report

by Noor asif

Submission date: 26-Aug-2021 01:29AM (UTC-0400)
Submission ID: 1633775528
File name: Complete_Documentation_FYP_21-P-45.pdf (2.81M)
Word count: 9492
Character count: 61694

Title project
BSSE 21-P-45

Session 2017-2021
Bachelor of Science in Software Engineering

Submitted by
Mohsin Quddus 17-NTU-1090
Ayyaz-ul-Haq 17-NTU-1078
Talha Khawar 17-NTU-1100

Supervised by
Dr. Toqeer Ahmed

Co-Supervised by
Dr. Rehan Ashraf

DEPARTMENT OF COMPUTER SCIENCE
NATIONAL TEXTILE UNIVERSITY, P.O-37610 FAISALABAD

DECLARATION

We hereby declare that this project report entitled "Guide Pose" is written by us and is our own effort and that no part has been copied or taken without a mentioning reference of source

Submit by	Signature	Date
Mohsin Quddus	_____	_____
Ayyaz-ul-Haq	_____	_____
Talha Khawar	_____	_____

This project document is submitted to the Department of Computer Science at National Textile University in partial fulfilment of the requirements for the degree of Bachelor of Science in Computer Science. The Project is equivalent to 32 weeks of full-time studies. We have read the report and confirm that this report meets the minimum requirements for the degree of Bachelor of Science in Software Engineering (BSSE).

Contact Information:

Author(s):

Mohsin Quddus _____ _____

17-NTU-1090 **Signature** **Date**

Ayyaz-ul-Haq _____ _____

17-NTU-1078 **Signature** **Date**

Talha Khawar _____ _____

17-NTU-1100 **Signature** **Date**

Department of Computer Science

National Textile University

P.O ± 37610 Faisalabad

Faisalabad

Web: www.ntu.edu.pk

Phone: +92 4192 30 081

Fax: +92 41 92 30 098

CERTIFICATION

This is to certify that this project titled "Guide Pose" was found to satisfy the requirement for the award of "Bachelor of Sciences in Software Engineering" degree by the Department of Computer Science, National Textile University.

Supervisor:	**Date**
Dr. Toqeer Ahmed	
External Examiner	**Date**
Internal Examiner (FYP-Member)	**Date**
Name:	
FYP-Convener	**Date**
Dr. Rehan Ashraf	
Head of Department	**Date**
Dr. Muhammad Asif Habib	

ACKNOWLEDGEMENT

This project is developed by maximum amount of hard work and our full dedication. In this System, many people have paid huge amount of contribution through which we will be able to achieve our goal. We are very thankful for their precious time they rewarded us without their guidance and their kind advices we are nothing.

We thank thousand times to ALLAH for the knowledge and perseverance that has blessed upon us during this whole effort and throughout our life, “We are nothing without this strength that ALLAH showered upon us”. My class fellows and my seniors who played major role to support us, encourage us and to strengthen us.

We pay our greatest gratitude to the most respected Faculty Members of our Department who gave us their precious time from their busy schedules, and they are so kind and friendly that we even cannot describe this in words. We would like to thank our **Supervisor Dr. Toqeer Ahmed** and **Co-Supervisor Dr. Rehan Ashraf** for guiding us throughout this whole project and progress.

They guided us in every module of project and consulted them what new advancement will be. We pay nothing except our respect for their guidelines and continues support and effort.

We thank every person from the core of heart who guided us directly and indirectly.

I would like to thank our **Convener Sir Shahid** for motivating us throughout this project, without him we will not be that serious.

Respected Faculty members have helped us a lot and guided us according to their experience. They inspired us a lot So that we are here at this stage to present our work.

Finally, we are very thankful to our parents who provided us this platform their guidance, motivation, support (financially and emotionally) throughout our journey of four years. The patience, support and understanding shown by our parents, brother and sister is most appreciated.

ABSTRACT

In this era of efficiency and performance machines and systems tends to be better and faster. Everything is being automate and self-aware for making lives easy and better than before. One day we are working on computer vision and found a great idea of using computer vision latest technique pose estimation in a way that we can produce a product that can change the future of body fitness. It's very vast idea but in this project we are using pose estimation for the home workout, gym person any other sportsman wants to maintain health or to do exercise with accurate angle can use this application. The main purpose of this application is to provide accurate angle according to your body without hiring any trainer. As wo all know while doing exercise wrong angle can cause injury or cranks in muscles or you may also lose your body part. So to avoid this problem we created an application that can tell user about the angle of specific exercise to the user. This application is a massive solution to address all the problems mentioned above.

