routes must be designated and still background. The Experiments were conducted, and success rate was satisfied.

A real time vehicle's license plate recognition system was simply based on Pattern Matching. Basically, this was a simple project that only collect data for surveying or some application purposes and was done on C++ language.

Learning-Based approach for license plate recognition was basically uses neutral networks as filters for analysing the colour and texture of license plate. It was also the Video based projects mainly used in parking lots etc. 1000 videos were tested, and success rate was satisfied

Car license plate recognition with neural networks and fuzzy logics is another application that use neural networks for minimizing the errors in recognition. The experiments were done on Highways of Netherland.

2.2 Area of Studies

We must have to cover the subjects that is related to our projects and that will also help out in the making of this project. Mainly **Digital Image Processing** for the detection, recognition, identification of the license plates. **Database** for matching the number plates for further processing. **Software Engineering** will guide us the flow of data and let us choose the best methodology for this project. **Software Project Management** for best managing the time and

schedule this project and finally **Software Architecture and Design** for documenting this project.

2.3 Reason of Development

Video based License plate recognition is most widely used around the world but with certain limitations so basic reason behind this project is that it provides you the easiest way to recognize the number plate with very less limitation as the project scopes is within the highways or motorways domains mainly including toll tax plazas. One of the main reason for the development is we are making it cost effective that may be used by ruler areas or countries.

The related studies section shows that most of the working of applications are limited and using the most complex techniques like neutral networks. And in this project, we are using simple techniques like pre-processing of image applying filters and segmentations and in the end template matching. A light weight project that can be easily be installed and portable.

Other reasons include that in my country Pakistan we are always at high risk stakes so security concerns. So, we are eradicating the main security issue by developing this project, it can be used on military outpost or by city traffic police or mainly on toll tax plazas on motorways and highways. We are adding more and more modules in this project to make it scalable like in addition it will also find out if the car is registered or not, if the car is stolen or not, as application would be integrated by City Traffic Police Database that will hold the record of the car in the country.

Furthermore, this project is design for my country Pakistan as in Europe or in UK these types of projects are already implemented and developed but in Pakistan it may have been developed but not implemented. So, it will be implemented on small scale even on university level and then on large scales like on Motorways or Highways

3 Methodology

3.1 Methodologies for Software Development

In the development of the software there are many things that must be kept under consideration to make the software, so basically there are several steps in the software development including requirement elicitation, system design, program design, implementation, integration testing, acceptance testing, maintenance.

The choosing of the Methodology for your project must be perfect to handle many problems that could be face during the making. Many of the methodologies involves different factor some are according to risk management some focuses on implementations some involves testing phase iteratively and finally the maintenance part.

So if you chooses the waterfall model or V model you are definitely sacrificing your project risk problem, you can't handle risk or if any changes made to the requirements if you choose these types of model.

There are many methodologies nowadays some of them includes waterfall model V-model, spiral model, Agile, Scrum.

3.2 Existing Methodologies

Following the List of Top Methodologies using nowadays.

- Agile
- Rapid Application Development
- Spiral
- Extreme Programming
- Waterfall
- Scrum

3.2.1 Agile

There are many form of Agile Development Method including scrum, future Driven Development, Extreme Programming, Crystal. There is continues change in the business environment, Businesses are operated globally so there is rapid change, and these changes can be new opportunities in the market, economically condition etc.

Actual meaning of this Agile is that it has capability of embrace the change. It can be demonstrated by umbrella.

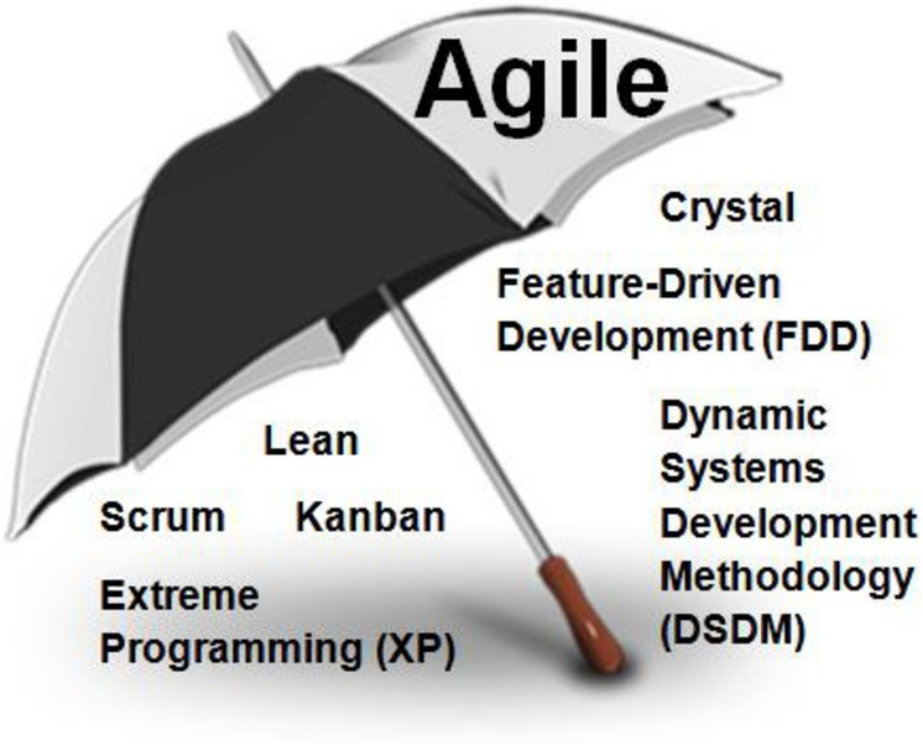

Figure # 1 Agile [1]

3.2.2 Rapid Application Development

RAD is a condensed Development Process that basically made high cost system with low investment. Helps the Developer to shift the requirements according to the future change. If there any change made on the already build software then RAD helps you out in any manner to made changes.

RAD have four phases

1. Requirements Planning
2. User Design
3. Development
4. Cutover

In the User design and development phase there is iteration over these phases until the user is satisfied that the project is build according to the requirements. RAD is very effective in some cases that where projects objectives are well define but not computationally complex. The RAD is famously use for those software that are short in size and time sensitive.

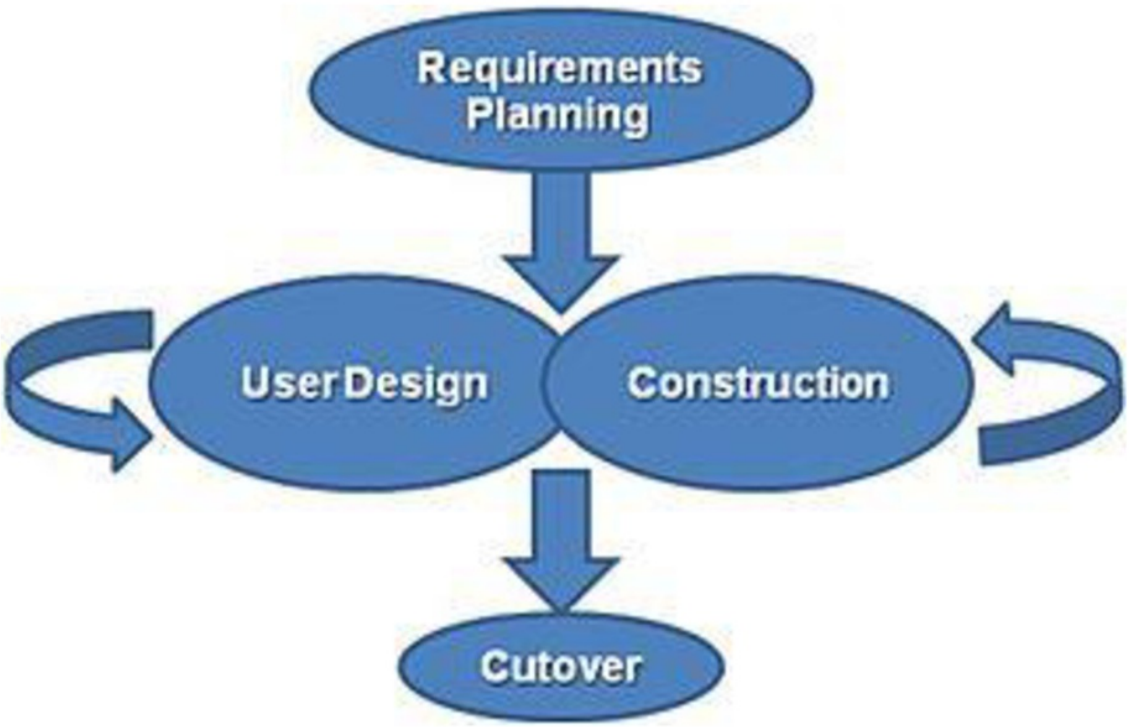

Figure # 2 RAD [2]

3.2.3 Spiral

Spiral Model is one of the oldest Methodology and that is the combination of Water fall Model and Iterative Model. Every phase of the Spiral Model starts with design goal and ends with the prospection of client that viewing the progress. Basically there are some limitations with the spiral model that is its not well defined in the software development as that of scrum.

So reasons is that the spiral model is not cost effective relatively expensive and not suitable for the small scale projects.

Spiral can have 4 phases following show the details.

2

1. Planning
2. Risk Analysis
3. Engineering
4. Evaluation

Planning includes the estimation of cost, scheduling and the resources required for iterations. Important part includes the understanding the system requirements that can only be achieved if there is strong communication of client and system analyst.

Risk analysis is one of the important phase in the development as it identifies the potential risk and then tries to reduce it.

Engineering includes the basic thing that project need like testing, coding and deploying it on the client side.

Evaluation is done when your software is ready to deploy, and it is done by client, the client simply evaluate the software by monitoring the potential risk.

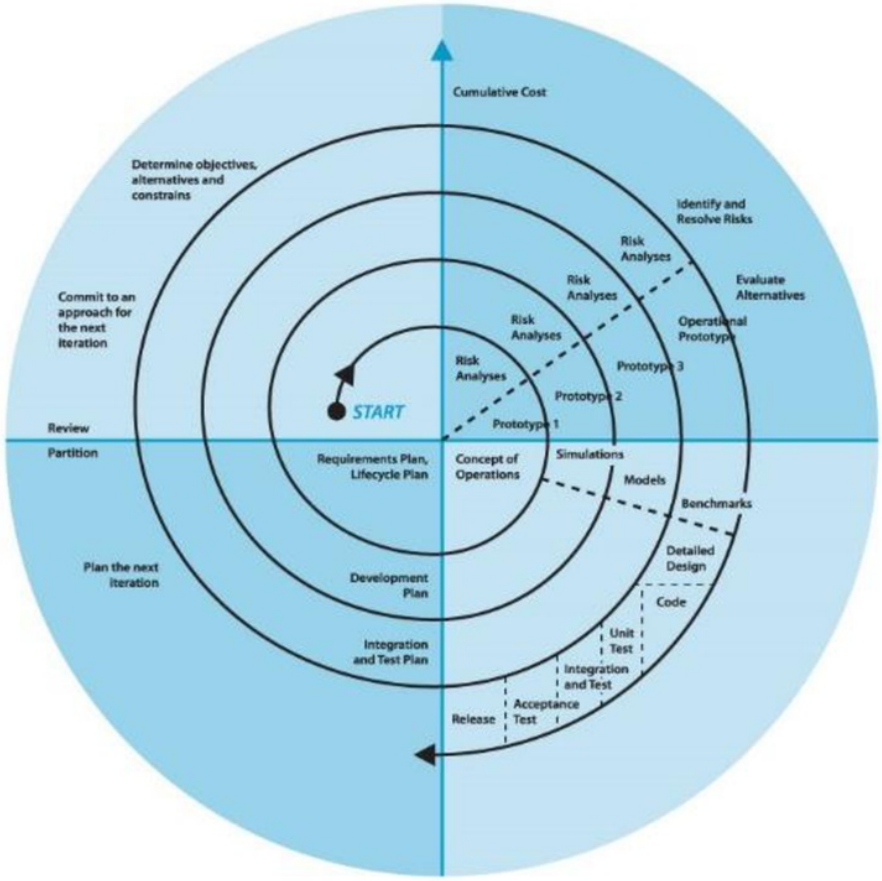

Figure # 3 Spiral Model [3]

3.2.4 Extreme Programming

Extreme Programming is actually the sub branch of the Agile Development. it is actually a kind of design we use to improve the substantial in the software like is quality of service. The most effective use of Xp is that it easily adopts the changing needs of the client.

Xp is used for basically high quality software with very simple and fast development. if you want to reduce the cost of your project then extreme programming would be best to choose. Another function of Xp is that it avoids you not to develop the modules that are not currently needed.

Figure # 4 Extreme Programming [4]

3.2.5 Waterfall Model

This methodology is one the oldest and tradition model for the development of the software and its comes with the several phases that are sequential that flows steadily downwards like a waterfall flowing through the phases, but it is easy to manage and understandable.

There are certain phases waterfall entails

- Requirement analysis
- System design
- Implementation
- Testing
- Deployment
- Maintenance

- Requirement gathering, and analysis includes all the requirement need to implement the software, that is it simply gathered requirements.
- In System design the gathered requirements are now analyse and design is made according to the requirements and mainly helps to define the system architecture.
- Next phase is implementation all the coding is done in this phase.
- Testing is one of the main phase all the type of testing is done is this phase like white box testing, black box testing.
- Deployment includes installing of the software and application on Desktop or pc.
- Maintenance is most important phase that need to be done throughout the lifetime of this software.