Table of Contents

List of Figures

Chapter 1

Introduction

1.1 Introduction

The main aim behind this project is to aid all the sportsman to work out and exercise in the most accurate way possible for a sports man to get maximum out of the body they have to do everything right. Doing exercise in the wrong way not benefit the body at all, but it may cause a lot of injuries. And it may cause the player to permanent loss to its physical body part. so due to the wrong exercise athlete can get muscle pull and strain, sprained ankle, shoulder injury, knee injury, shin splint, wrist sprain and Tendinitis. These are some examples of injuries caused by the inaccurate angle or pose of the athlete or these injuries may cause to end or halt for a long time. A study publishes in 2013 states that there is a rate of 3.1 injuries for every 1000 hour spent doing CrossFit Training Our Main objective is to rectify the problems an athlete can face while training. This solution provides a virtual assistant to the athletes, tell the athlete how to do an exercise also check the athlete's correct angles and movement. This solution is going to be a complete package. A professional can teach the machine how to do a particular exercise in it most efficient way. After that the machine will be mature enough to tell the athlete where actually the athlete is making mistake and how he/she can correct it We are going to create two different versions of our product. One for the professional's users where the solution will be deployed on hardware or desktop and will be available as device. A GPU will be available to train test and doing other related operations. The 2nd Version will be available on mobile side where user can record his/her video according to the predefined exercise. The video will be analyses on server sent by the mobile and the server processed and generate result again the video after that the results can be seen by the user

1.2 Purpose

Pose estimation is a computer vision technique that predicts and tracks the location of a person in an image or video. We can also think of pose estimation as the problem of determining the position and orientation of a camera relative to a given person and we done it by identifying, locating, and tracking a number of Key Point's on a given person. We clearly envision the power of pose estimation by considering its application in automatically tracking human movement. From virtual sports coaches and Al-powered personal trainers to tracking movements on factory floors to ensure players safety. Our main purpose to train the players in sports to obtain their angle with respect to their workout and helps them to perform well without any injury We solve this problem and use it in

three main domains i.e., home workout, GYM user, athletes. Ones who use this project can get the benefit not to hire trainer in GYM or if he/she wants to do home workout for their angle correction to provide safety to the players from any kind of injury happened due to wrong angle and also help the players to achieve the right angle for the specific exercise or phase.

1.3 Project Scope

People of every age will be able to use this system. Our AI-based system will be interacting with people according to their condition and nature. This project has a very vast scope because it can be implemented on the people of every age and will act accordingly. Mainly the daily Gym doer's athletes or related to this king of sportsman's groups. These groups will be our utmost priority to deal with. Moreover, people of every age can use this application to do exercise to assess their physical health. This automated system will not only be implemented in Pakistan. In Fact, people from any country, religion, race and age would be using this platform. Because we are not specifically implementing it, but generally for all human beings having the access to technology.

1.4 Area of Studies

In our 4 years of study in this degree, different courses like Software Engineering, Digital Logic Design, Database Designing, Computer vision, Data Science have been studied and will be helpful in development of this Project. Database Design and Analysis plays an important role during the development and implementation of this project.

1.5 Gathering Requirements

The most important part of every project is that how you gather requirements and how accurate you are able to work and understand that requirements. If the requirements that you gathered are correct then there will be less change in project through which the project will be error free and meets the requirements of user but if the project requirements are not accurate so for any change in project, we have to start it from the initial stage which will be cost effective and time consuming. To control the risk, we have to collect the requirements with a complete homework and should be accurate. We might consult with the clients; our system expected users or the organization that currently have implemented the system like our proposed one. However, if the error or risk has occurred you will be able to change that module and part in such a way as with little changes. After the

requirement gathering verify them in the best way and understand, what the client wants "Listen to him carefully".

1.6 Project Planning

Table. 1.1. Project Planning

Task	Dec	Jan	Feb	Mar	April	May	June	July	Aug
Topic Selection									
Finalize Topic									
Gather Requirements									
Analyze Requirements									
SRS Document									
Write Document									
Modify									
Submit									

1.7 Risks and Risk mitigation

This project is being implemented for the first time. There are some risk factors which may occur.

1.7.1 End User:

This is a first ever automated system to measure the pose of the body with the instructions of doing specific exercises Anybody can use this and do the exercises with accurate angles. But there is a risk that people may not find it suitable because still in this century there are some groups of people who don't trust on technology based automated systems dealing with humans in such critical circumstances. To solve the people acceptance issue, we will provide some training sessions to the

athletes or other sportsman. So, they can easily communicate with the automated system and do their exercises.