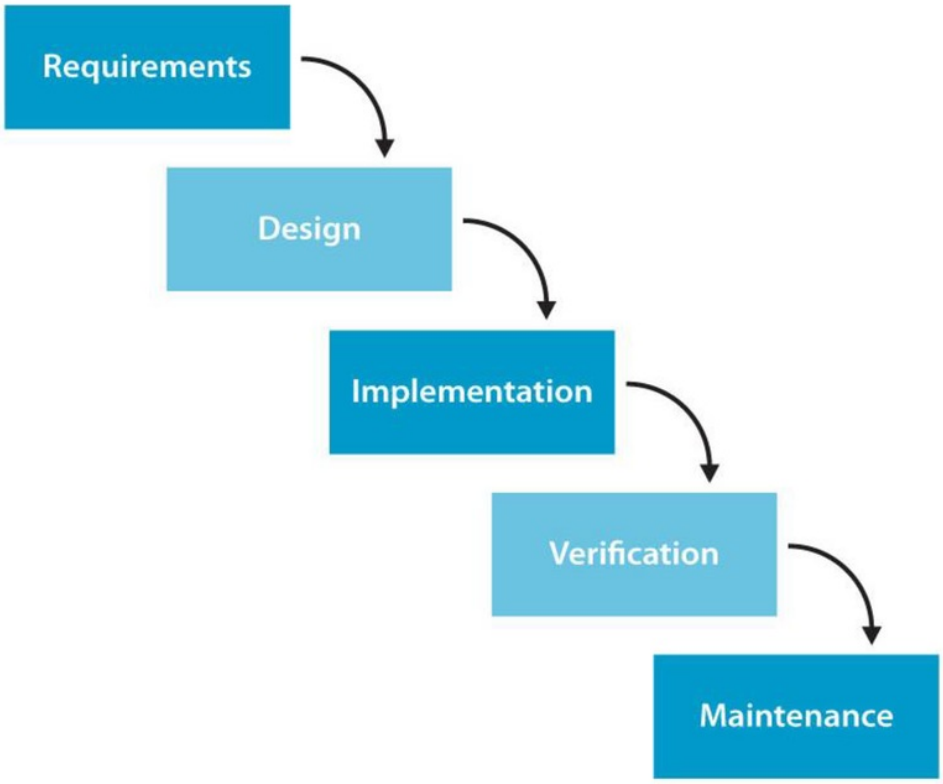

Figure # 5 Waterfall Model [5]

3.3 Selected Methodology

Selecting a methodology is very sensitive to choose as your whole project based on it. The methodology must be selected according to your project like if you are making a software

which in future doesn't need any change you can choose Waterfall model, but in our project case we are using Agile Iterative Model. This model handles many things, one of the thing is Risk, with every iteration we check the risks, development, testing.

Other reason of choosing this methodology is that this project is flexible and can be used in many domains so in that case we can update any module or add any module according to the domain. If the project is being used on the university level less number of module is required but if used on toll plazas or in market parking lot than it have different modules so that's why we chose Agile Iterative model.

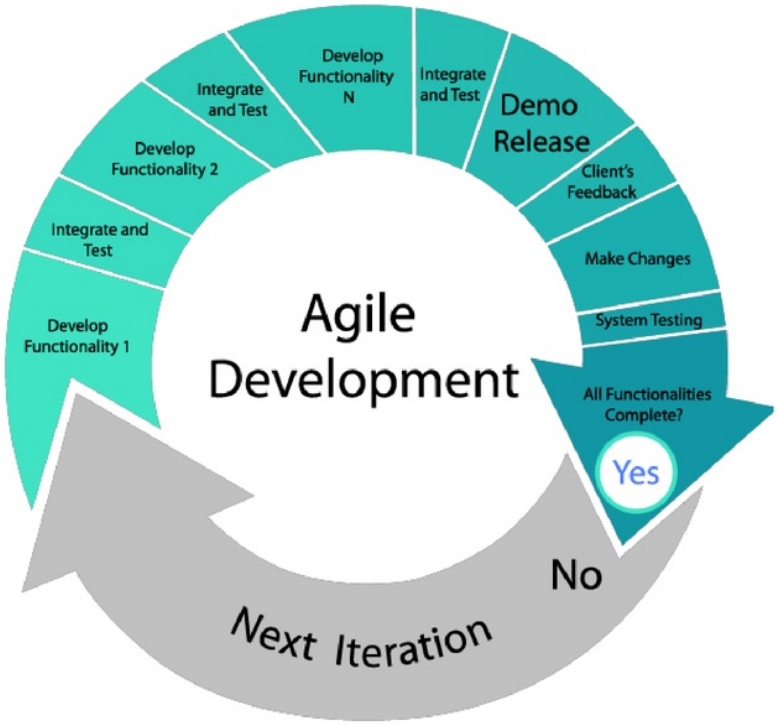

Figure # 6 Agile Iterative Model[6]

So with every iteration there are phases that we can change, with the changes made we can develop the modules accordingly and we can also add different modules. So agile is basically give us opportunity to embrace the change. So by this improvement are made at each iteration give us best quality of product to the organization.

Error recovery in each iteration is the best feature of this model. Error on testing can be handle on next iteration.

4 System Requirement

4.1 System Requirements

First thing in developing a system is gathering requirements. On the bases of those requirements we develop that system. Understanding requirements is curial part of requirement gathering phase because requirement is gathered through description of the user desired system and one must understand the exact meaning. System requirement is all about the project that would be run on the machine keeping in view the specification of the machine. These requirements tell about performance of the project. Smooth flow of the project.

4.2 Hardware Requirements

Hardware requirements indicate the minimum requirement on which system runs smoothly without any crashing or failure, otherwise recommended required are optional for better requirement. Requirement for our system are as follows.

- High resolution and high-speed camera.
- Processor speed 2.6 GHz
- 1 GB Memory
- Graphics card Asus Strix GTX 1080Ti
- ROM desirable.
- I/O ports
- Monitors.

4.3 Software Requirements

Software requirements indicates the platform on which the system is develop and on which the system runs. For the system development MATLAB is required and for the handling the data.

4.4 Functional Requirements

Functional requirement concerns with how the system works and how the outsider can interact with the our systems, like if a user or an employee have to use the system his/her have to go through some steps.

The these steps includes.

4.4.1 User Sign up by Admin

Due to security reasons not any person can sign up the LPR system. If any user wants to be a part of LPR system his/her must have to contact the admin for an account. User just have to give his Full name, ID ,Username, Password.

4.4.2 User Sign in

Now user have its Username and Password which is provided by the Admin, now user just have to open the system and provide its credentials to log in the system.

4.4.3 Authentication of User

Authentication of user is very important as this project is attached with the Traffic police database for matching vehicle number plate. So all users must be verified from its national identity card and enter its unique username and password to login.

4.4.4 Show All Employee/User

Any User/Employee can see all the employees using the system and admin can also have access to see all the users.

4.4.5 Add an Employee/User by Admin

Only Admin have the rights to Add any user to the system with proper authentication. User just have to give his/her credentials like ID, Full Name, Username, Password and Admin can simply add the user.

4.4.6 User's Profile

There are security concerns with the system so user can't see its profile or manage if he/she wants to update profile must have to concern the admin as all access and rights are own by admin.

4.4.7 Recognize License Plate Number

Both Users and Admin can recognize number plate by two methods first is manually that is user can manually browse the picture taken my camera or by the camera on runtime.

4.4.8 Video Based Recognition

Admin and user can also have access to recognize number plate by video in case of any vehicle might not stop at spot.

4.4.9 Deleting User

Admin have the rights to delete any users from the system. User can't access the database so user need to request the admin if he/she willing to leave the system. User just have to give his/her id to delete from the system.

4.5 Non-Functional Requirements

Non-Functional Requirements depicts vague behavior of system. It contrasted with functional requirements but are not functional requirements. It contains additional features which do not affect the basic behavior of our project.

4.5.1 Performance

The basic ability of a system to respond in no time in any situation falls in the category of excellent performance. keeping up this ability has major role in developing a good system. Performance also named as response time or as directly proportional to response time.

4.5.2 Security

Making a system secure is an essential factor in case you don't want to get any harm to system. The ability of system to run in safer environment without any outside threat is related to security.

4.5.3 Availability

The availability is the numeral factor which can be calculated. It requires the ability of system to be fully committed to its recommended performance for a period of time for example a system can be available for 18 hours in a single day has availability factor of 0.75 otherwise its performance will be affected.

4.5.4 Maintainability

All systems require some maintenance in order to run smoothly and also not all systems has 100% fault tolerance. They break down sometimes and maintainability ensures that it will be handled in no time.

4.5.5 Reusability

Our system is highly reusable because of single module which can used anywhere where security is needed. The higher the reusability the greater the chances that our product can be demanded in other domains.

4.5.6 Extensibility

The secondary aim of this project is to make a spin off which can be handled separately by giving our project enough flexibility and also to create a better version of it. Extensibility means further modules or functional requirements can be added to the system without affecting the existing system.

4.5.7 Operability

To make the system more operable , automated as well as manual functional handling is added. In case of any crash of main module a user can manually add details of the subject. This helps in better handling of system and also it increases the factor of availability.

4.6 Overall System Requirements

According to the Functional requirements and Non-functional requirements basically tells the features of the project and flow of the data, rights of the users and admin.

There are some feasibility studies that concern with the development of this project and gives you through information about how to deal with the system and what the abilities.

4.6.1 Technical Feasibility Study

To check the technical feasibility of this project, have to do study and review some questions like if this project can help you to reduce the crime related to vehicles or if car stolen or not, or if this project is capable of deploying in many fields like toll plazas, parking lots, or even in training institutions.

So yes of course our project is technical feasible in many fields as the system we are making can easily be deploy or install in standalone computers or even portable can easily be convert to other applications like android or web.

The project if installed on Desktop doesn't require any fast internet just accessing online Databases.

4.6.2 Economic Feasibility

This feasibility concerns with the cost that is the project is economically affordable or not. Well this project needs some investment it may be costly for small organization as it needs high resolution camera or in dark night vision camera may use.

4.6.2.1 Development Cost

Cost to develop this system is little bit high due to expensive high resolution camera and fast standalone desktop with high processing speed. All its takes

- Hp Laptop with core i7 7th gen
- MATLAB R2017 for the development.

4.6.3 Operational Feasibility

This project is solves many real life problems in fast way, as it responses very fast in recognizing the number plate and matching it with database thus giving an alert. It perform many functions includes

- Matching number plate with stolen car number plate
- Matching number plate with unauthorised number plate

4.7 Use Case Diagram

Use case diagram are very important for any project or system as it describe and visually tells how the external user or internal user can interact with the system and who have the access or rights to which module of the system.

4.7.1 System Use Case Diagram

System includes User/Employee and Admin as an actor who can interact.

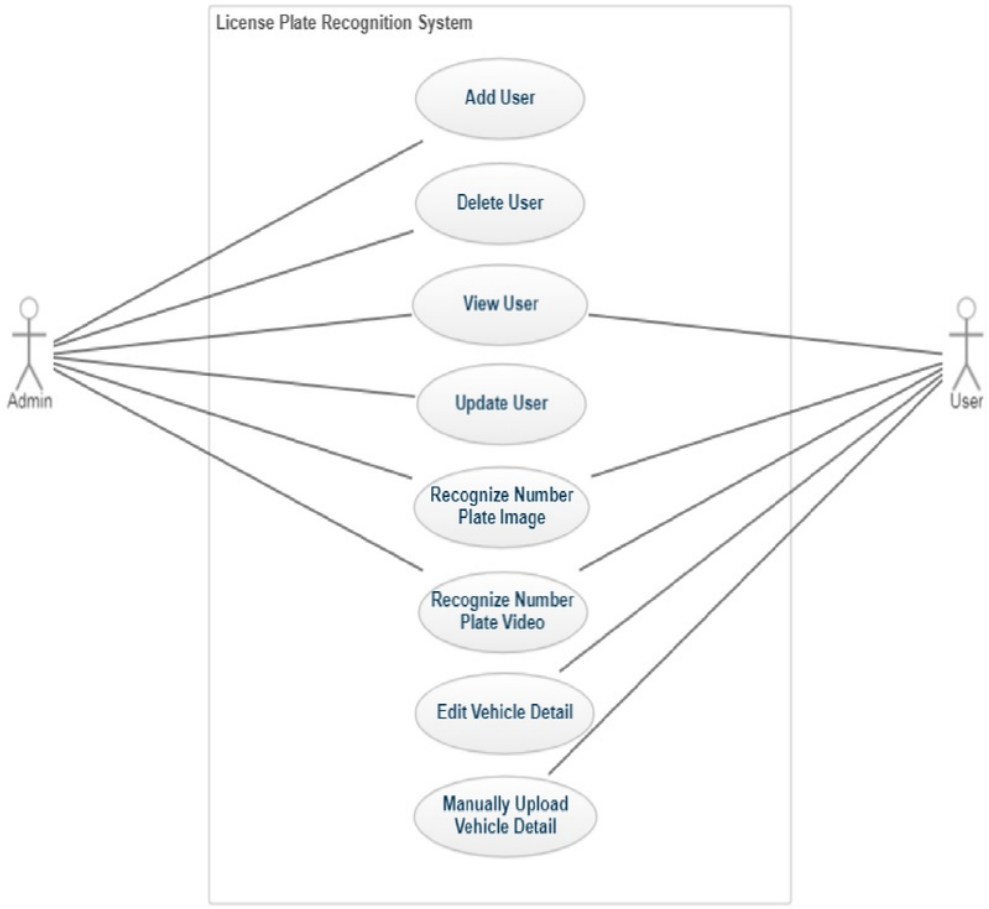

Figure #7

We need to describe our system other use cases like authentications and admin cases separately for clear vision.

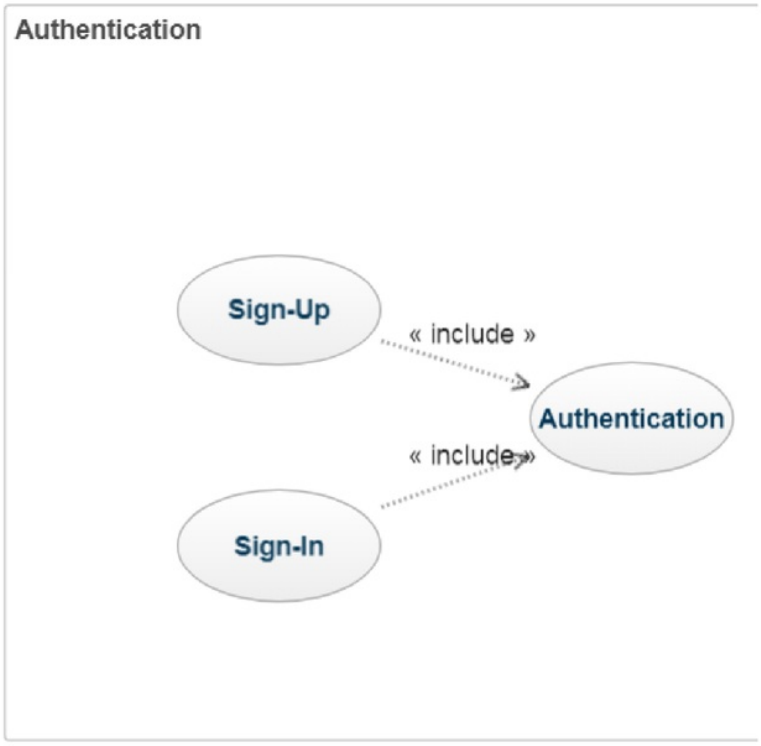
Authentication
Sign-Up
« include »
Authentication
« include »
Sign-In

Figure # 8

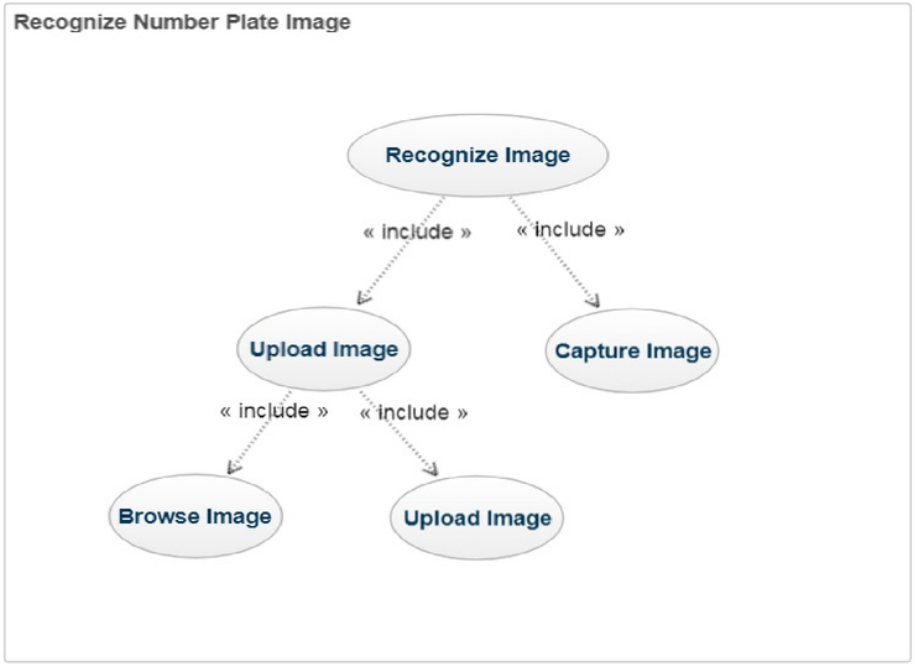

Figure # 9

4.7.2 Admin Use Case Diagram

Functionality that Admin can perform includes

- Admin can add an user
- Admin can delete any user
- Admin can update any user
- Admin can view all the user
- Admin can set username and password for the users
- Admin can recognize the plate and video.

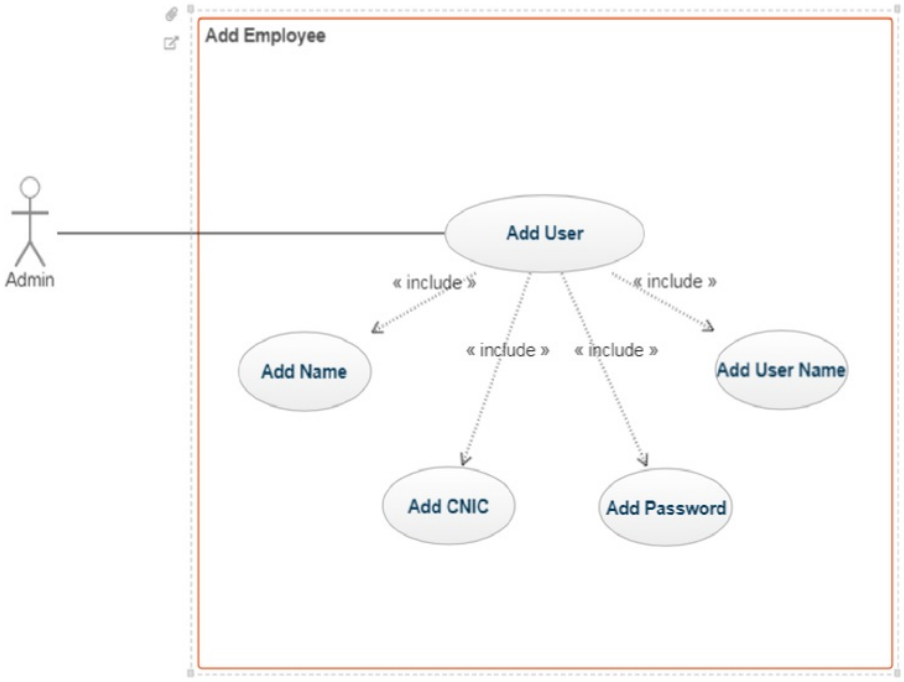
Add Employee
Admin
Add User
« include »
« include »
« include »
« include »
Add Name
Add User Name
Add CNIC
Add Password

Figure # 10

5 Architecture Design

5.1 Architecture

Basically, in all the projects architecture of the software defines the workflow and frameworks of the project model. The Architecture also helps the user or the programmers to study the model and easily use the system.

5.2 System Architecture

System Architecture shows the workflow of our system that is how the employee and admin can interact with the system. Employee can simply use the system by entering login details as well as the admin as this system is a desktop application.

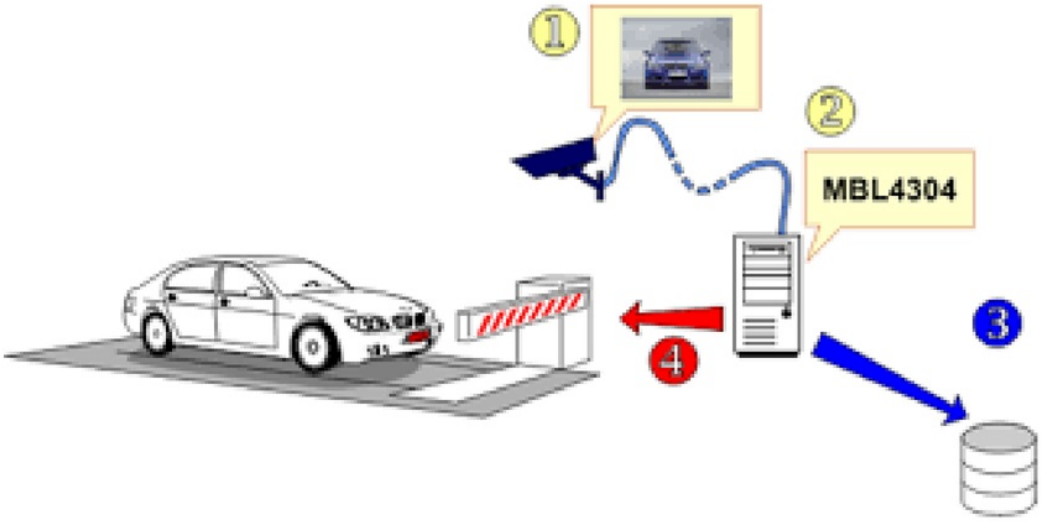

Figure 5-1 System Architecture reference

5.3 Sequence Diagrams

Sequence diagram are one of very important diagrams in the project as the name depicts itself that these diagrams tell the sequence of some events. Diagram includes the messages that passes from one object to other and then other will respond corresponding, every object and actor has a activation time that is it will active for some time and then rest and if need by other object it will active again.

5.3.1 Employee Sign- In Sequence Diagram

This diagram describes the employee sequence that is how employee perform sign in. He/she enters the username and password which then validates further and if match found then the event is successful.

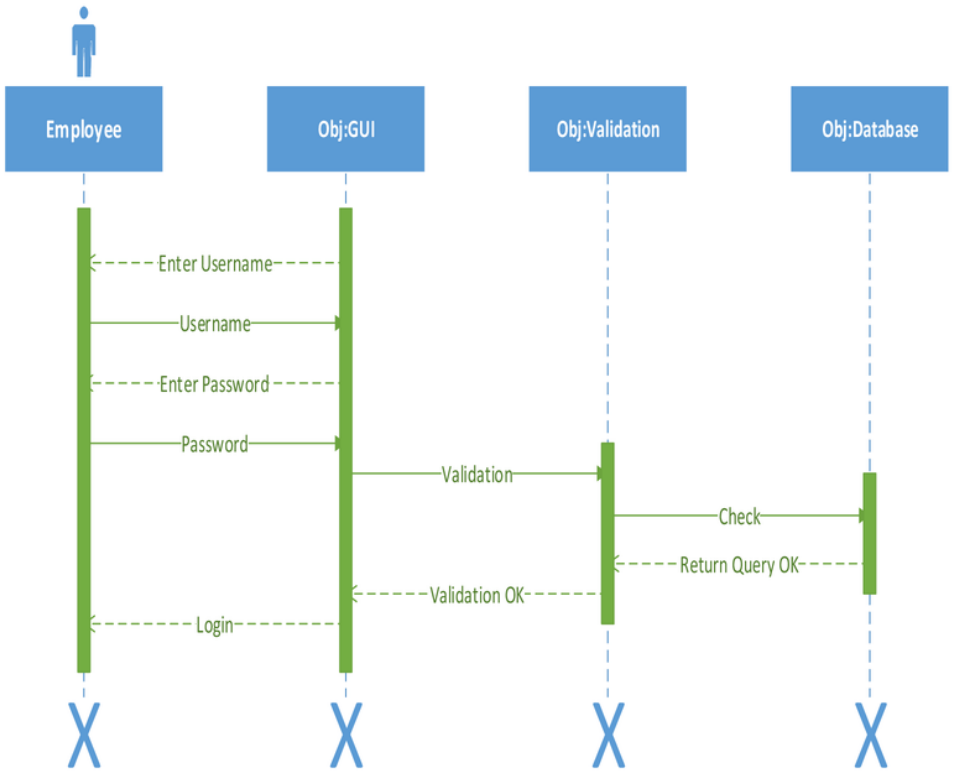

Figure 5-2 Employee Sign-in Sequence Diagram

5.3.2 Employee Sign-up by Admin

This diagram shows the how the Admin creates the account of an employee. Admin will enter the details of employee like CNIC that will validates and then admin enters employee full name, username and password.

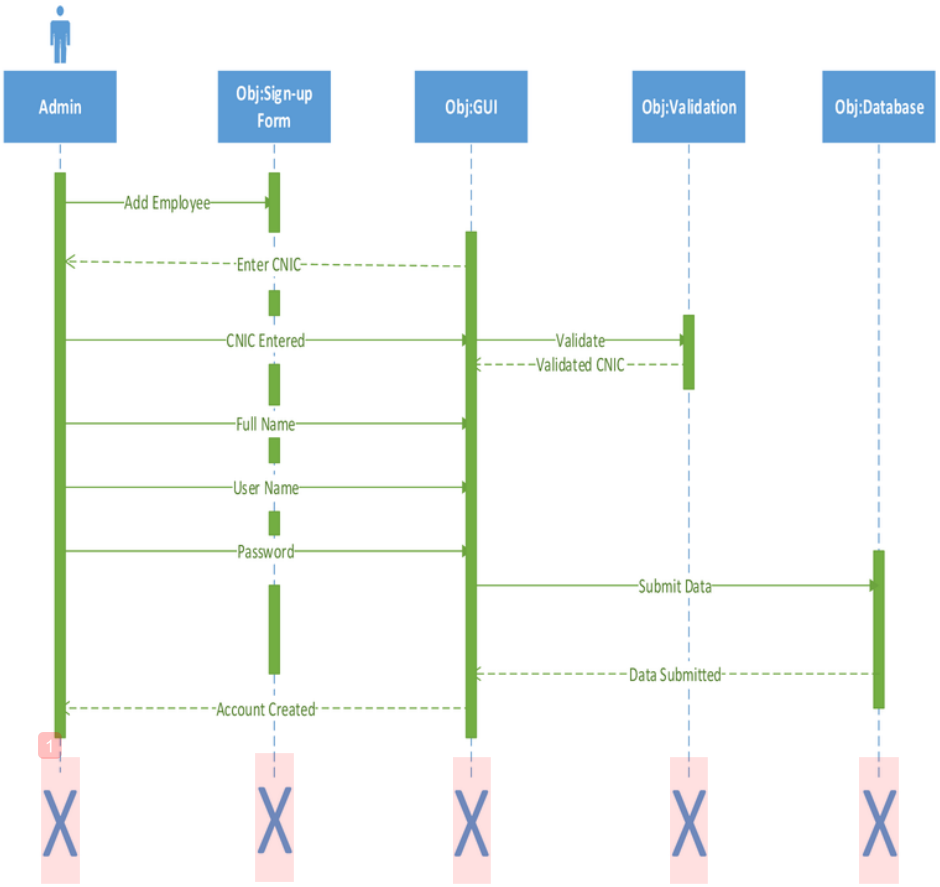

Figure 5-3 Employee Sign-up Sequence Diagram by Admin

5.3.3 Admin Sign-in Sequence Diagram

This diagram describes the admin sequence that is how admin perform sign in. He/she enters the username and password which then validates further and if match found then the event is successful

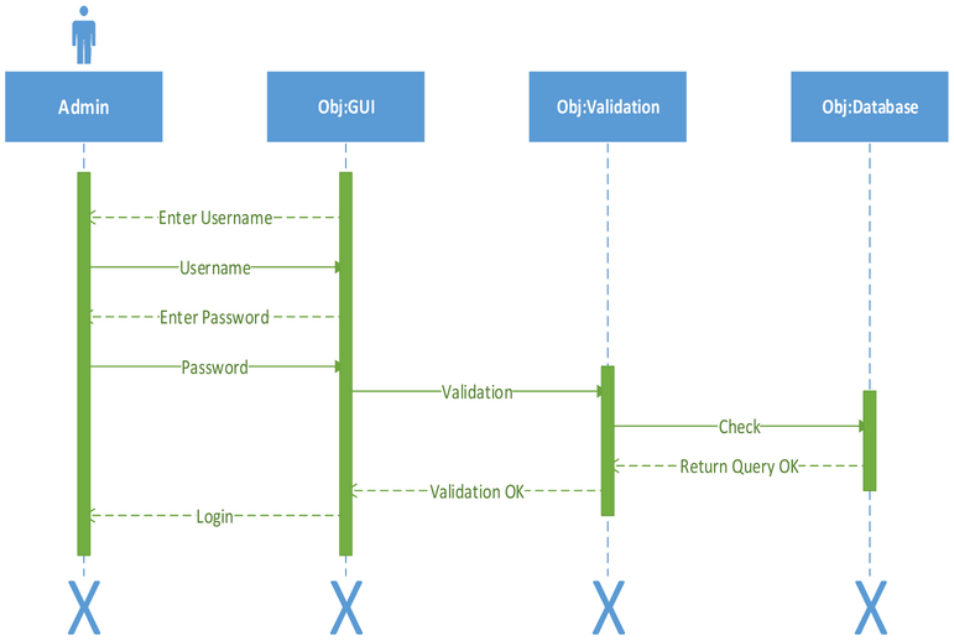

Figure 5-4 Admin Sign-in Sequence Diagram

5.3.4 Delete Employee by Admin Sequence Diagram

This diagram shows the how the Admin deletes the account of an employee. Admin will enter the details of employee only CNIC that will validates then and if match found it will delete form the databases.