1.7.2 Technical:

May we face some technical issues while implementing the system. Detailed measurements and performing tests on individual persons and then creating graphs of results is a very complicated task. To reduce the technical risk, we made plans for implementation under the supervision of our Respected Supervisors.

1.7.3 Schedule:

Due to ongoing situations of COVID-19 everything got disturbed. University schedules and meetups with group members regarding discussion of projects are getting delayed. Therefore, there is a risk of delay in completion of project to minimize the disturbance of schedule we are communicating with each other in online meetings.

1.7.4 Acceptance:

Acceptance of Sport Trainers Some of the Trainers may not accept this automated application. Probably, they would think that this system is bypassing their importance of training the newcomers. To reduce this. We discussed with some Trainers regarding this project and earned their trust that we are not By-passing them. We got their ideas to implement the system just for the measurement angles and help the newcomers to easily got the exercise and the pose for the sports.

1.8 Project Overview

This project is designed to tackle with the wrong angle exercise problem. Doing exercise in the wrong way not benefit the body at all, but it may cause a lot of injuries. And it may cause the player to permanent loss to its physical body part. An automated pose estimator system will be helpful for the workout users that they do not have to hire trainer. The application in their mobile helps the user to exercise anytime anywhere. Application contains sign-up functionality also attached the sign-up with google facility that save the record or information of the user. In addition, there is no centralized database to keep the record of user, therefore, with this system user can be able to track the performance of its own exercise. There is also an admin portal where admin can add exercises and also can get the feedback about the exercises. The application is just simple as it, the main aim is to

focus on the quality and communication between the user about the angle with can be shown using response of the video.

Chapter 2

Literature Review

2.1 Doing the Wrong Type of Workout

Where did most people learn their exercise? By watching others at the gym (who may be exercising incorrectly)? From your friends, co-workers, the web, TV, the newspaper, the latest research findings, or perhaps your 5th-grade gym teacher? What you're doing for exercise directly determines the results you will get. To learn what you should do, there's no better place to start than by writing down your goals and then working with a professional trainer to design the right workout to meet those goals. Haphazard exercise will provide haphazard results.

2.2 Never Changing Your Wrong Workout

When you do the same thing day after day, you get very good at it. In an exercise, this is called the principle of adaptation. It means that we become very efficient by doing the same exercise over and over. This is great for some sort of schedule of work but not that great for physical fitness progression. If you always do the same wrong workout for the same amount of time, you will eventually hit a muscle dam- age. Learning the right way to exercise is essential to getting results. Form does matter, especially when doing any strength trading exercise. Incorrect form or technique also sets you up for potential injuries, pain, and soreness. To learn proper technique, there's no better place to start than with a personal trainer or coach.

2.3 Solution

Due to the critical effects of wrong exercises discussed in above section we develop an algorithm that will solve not only the problem, but it’s also cost-effective user no need to go to the trainer, just to download the application and do the exercise in an appropriate way without any worry or wrong angles.

The user will see an interface where he/she will be doing exercise and information is transferred to user using colors. in particular exercise the angle of the user shown using red and green color the green color indicates that the angle is good on the other hand red shows wrong angle. This is the brief summary of application for the home workout user. On the other hand, we can also target by using the following set of angles of skiing and Snowboarding sportsman’s the angle is most important for these sports. Slight change of angle will make wo to get down or may cause injury or permanent body part loss. So, for this the range of the angles we done some case study of ranges between the angles which are following.

Joint	Angle
Hip to shoulder	Left leg angle > 160 or Left leg angle <80
Hip to knee	Right leg angle > 160 or Left leg Right <80
Right shoulder to knee	Right Hip > 160 or Right Hip <80
Left shoulder to knee	Left Hip > 160 or Left Hip <80
Shoulder to shoulder	Left shoulder angle > 80 or Left shoulder angle <30
Elbow	Left elbow angle >66 or Left elbow angle <8

Table 2.1 Angles for the skiing (Case Study)

Figure 2.1 Wrong Angle of skiing

Figure 2.2 right Angle of skiing

If the angles are according to the range described there will be no read line on the screen but if the angle disobey the range the red line will indicate the user to change that angle.

So in the application we basically targeting some basic exercise now but in future we will add more things like exercises, skiing, football users etc. Some of the exercise visualization result is shown like this as below.

Figure 2.3 right Angles of exercise

Figure 2.4 right Angles of exercise

2.4 Related Work

Currently there is no application use pose estimation or computer vision technique to detect the angle then guide user about wright and wrong course of exercises. Many of them just show the simulation or GIF about the exercise to guide user It means right now there is a need of convergence of the old techniques. but our system guide user owns their own body parts to get the technique about the exercise quickly and correctly. We are going to design a system, which will be useful to GYM and home users.