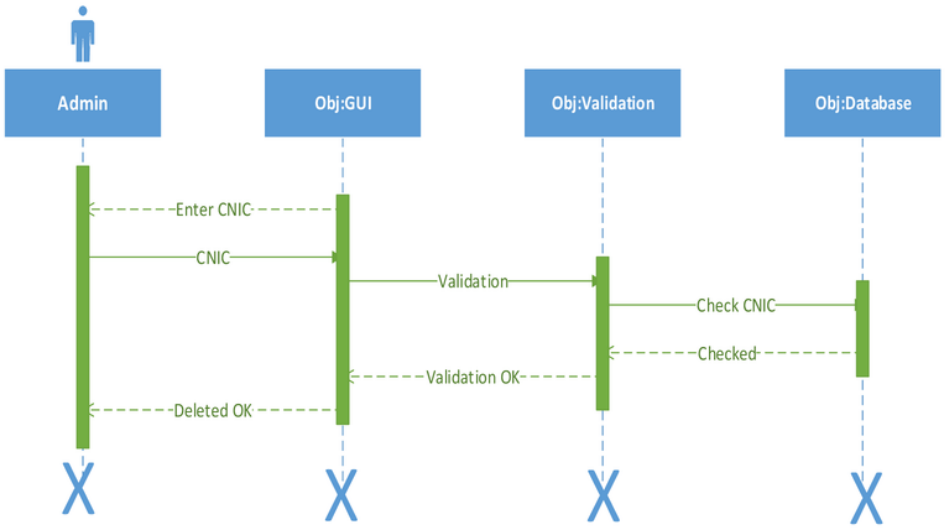

Figure 5-4 Delete Employee by Admin Sequence Diagram

5.3.5 Update Employee by Admin Sequence Diagram

This diagram shows the how the Admin updates the account of an employee. Admin will enter the details of employee that will gathered by them which the need to update. Admin will enter CNIC that will validates then and if match found it will update that employee record from the databases.

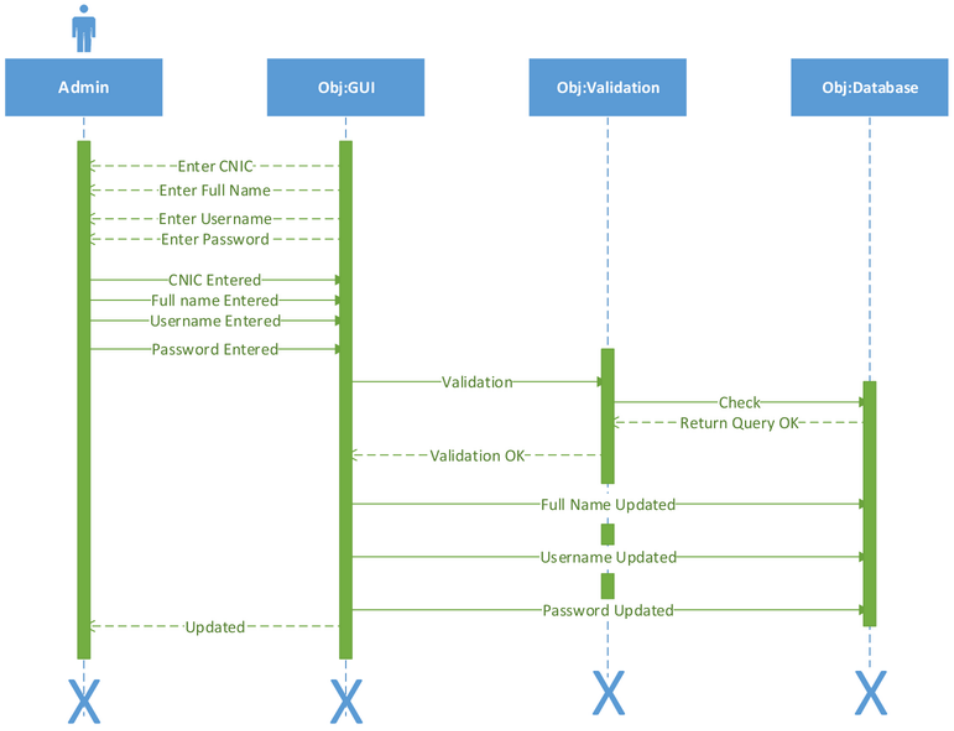

Figure 5-5 Update Employee by Admin Sequence Diagram

5.3.6 View all Employee by Admin Sequence Diagram

This diagram shows the how the Admin view the account of All the employee using the system. Admin just have to click the button that will fetch records of employee and show it on the GUI.

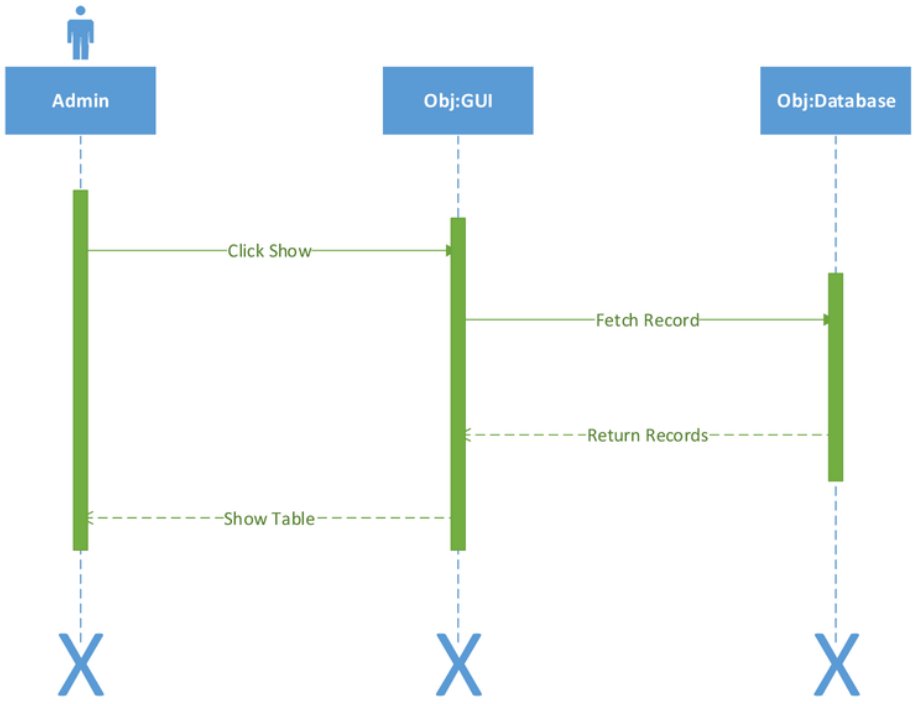

Figure 5-6 View all Employee by Admin Sequence Diagram

5.3.7 Recognize number plate by Admin Sequence Diagram

This sequence diagram is one the main diagram that describes the whole system how the events will generate and how the objects passes their messages to recognize the plate and save the extracted number to databases. Admin can simply ignite the events by clicking some buttons on the GUI and rest is handled by the system.

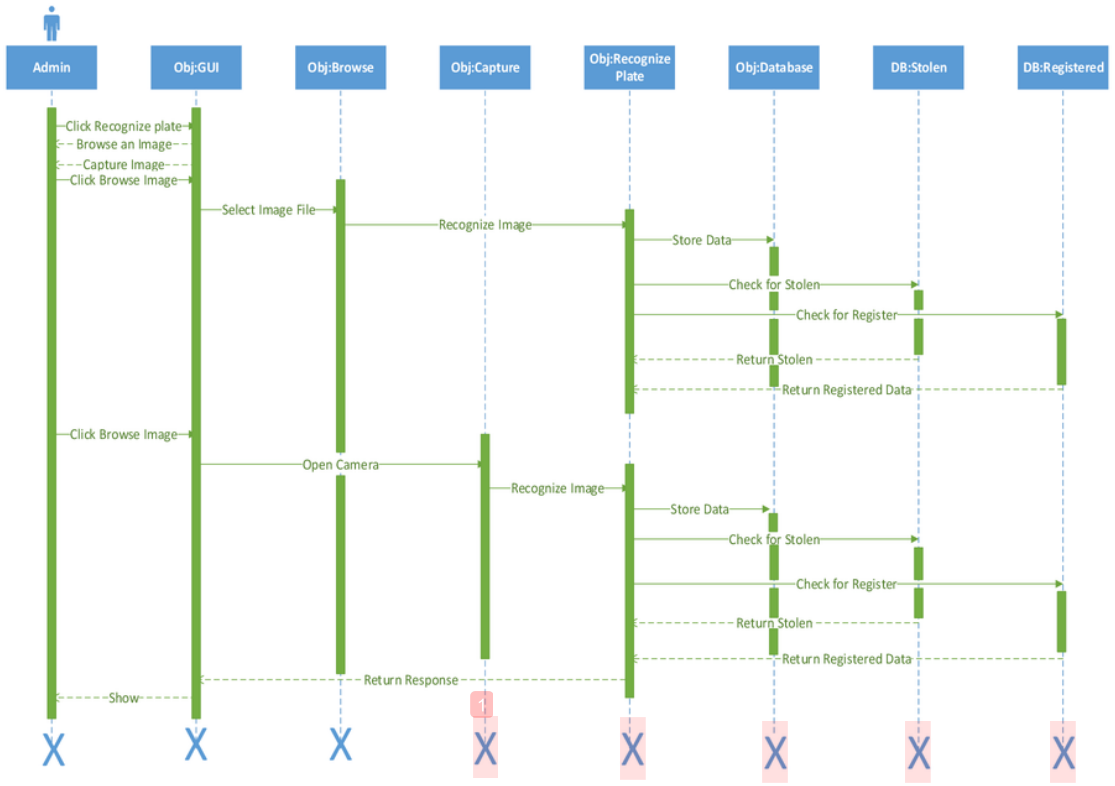

Figure 5-7 Recognize number plate by Admin Sequence Diagram

5.3.8 Recognize number plate by Employee Sequence Diagram

The sequence diagram would be same for the employee as the backend event are the same all the event will triggered in a same manner as admin diagram.

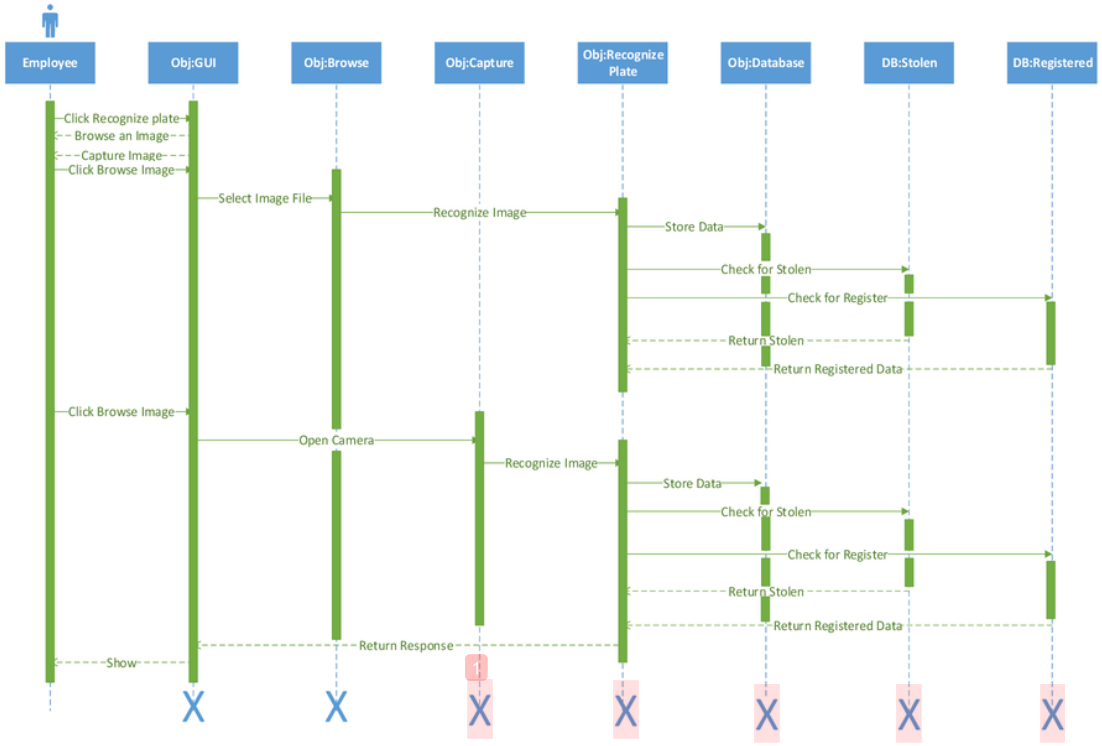

Figure 5-8 Recognize number plate by Employee Sequence Diagram

5.3.9 Add Manually by Employee Sequence Diagram

This sequence diagram describes the event sequence when employee add manually the number plate of a vehicle by browsing it form the folder and give it to the system.

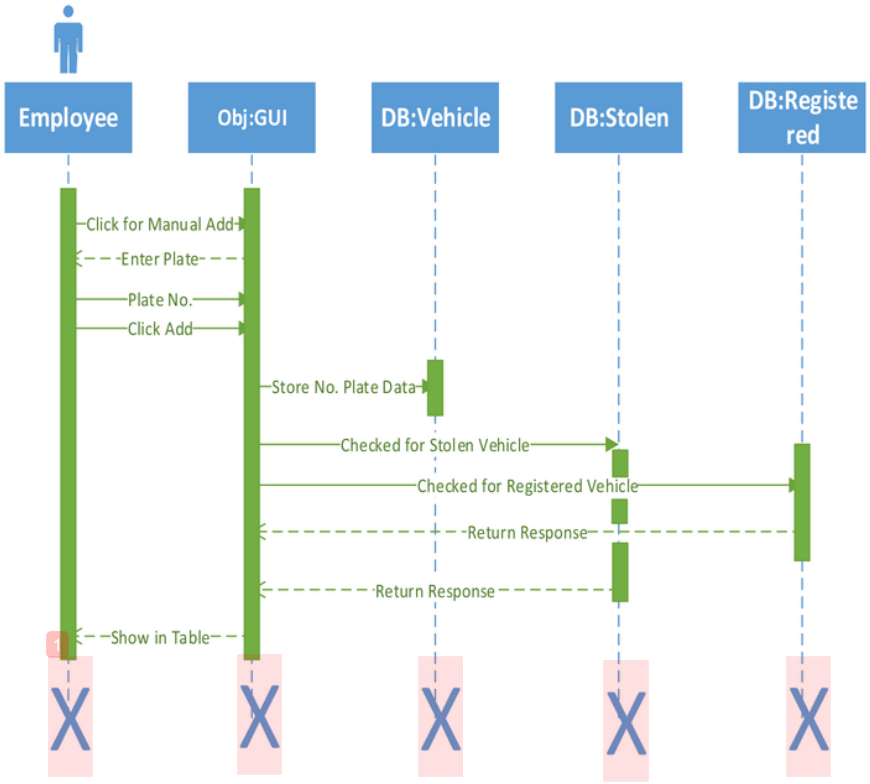

Figure 5-9 Add Manually by Employee Sequence Diagram

5.4 Activity Diagram

Activity Diagram are also the main part of the architecture diagrams they basically tells the activity of the events how they take place and flow charts of the event occurs. In our system we have two actors the Employees and the Admin they have different activities for controlling the system.

Below sections show the activity diagrams of both the actors.

5.4.1 Employee Sign up Activity Diagram

In this activity diagram only admin can create the account of the employee admin just have to take the info details like CNIC and other. After the CNIC validation the account will be created.

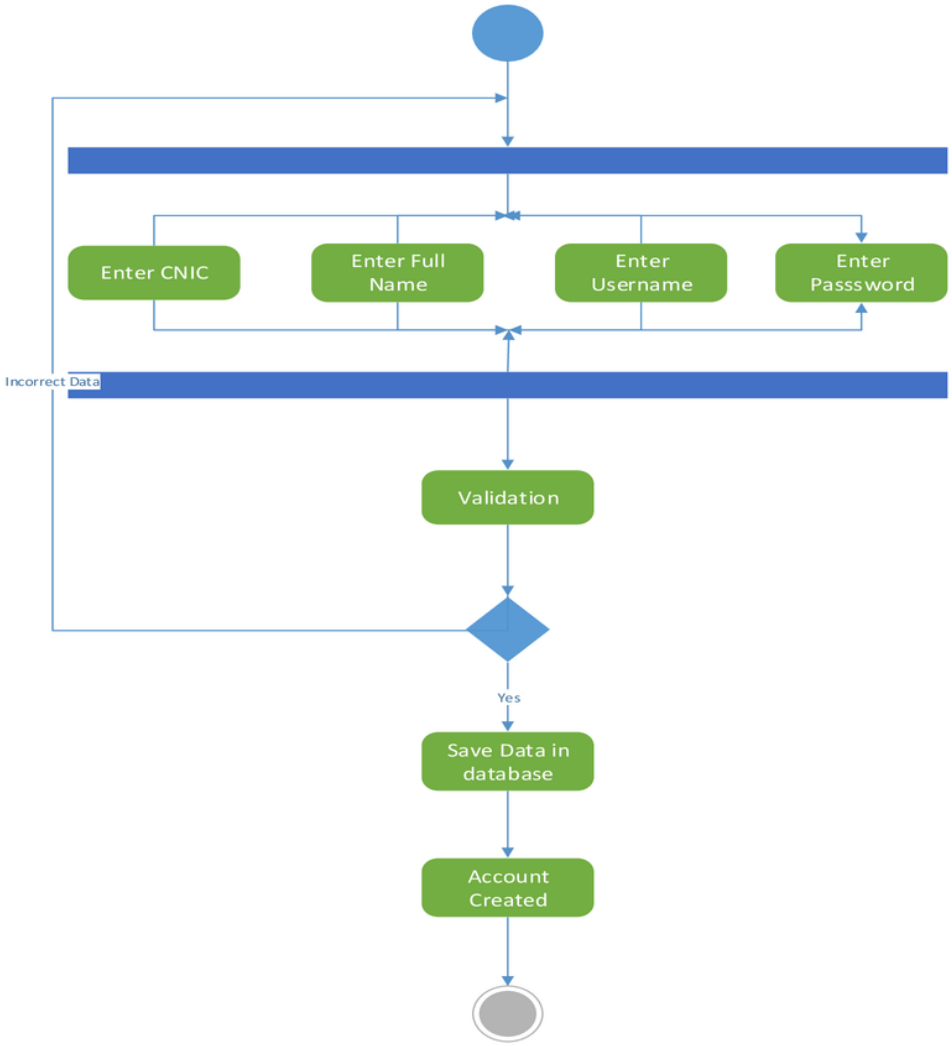

Figure 5-10 Employee Sign up Activity Diagram

5.4.2 Admin Sign in Activity Diagram

This Activity diagram describes the work flow of sign in by admin. Admin just need to give username and password which later will validate and if yes then admin homepage will open.

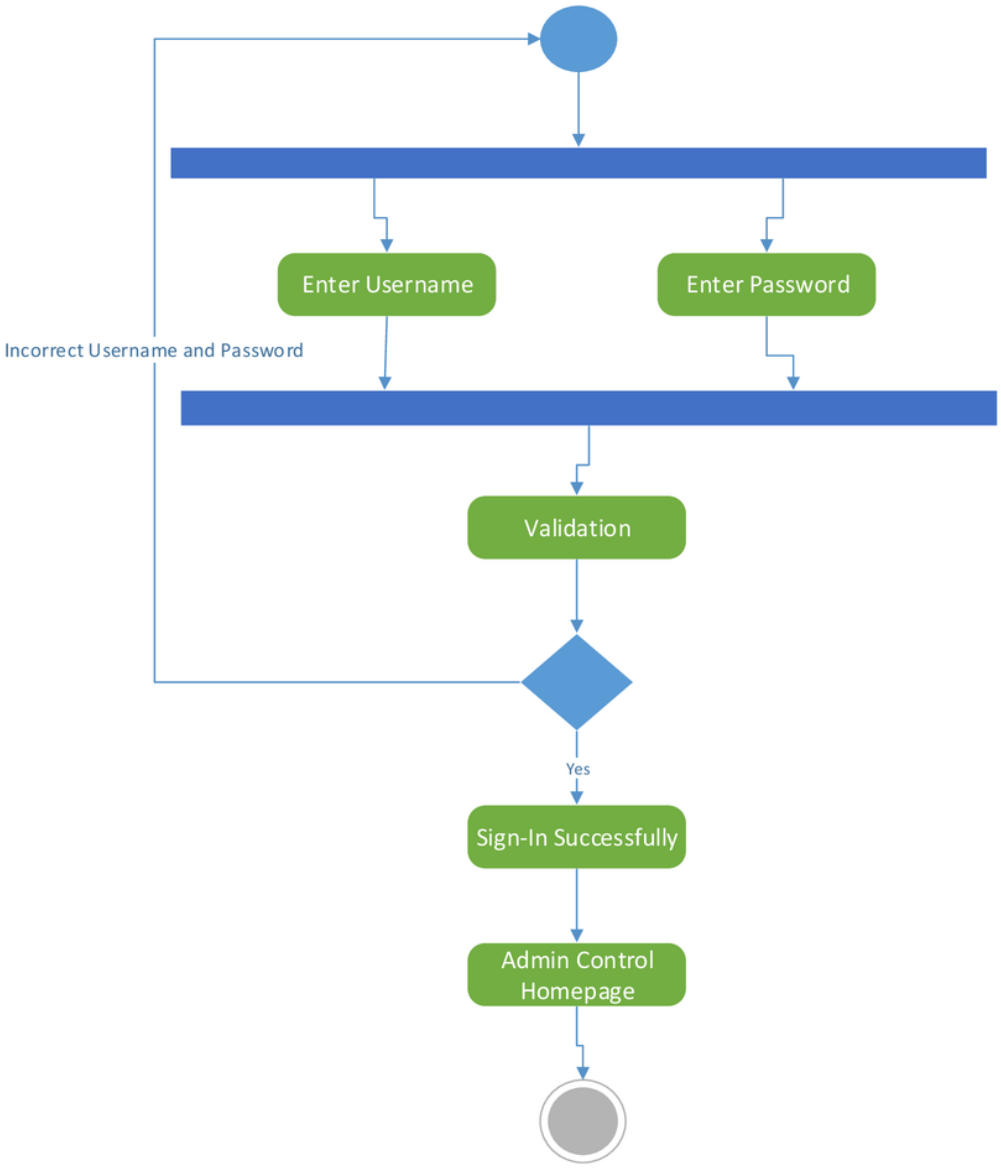

Figure 5-11 Admin Sign in Activity Diagram

5.4.3 Admin Sign in Activity Diagram

This Activity diagram describes the work flow of sign in by Employee. Employee just need to give username and password which later will validate and if yes then Employee homepage will open

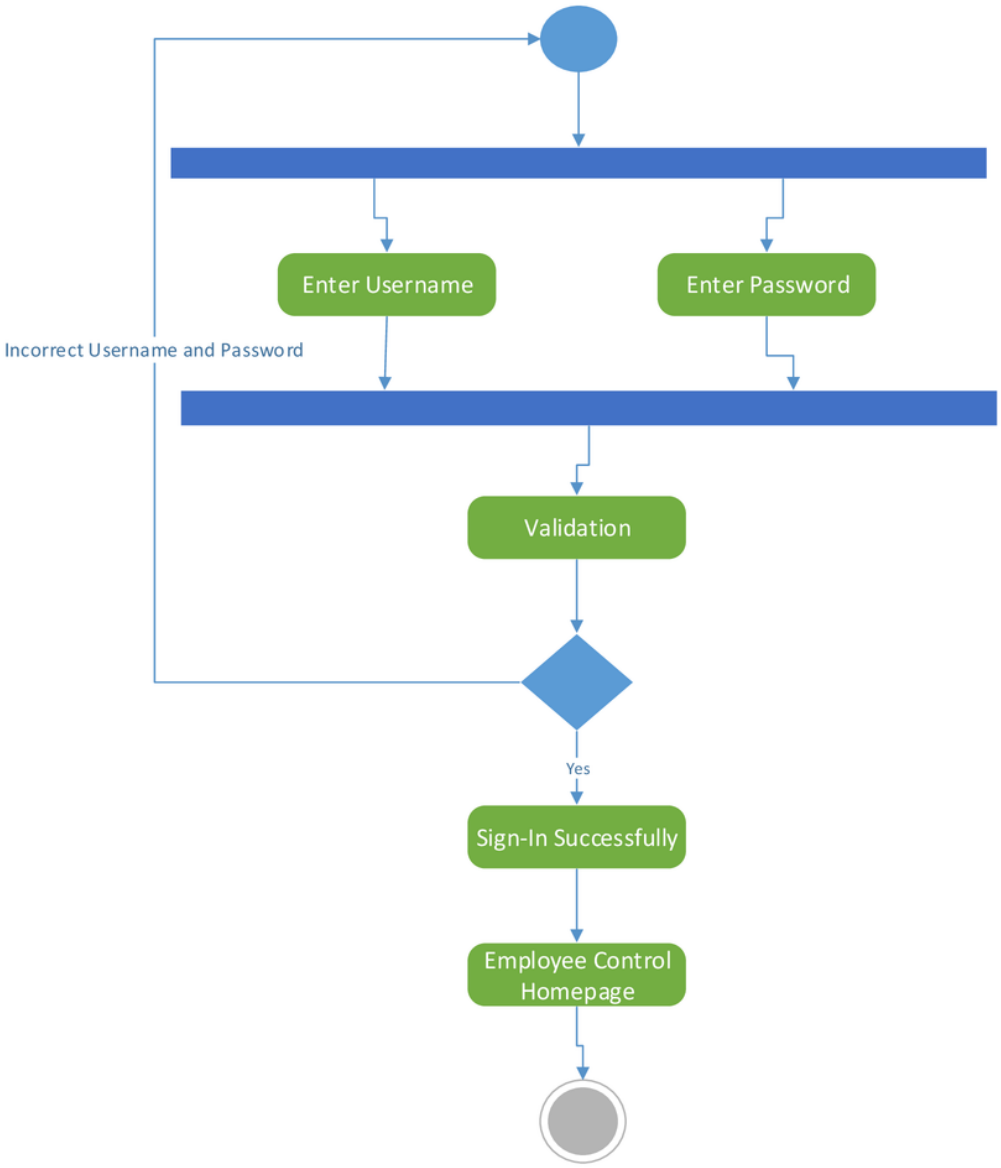

Figure 5-12 Employee Sign in Activity Diagram

5.4.4 Add Employee by Admin Activity Diagram

This activity diagram describes the activity of admin that how he create an account of an employee.