- ✓ It is going to provide these services to GYM persons:
- ✓ Automatic angle detection
- ✓ Save a lot of time
- ✓ Manage a centralized database
- ✓ Integrity, accuracy, and consistency in the angle detection

There are many theses and reports available on the internet in libraries that can be useful for our project?

2.5 OpenCV

We use this library to interact with the camera and start capturing frames, these frames or you can say video is then used to send the models for further use. There are different libraries to do this type of task but the easy and the most popular one is OpenCV. The community of this library is also huge so if we got any error in the future, we can tackle it easily.

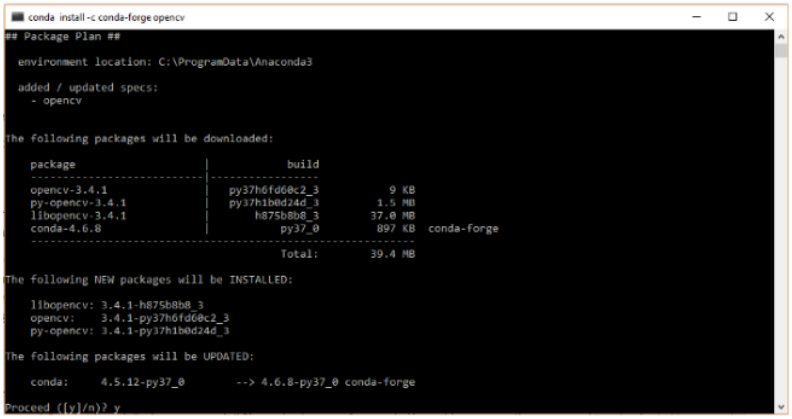
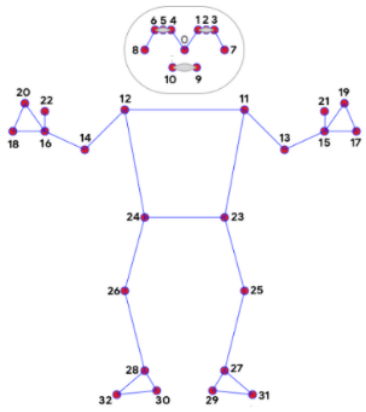


Figure 2.5 OpenCV Installation

2.6 Mediapipe

The research in this field is going very fast and after months of our efforts we choose alphapose or our final model but recently google release this framework, Mediapipe which is an open-source framework and easy from previous models to implement and the dependencies as compared to the alpha, fast and open pose are very low. The pose estimation module of the Mediapipe gives us following points from the human body and after that we do further calculations on that points.



0. nose
1. left_eye_inner
2. left_eye
3. left_eye_outer
4. right_eye_inner
5. right_eye
6. right_eye_outer
7. left_ear
8. right_ear
9. mouth_left
10. mouth_right
11. left_shoulder
12. right_shoulder
13. left_elbow
14. right_elbow
15. left_wrist
16. right_wrist
17. left_pinky
18. right_pinky
19. left_index
20. right_index
21. left_thumb
22. right_thumb
23. left_hip
24. right_hip
25. left_knee
26. right_knee
27. left_ankle
28. right_ankle
29. left_heel
30. right_heel
31. left_foot_index
32. right_foot_index

Figure 2.6 Points of Mediapipe pose Estimation

2.7 Model Working

2.7.1 Basic working principle of Pose Estimation models.

- ✓ Model will try to estimate 32 points of a Person from image.
- ✓ After that it will try to join this points to make a skeleton.
- ✓ There are mainly two approaches which are used to achieve above 2 tasks:

2.7.1.1 Top Down

- ✓ First it will detect the Person from available frame.
- ✓ Then it will get that detected object.
- ✓ And then it will try to estimate 132 key points for each detected Person from that frame and finally try to create the skeleton.

2.7.1.2 Bottom Up

- ✓ First it will try to estimate the 18 key points from image for each Person.
- ✓ After that it will try to estimate Person from those key points. i.e., joining the key points and making the skeleton.

2.8 Areas of Studies

We require the studies of different subjects for the formation of our project. These subjects include Software Engineering that helped in determining the flow and best working methodology for our project, Deep Learning, Digital image processing, Database which will help us to train, test our system as well as to store data into their appropriate databases.