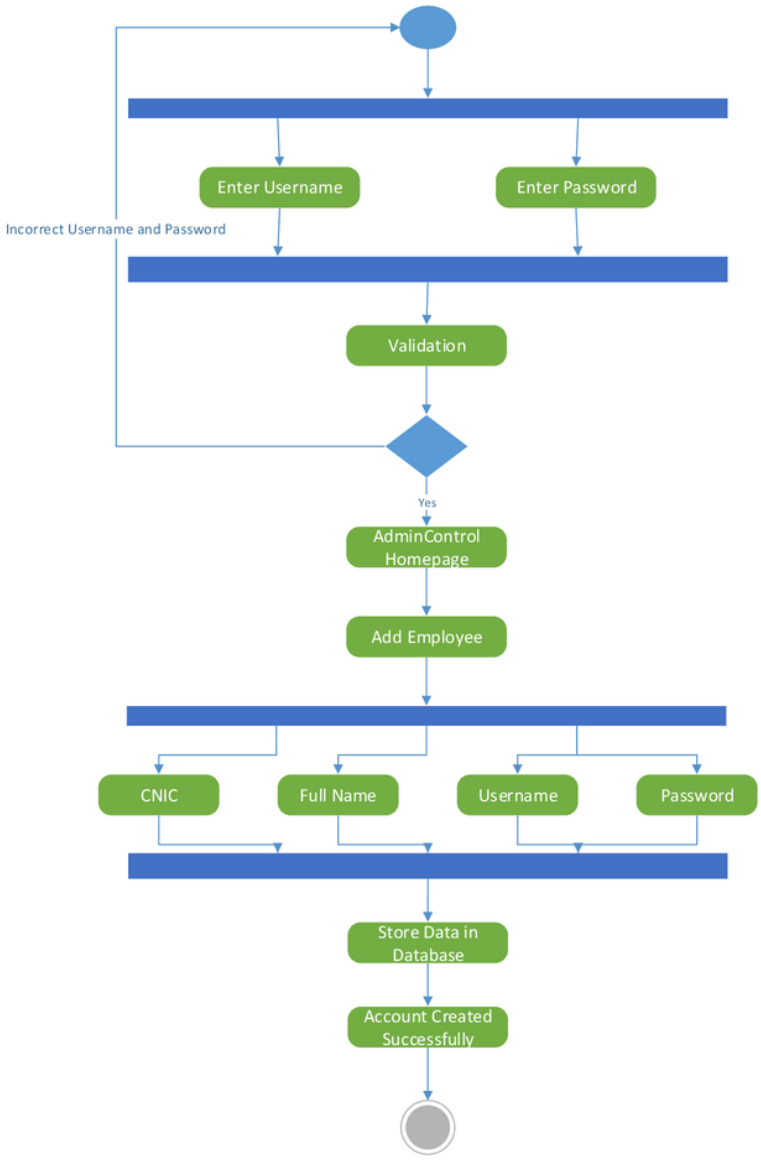

Figure 5-13 Add Employee by Admin Activity Diagram

5.4.5 Delete Employee by Admin Activity Diagram

This activity diagram show that how admin delete the employee from the databases successfully.

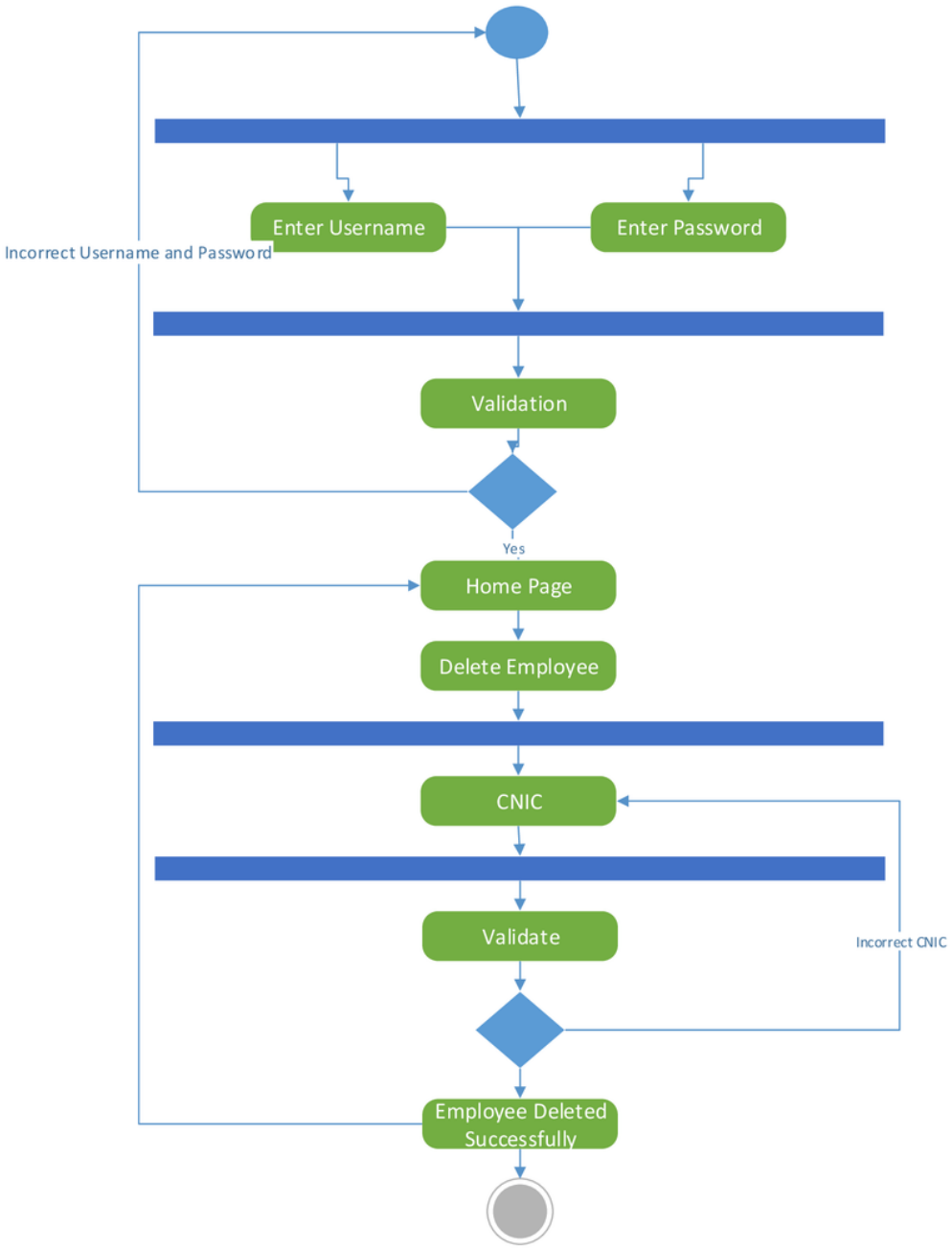

Figure 5-14 Delete Employee by Admin Activity Diagram

5.4.6 Update Employee by Admin Activity Diagram

Admin can simply update employee using validation of CNIC and employee data.

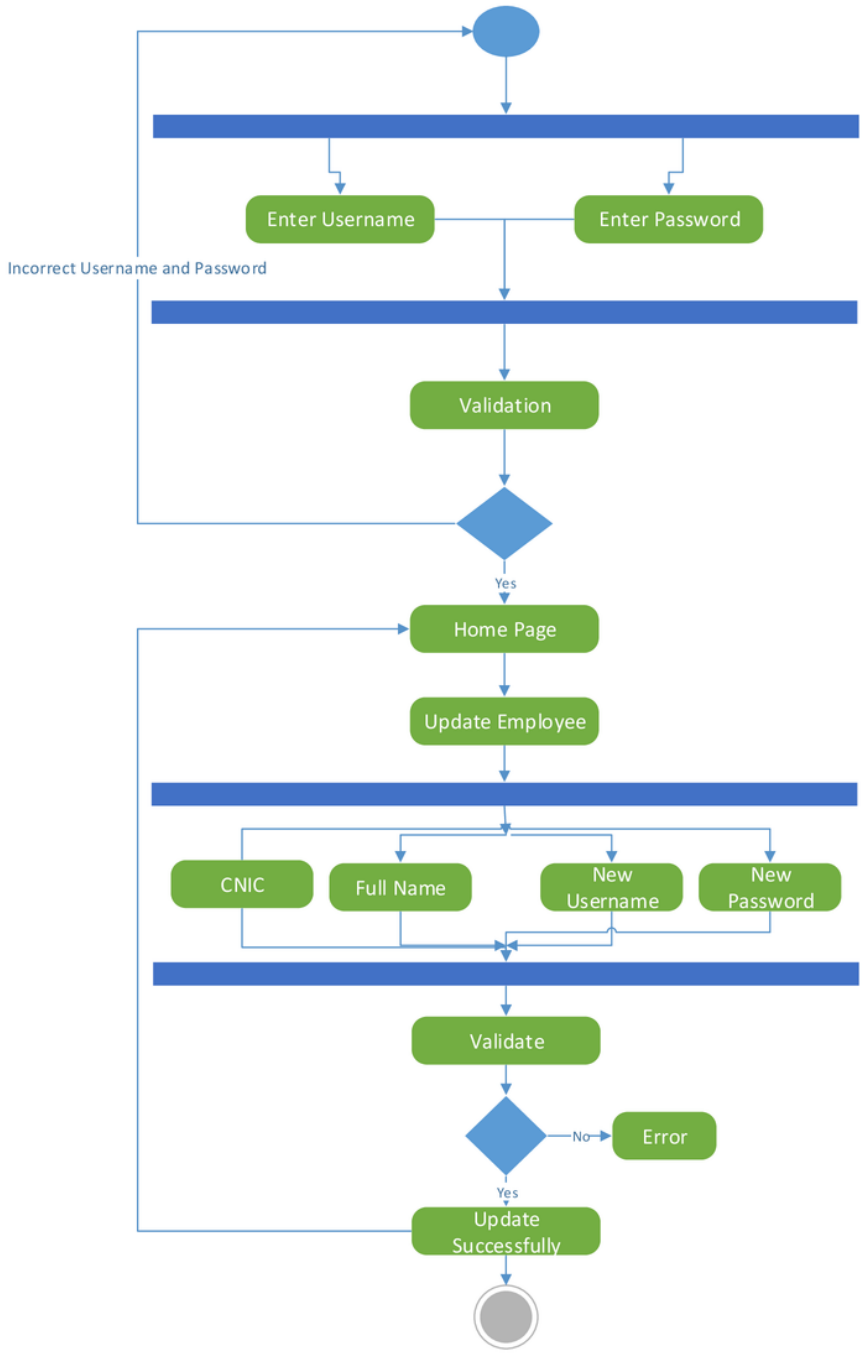

Figure 5-15 Update Employee by Admin Activity Diagram

5.4.7 View All Employee by Admin Activity Diagram

This Diagram show the activity how the admin can fetch all the employee records from the databases.

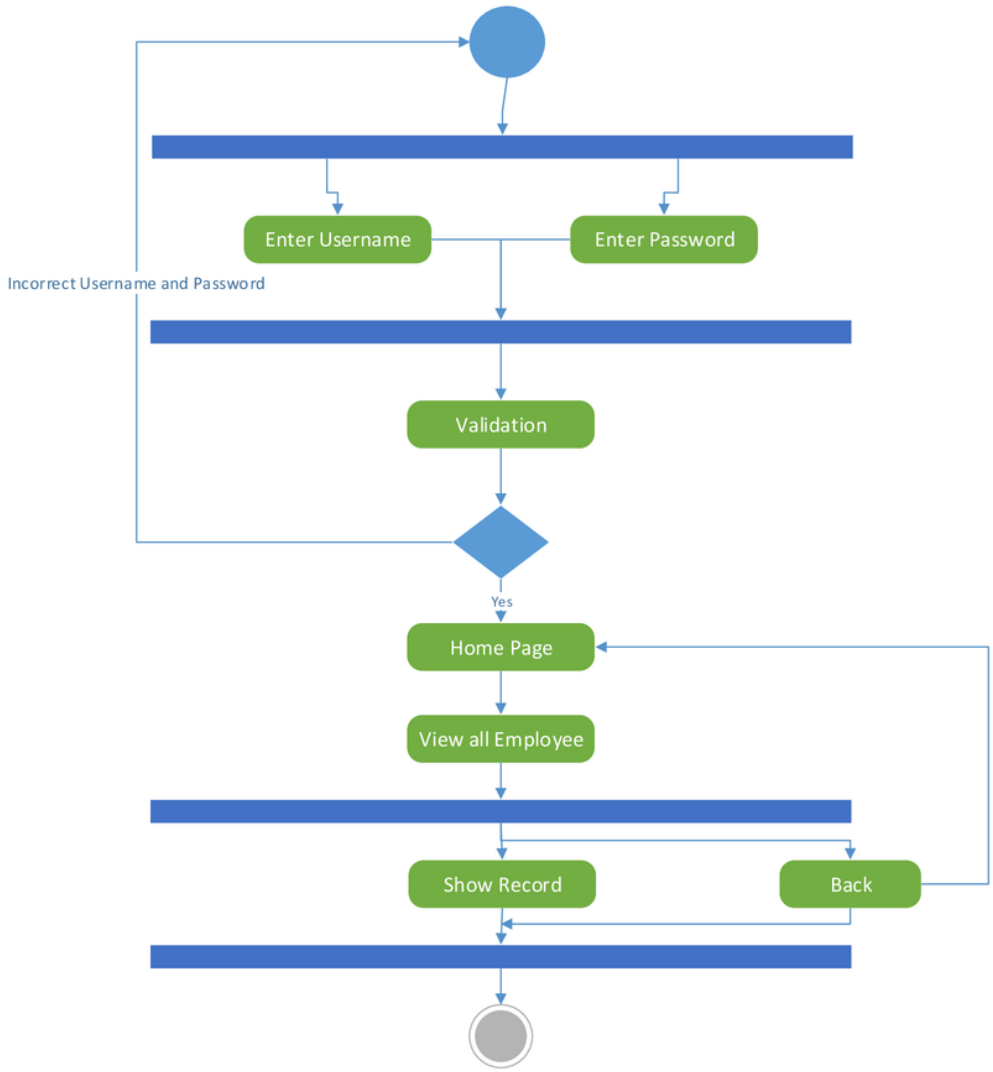

Figure 5-16 View All Employee by Admin Activity Diagram

5.4.8 Recognize plate by Admin Activity Diagram

This is the main activity diagram of the system that tell the workflow of the license plate recognition by Admin.

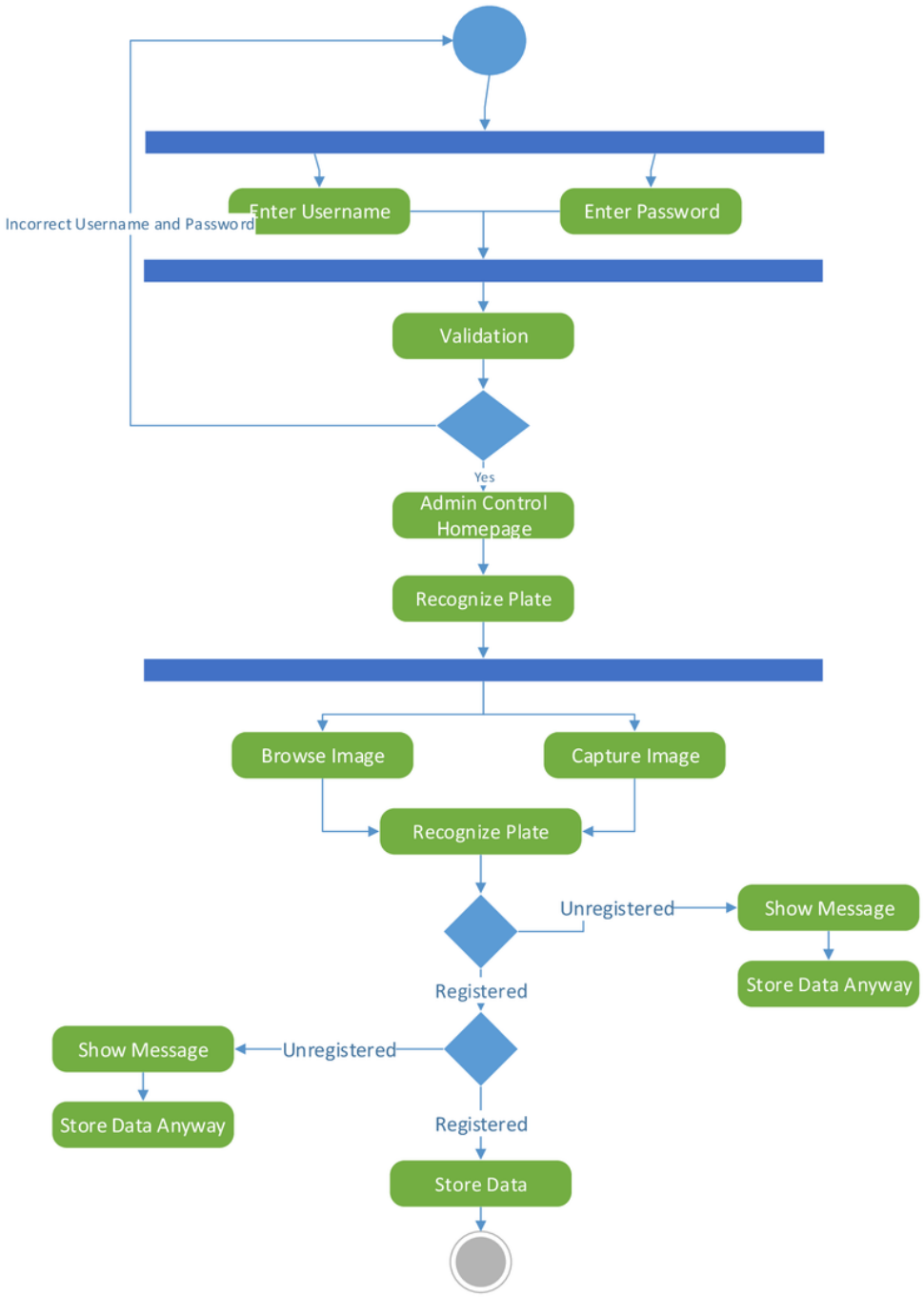

Figure 5-17 Recognize plate by Admin Activity Diagram

5.4.9 Recognize plate by Employee Activity Diagram

Employee can also have this right that he can also use this module. This activity show how the employee can perform this activity.

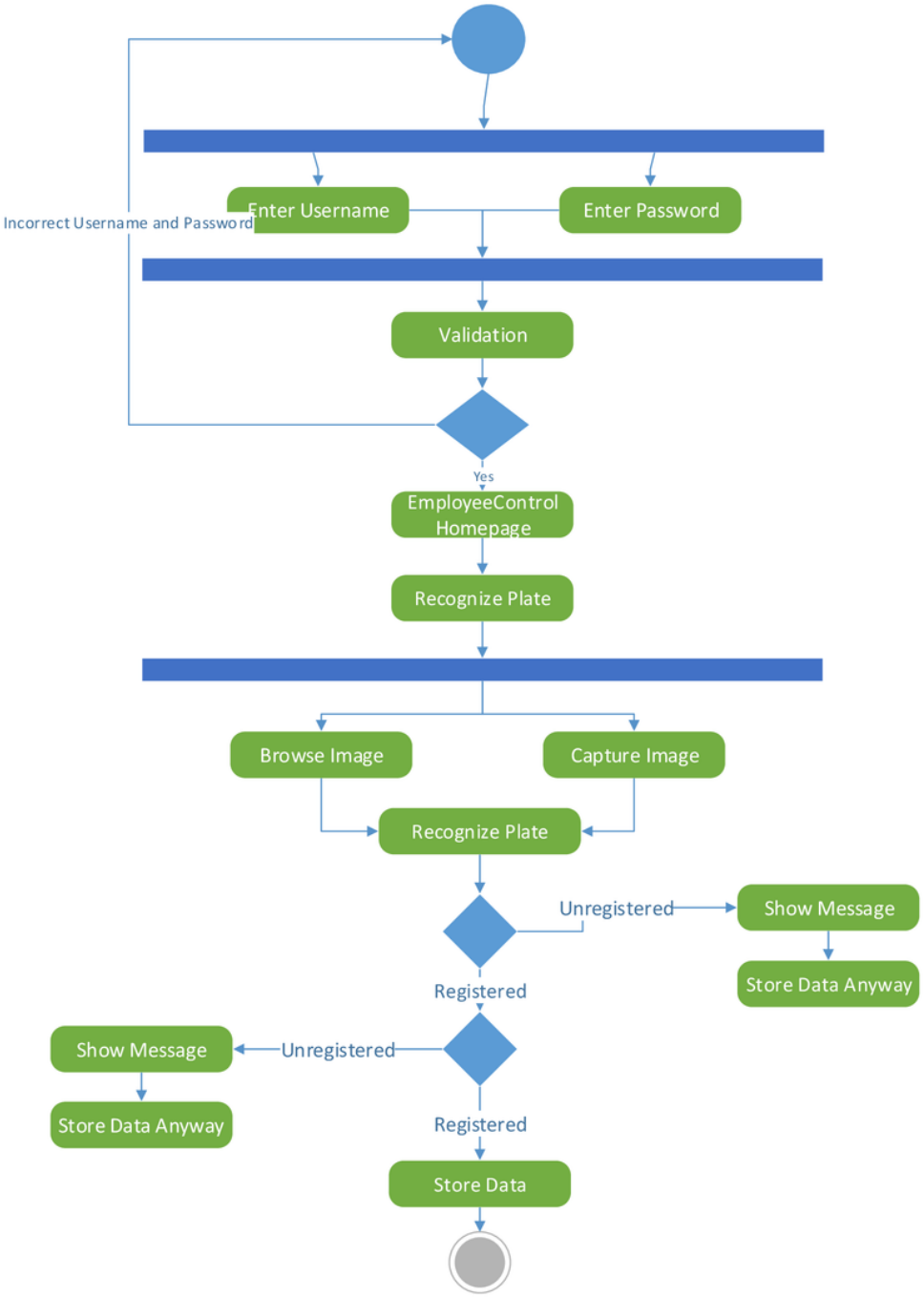

Figure 5-18 Recognize plate by Employee Activity Diagram

6 Testing

6.1 Test Cases

Test cases are developed for testing the functionality of your system.Test cases are developed for different features and the output determines whether the system is performing right under specific conditions or not.

6.2 Black Box Testing

A type of testing in which tester does not know about the structure of the system, its design, its code. System is tested by providing different inputs and results of these inputs are matched with supposed outcomes.

6.2.1 Register Employee Test Case

KJEwhfbkvbbKvbKBKbkbvkBbbkbb

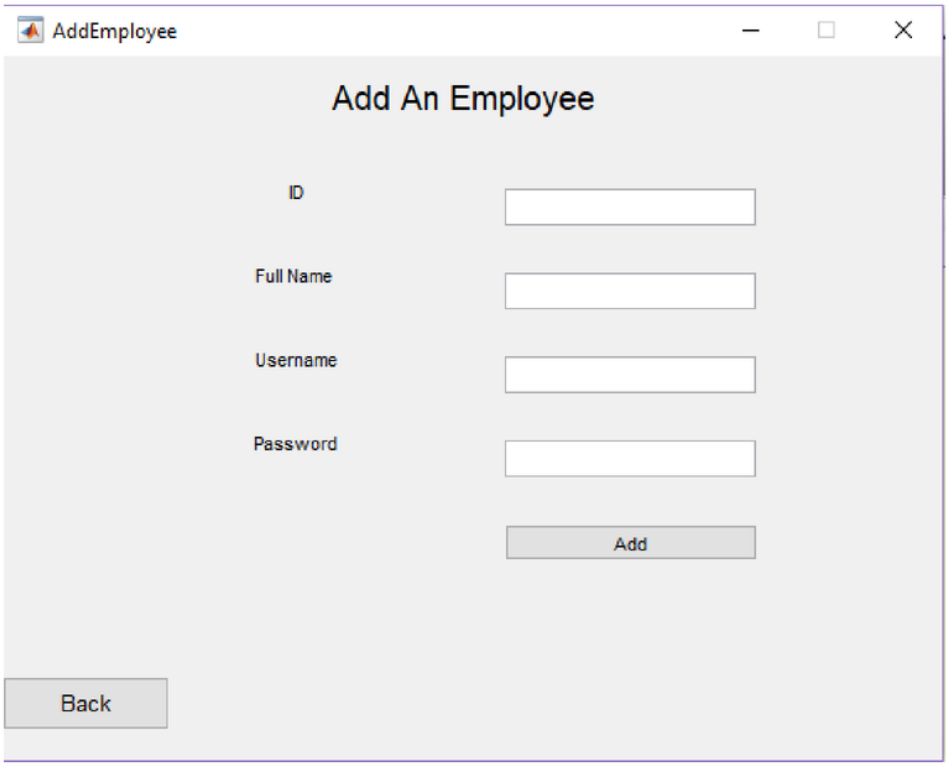

Figure 6.1: User Registration Form

Test Case	Test Scenario	Test Steps	Test Data	Result	Pass/Fail
1	Enter invalid ID	Enter ID, Full Name, Username ,Password	ID=186236784654 Full Name=M Usama Butt Username= usamab8 Password= qwerty123	ID must be of 14 digits	Pass
2	Enter invalid ID	Enter ID, Full Name, Username ,Password	ID=1A8623678465C Full Name=M Usama Butt Username= usamab8 Password= qwerty123	ID cannot contain any symbols and characters	Pass
3	Enter invalid Full Name	Enter ID, Full Name, Username ,Password	ID=34186236784654 Full Name=M Usama Butt8 Username= usamab8 Password= qwerty123	Full Name cannot contain any symbols and characters	Pass
4	Enter valid ID and Full Name	Enter ID, Full Name, Username ,Password	ID=34186236784654 Full Name=M Usama Butt Username= usamab8 Password= qwerty123	Employee added successfully	

Table 6.1: Sign Up Test Case

6.2.2 Employee Login Test Case

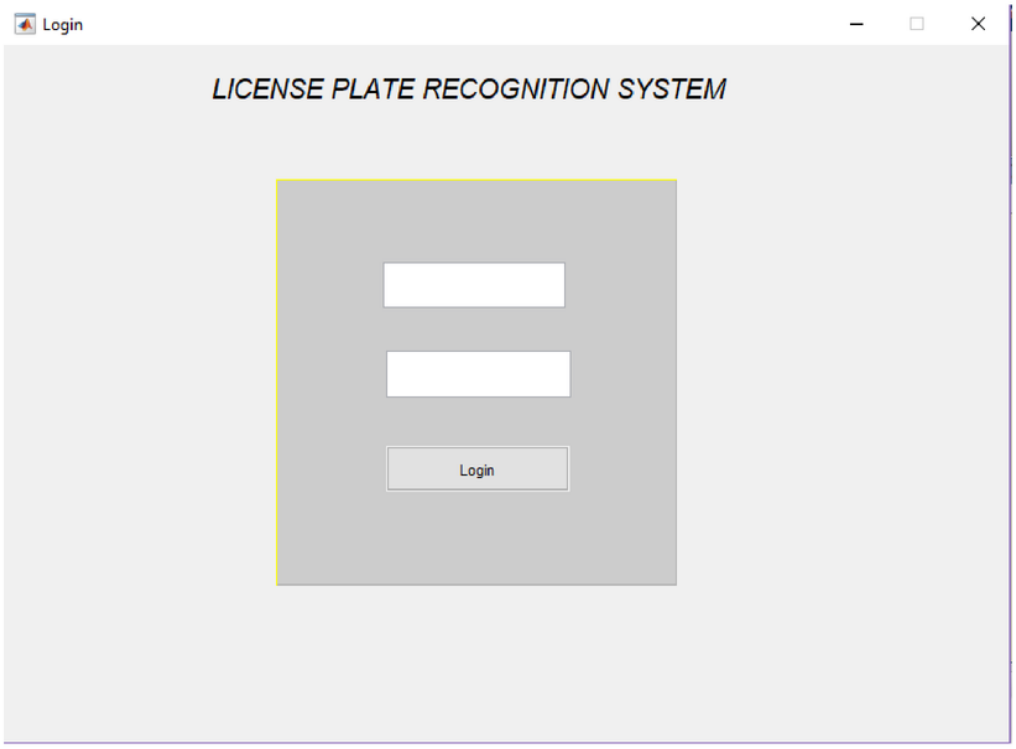

Figure 6.2: Login Form

Test Case	Test Scenario	Test Steps	Test Data	Result	Pass/Fail
1	Enter invalid Username	Enter Username, Password	Username= usamab88 Password= qwerty123	Error: invalid username	Pass
2	Enter valid Username and password	Enter Username ,Password	Username= usamab8 Password= qwerty123	Login successful	Pass