2.9 Reasons of Development

The main purpose for marking this application is this project is designed to tackle with the wrong angle exercise problem. Doing exercise in the wrong way not benefit the body at all, but it may cause a lot of injuries. And it may cause the player to permanent loss to its physical body part. An automated pose estimator system will be helpful for the home workout, GYM persons or any sportsman users that they do not have to hire trainer specially for the basic exercises and can easily get the correct angles according to their own body parts anywhere anytime.

2.10 Proposed Methodology

Firstly, the application is used to capture the video of the user while doing the exercise. When the video is captured the video is send to the server using the interface of application through the API when the video is received the main process starts.

In main process the code that is uploaded or deployed on the server activate caught the video send by the user and starts processing it. In the processing phase the video is divided into frames and every frame is to pass through the model the model detects the human in the image and the points of it the points are returned and next hardcoded parts begin.

Every exercise has different angles; we have two methodologies first is for the real time in which the user does exercise according to the video shown to it with the response of real time given to the user that the exercise is going right or wrong. This method is done in desktops

But the method use in the application is when the frames processed by the model and results constantly given as output of the function that points are combined to make structure and the angles are find out through the lines. These angles are then combines through the original hardcoded angles and then the color of the lines of the skeleton is show according to it. If the angle is wright the default skeleton color is shown otherwise the red color is shown to indicate that the angle is wrong. The whole video is processed in this way and when the frames finished the video is send back to the user as response.

2.11 Experiments

2.11.1 Pretrained Models Experiments

We use different models to test their accuracy, precision and their frame rate any try them to use in real-time, we have to do tradeoff between the accuracy and the real-time use. Environment created for the testing is shown below in the picture

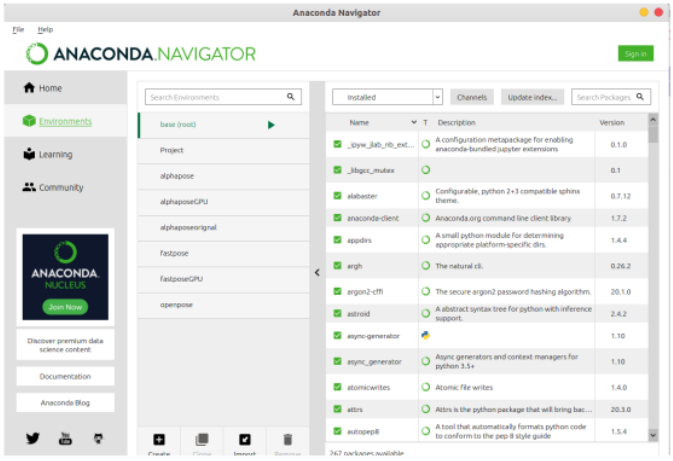


Figure 2.7 Anaconda environment List

2.11.1.1 Openpose

This Openpose model is good in performance but not working real-time its frame rate is slow which is 10 fps environment created for the testing is shown below in the picture. The Openpose return 17 points of human body.

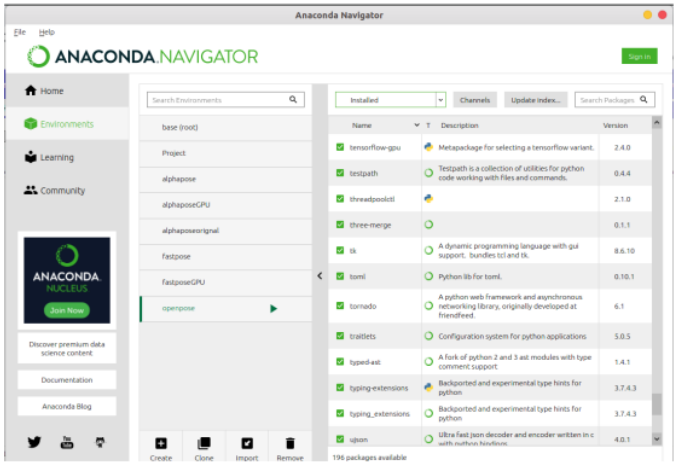


Figure 2.8 Anaconda environment of openpose

2.11.1.2 FastPose

The first model we use to detect the human and then return the different key point of the joints in human this model is working Real time but not giving satisfactory accuracy some of the statistics are following It is the 46% smaller and 47% faster than openpose. FastPose is giving 55 fps on cpu. The FastPose return 17 points of human body.

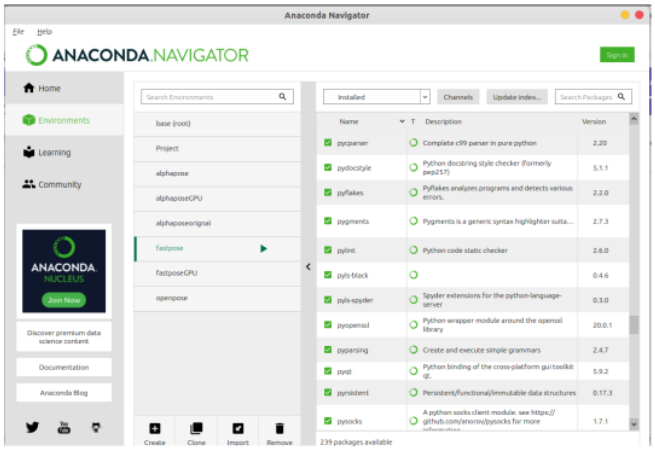


Figure 2.8 Anaconda environment of Fastpose

2.11.1.3 Alphapose

At last, we found this model which is best from all the previous ones and gives high accuracy from the previous one but frame rate for the real-time use is again low according to its documentation it runs at 23 fps on COCO validation set. The alphapose return 17 points of human body.

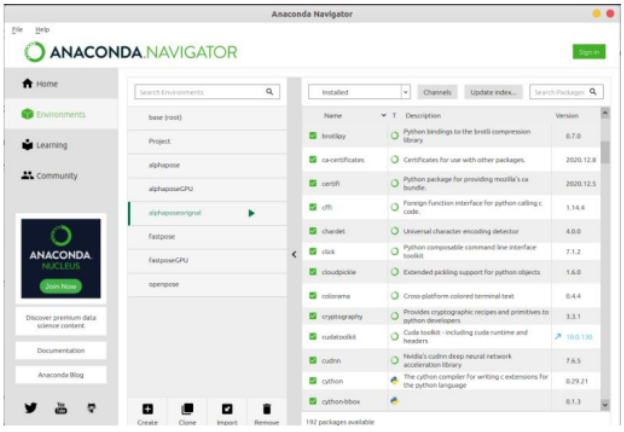


Figure 2.9 Anaconda environment of Alphapose

2.11.1.4 GluonCV Alphapose

This is the same model alphapose but provided by the GluonCV library with high encapsulation so for that we don't have to install all its dependencies but just the GluonCV library and its code is much easy to understand and to take it to move forward. The GluonCV alphapose return 17 points of human body.

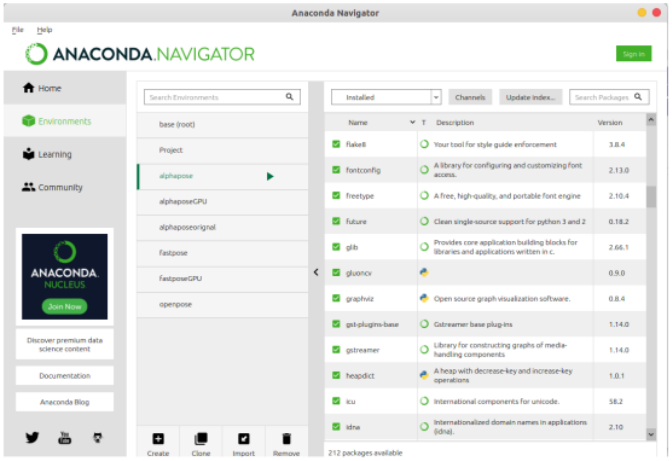


Figure 2.8 Anaconda environment of GluonCV alphapose

2.12 Experiments Result

In this FYP Documentation, we present an effective and efficient approach using advanced pose estimation techniques to improve points and human body recognition. In this section, we'll give experiment results from the experiments phase

Model Name	FPS	Mean Average Precision (mAP)
Openpose	10	61.8
FastPose	55	66.5
Alphapose	23	**73.3**
Mediapipe lite	30	**90.2**
Mediapipe Full	28	**95.5**
Mediapipe Heavy	25	**96.4**

Table 2.2 Model Score Measurements.

The above table shows the frames per second and the mean average of precision of different models on coco dataset. The mean average precision (mAP) of a set of queries is defined by.

$$\mathrm{MAP} = \frac{\sum_{q=1}^{Q} \mathrm{AveP(q)}}{Q}$$

where Q is the number of queries in the set and AveP(q) is the average precision (AP) for a given query, q. precision of a given class in classification, a.k.a. positive predicted value, is given as the ratio of true positive (TP) and the total number of predicted positives. The formula is given as such:

$$\mathrm{Precision} = \frac{\mathrm{TP}}{\mathrm{TP} + \mathrm{FP}}$$

After the experience we choose Mediapipe heavy model to deploy on the server to get high precision and we not using this in real time so for some instance the frame rate doesn't matter for us the video just sends to the server through the application and after some time précised result of the processed video is send back to the application.