3	Enter invalid password	Enter Username ,Password	Username= usamab8 Password= qwerty1234	Error: invalid password	Pass

Table 6.2: Login Test Case

6.2.3 Update Employee Test Case

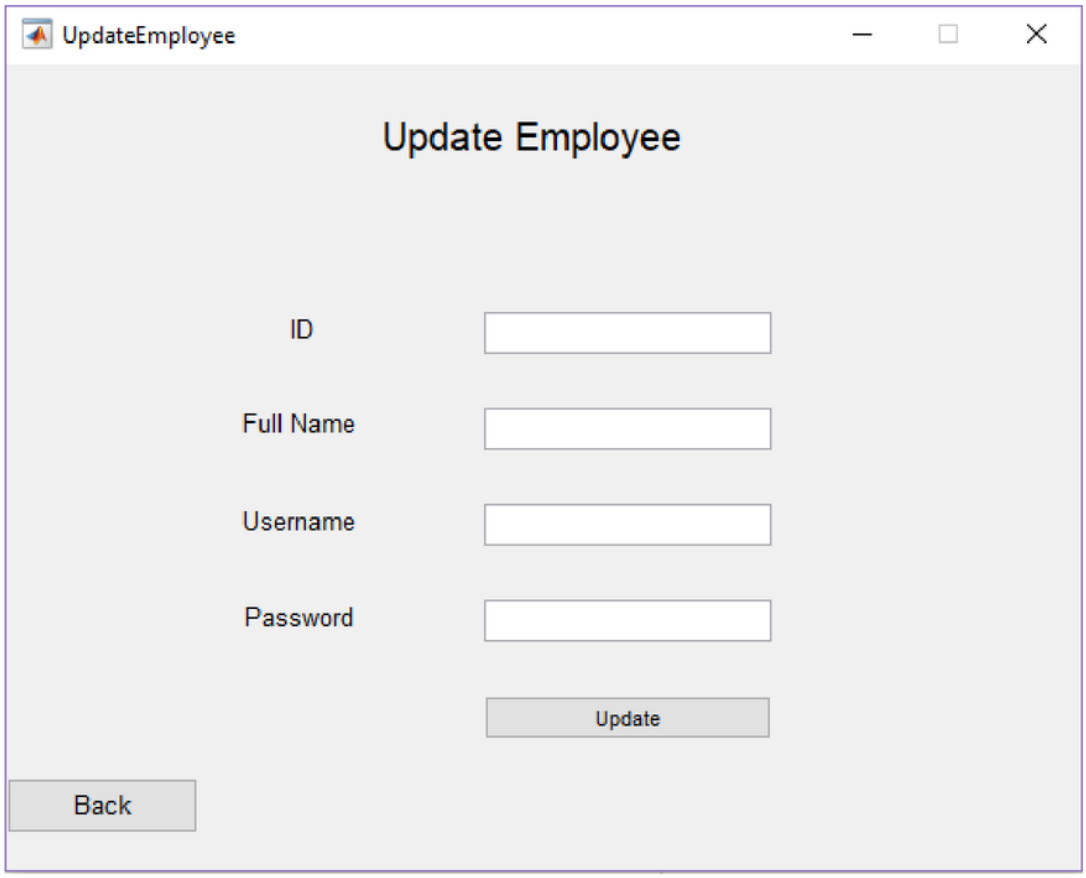

Figure 6.3: Update User/Employee Form

Test Case	Test Scenario	Test Steps	Test Data	Result	Pass/Fail
1	Enter Valid ID	Enter valid ID, Full Name, Username, Password	ID=03300342345234 Full Name=Hashim Ali Username=hashim69 Password=9933Wb	Update Successful	Pass

2	Enter Invalid ID	Enter Invalid ID, Full Name, Username, Password	ID=033003423 Full Name=Hashim Ali Username=hashim69 Password=9933Wb	Invalid ID not match. Enter ID again	Pass
3	Enter Valid ID but Missing Field	Enter Invalid ID, Full Name, Username, Password	ID=03300342345234 Full Name= Username= Password=9933Wb	Must fill All the Fields to update	Pass

Table 6.3: Update Employee/User Test Case

6.2.3 Delete Employee Test Case

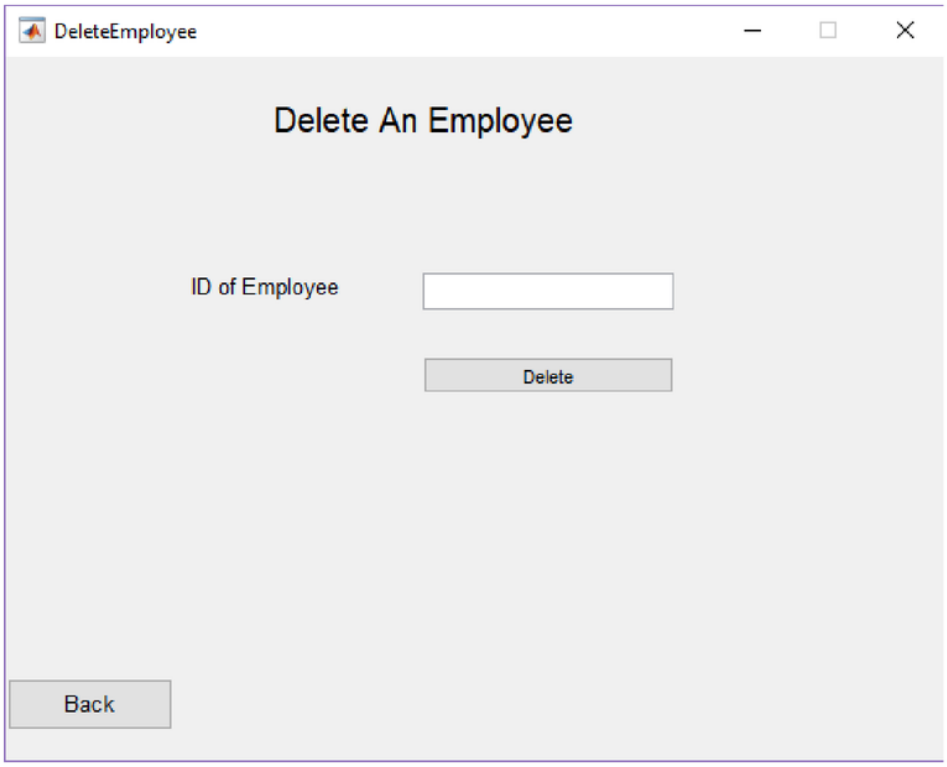

Figure 6.4: Delete User/Employee Form

Test Case	Test Scenario	Test Steps	Test Data	Result	Pass/Fail
1	Enter invalid ID	Enter ID	ID=76378746874387	Error: Employee does not exist	Pass
2	Enter valid ID	Enter ID	ID=76378746874387	Employee Removed	Pass
3	Enter invalid ID	Enter ID	ID=76378746	Error: incomplete ID	Pass

7 User Manual

7.1 Interfaces

Interfaces are the best visual representation that user can easily understand how to use the system. The following section elaborates all the interface of LPRS.

7.1.1 Sign Up Interface

Sign up interface for both the employee and Admin. Admin can only create the account for the employee.

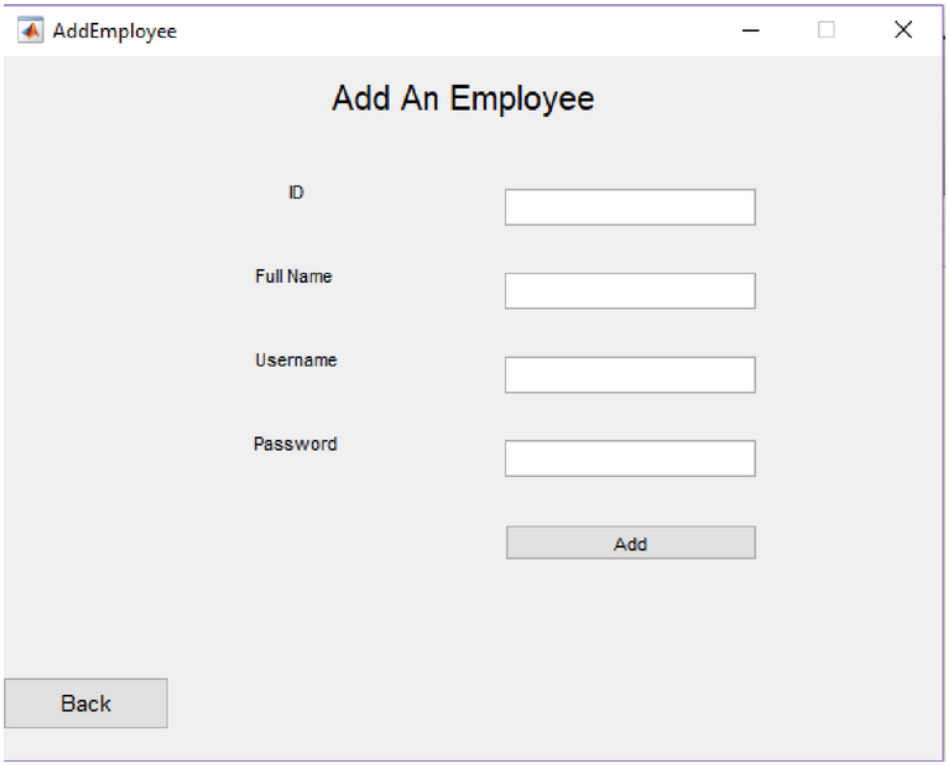

Figure 7-1 Sign-up Interface

7.1.2 Sign-In Interface

Same for both the employee and the Admin.

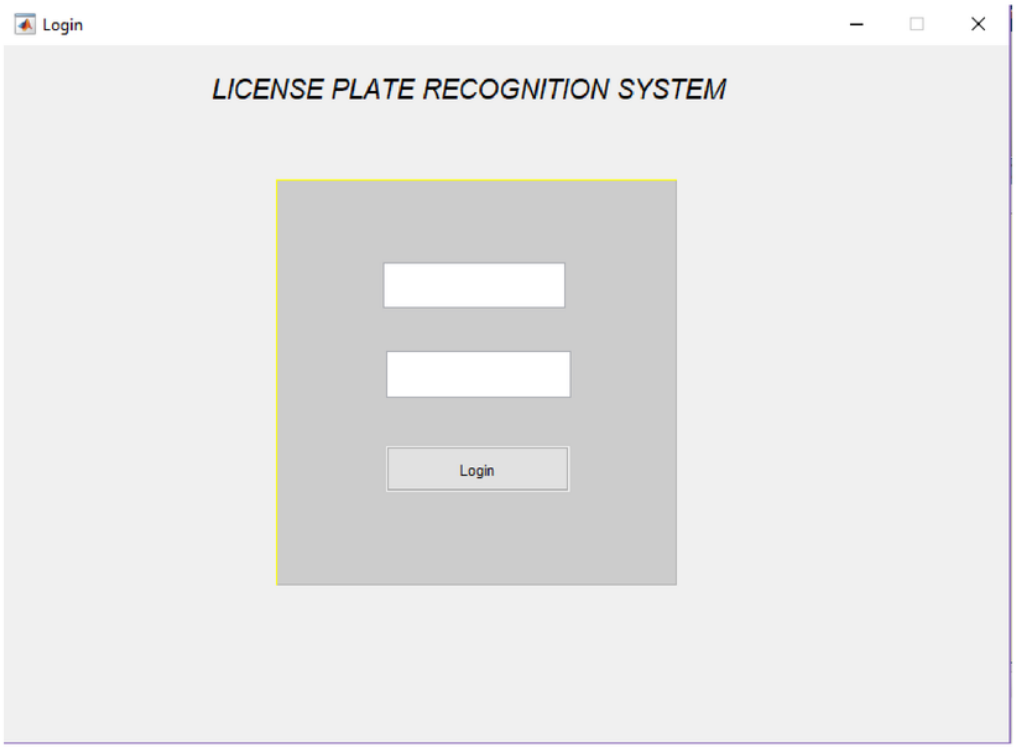

Figure 7-2 Sign-in Interface

7.1.3 Number Plate Recognition Interface

Main Interface of the system.

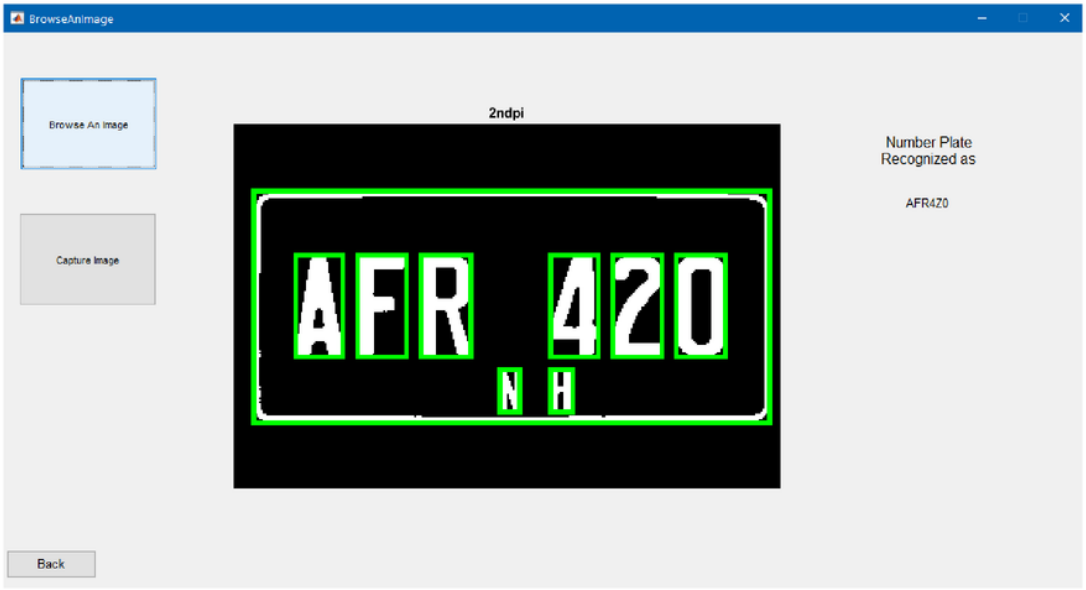

Figure 7-3 Number Plate Recognition Interface

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