Chapter 3

Problem Definition

3.1 Problem Definition

As in the modern era of time, we are still using the old techniques of marking the attendance manually, which is time consuming and difficult to manage as a centralized storage which cannot be queried. There are also chances of marking proxy attendance by students. Therefore, by using this system, "Automated Attendance System using Face Recognition", we can save approximately 10%/more time of the lecture, which can be used in lecture. There will also be a centralized database of attendance, which is easy to manage and query. There will be an accuracy, consistency and integrity in the attendance store in databases.

3.2 Existing Methodologies

There are many stages or methodology in software development that is called the software development life cycles (SDLC). Software Development is a process that contain different parts, tasks, procedure, phase etc. In last many years, we focused on developing the methodologies that can improve the quality and productivity of the developed software. We can also develop the software without adopting any methodology, that might be delivered easily and quickly, but productivity is affected with the usage of any development model, we can divide the development process into different phases, making prototyping, using part of code again in other places etc.

3.3 Adopted Methodologies

We will use the agile model with the incremental model for making the project successful and improve its working and development to its best.

3.3.1 Prototype

Prototype is a model in which partial working software/system is developed instead of developing the complete product. Prototype is developed using the required current requirements of the customers, which are known at that time of development starts. With this methodology, there is less chances of changing the requirements during or after the development process. The original development and coding is start when the customer satisfies with the working of the prototype. It may increase the cost and time of developing the software due to prototype development. Figure 3.1 describes the process/steps involved in prototype modal making.

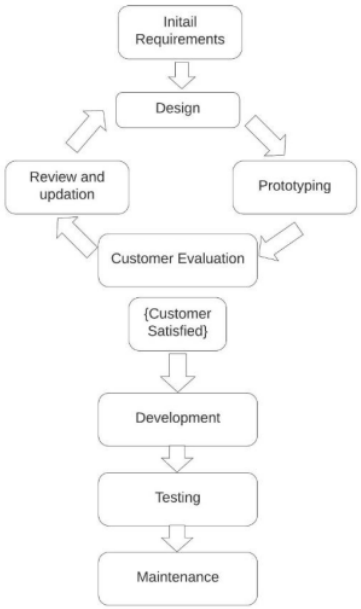


Figure. 3.1. Prototype Model

3.3.2 Incremental + Agile Model

Incremental Model is a process of software development where requirements are broken down into multiple standalone modules of software development cycle. Incremental development is done in steps from meet, plan design, develop, testing, verification, evaluate. Agile model is an incremental delivery process where each incremental delivered part is developed through an iteration after each time box. The central idea of the Agile model is to deliver an incremental version to the customer frequently after each iteration. Figure 3.2 Describes the Incremental + Agile Model Visually.

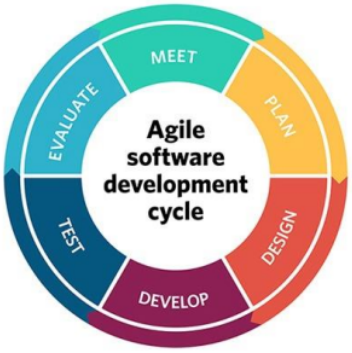


Figure. 3.2. Agile Software Development

3.4 Reason for Adopting Methodologies

We choose the Agile inside incremental model to develop the system with good productivity. In our system, we may need the steps of changing the requirements and needs of the users. We may need different requirements as well as different structure of this proposed system that is usable and valuable for the organization. Moreover, it will help us to divide the project into components that can be develop incrementally.

Chapter 4

System Requirement

4.1 Functional Requirements:

4.1.1 Authentication:

A user shall be able to manage his/her account. This includes logging in, signing up, password recovery, change password. An extra layer of security questions shall be used.

4.1.1.1 Login in

A user should be able to login in to the existing account. For successfully login a user, correct email and password shall be required.

4.1.1.2 Sign up

A new user should be able to register an account. A user shall be able to register using email or google API. A user will provide the name, email and password. The email will be verified before account creation. A security question shall also be taken.

4.1.1.3 Change password

A user shall be able to change his/her account password. User need to provide the email, old password, new password and security question answer to successfully change the password. A notification should be sent to the user's email.

4.1.1.4 Recover Password

A user shall be able to reset password. A user shall input the email and answer a security question before an email is send to user for recovering password.

4.1.1.5 Delete Account:

A User shall be able to delete his/her existing account. A user must provide the answer to security question, password and email and their account will be gone deleting all data

4.1.2 User Controls

The system shall allow the user to control all the activities happening on the app from capturing video to downloading video.

4.1.2.1 Capture Video

A user shall have control over capturing video. There should be a button for starting to capture the video. It should open the camera for video capturing. A button should also be there to abort the operation.

4.1.2.2 Send Video:

A user shall have option to send the captured video. After the user has successfully captured the video, there shall be 2 options, 1 to send video for processing and the 2 to abort the operation from there.

4.1.2.3 Preview Video:

A user shall be able to view the video. After sending video and getting processed a video is sent back which should automatically be shown on the user screen. The preview video screen should be given priority over other work being done in app.

4.1.2.4 Process Video:

A system shall be able to process the captured video by the user and do it successfully.

4.1.2.5 Connection

The System shall process the video over a server. The video should be sent to server through API and receive through API as well.

4.1.2.6 Sending Video

The application should be able to send the capture video to the server. It should send the video without any loss of data from video. A should have control whether to abort sending or not.

4.1.2.7 Receiving Video

The application should be able to receive the without from the server after processing. The receiving should be fast and no loss of information should occur.

28

4.2 Non-Functional Requirements

4.2.1 Hits per minute

The system shall be able to manage 1000 hits per minute. It shall process the video successfully for 1000.

4.2.2 Memory management

The system shall be able to manage memory issues on its own. The server should be able flush the memory and release the resources once the processing is done. The server should not get slow because of memory issues.

4.2.3 Accurate

The system shall provide accurate estimations to the user. The field is really critical and a small mistake can cause a lot. The app processing and working should be accurate and according to standards.

4.2.4 Efficient

The system shall be able efficient. It should give same about every time for same exercise. No change in angels or pose or any other think should occur. No loss of quality should occur and the video should be same size after processing.

4.2.5 Error Handling

The system shall be able to manage all errors and issues. As the application will connect to server, in case of failure due to any reason should be dealt accordingly. The system should be intelligent enough to show the user a proper message for issues occurring.

4.2.6 Speed

The system shall be able to process the video quickly. It should not take ever to process the video from the user. It shall be quick.

4.2.7 User Interface Specification

It will be designed in such a way that it would be easy to use for the admin and the user with the use of labeled buttons and forms that are simple, understandable.

4.2.8 Access Security

There are different security accesses rules for internal and external persons.

- ✓ Admin and users have difference in their access ranges. As the admin can insert, update, remove and view the exercises content, type, portion and user data.
- ✓ Whereas the user can just use, give feedback and might have permission to update their own data.
- ✓ Only admin have a complete access on the system and can handle it single handedly (or might can add more than 1 admins).

4.2.9 Accessibility

The system is accessible to only two entities.

- ✓ Admin with complete access
- ✓ User with some access (Like use/update their own data)

4.2.10 Availability

The extent to which the "Pose Estimation" will be available for the users of this system.

- ✓ The application and its working are available 24/7 whenever user wants to use it.

4.2.11 Reliability

The extent to which our system will consistently perform the specified functions without failure.

- ✓ In case of any failure the process should rollback and retry.
- ✓ The process should be consistent, and transmission of data should be lossless.

4.2.12 Maintainability

The ease with which we can maintain and fix all the errors and technical faults timely.

- ✓ The system should be easy to recover from failure and bugs can be resolved quickly and easily.

4.2.13 Modifiability

The system should be easy to deploy and can be modified easily and quickly so that it is beneficial for the organization.

- ✓ The system should be modifiable for the developer and designer with properly documentation and guidance.
- ✓ The coding should not be ambiguous and nested. As well as proper commenting and documentation will be available for the coders to modify for the new comers.

4.2.14 Usability

The Admin Panel must be designed in such a way that it could be easy to use for the admin.

4.3 Requirements Table Matrix:

Functional Requirement	Use Case ID	Purpose
F3.1.1	U1, U2, U3, U4	Authentication
F3.1.1.1	U1	Login
F3.1.1.2	U2	Sign Up
F3.1.1.3	U3	Change password
F3.1.1.4	U4	Recover password
F3.1.1.5	U4	Delete account
F3.1.2	U8, U5, U6, U7	User Controls
F3.1.2.1	U5	Capture video
F3.1.2.2	U6	Send video
F3.1.2.3	U8	Receive Video
F3.1.2.4	U7	Process Video
F3.1.3	U6, U8	Connection
F3.1.3.1	U6	Sending video to server
F3.1.3.2	U8	Receiving video from server

Table 4.1 Requirement Table Matrix

4.4 Class Diagram

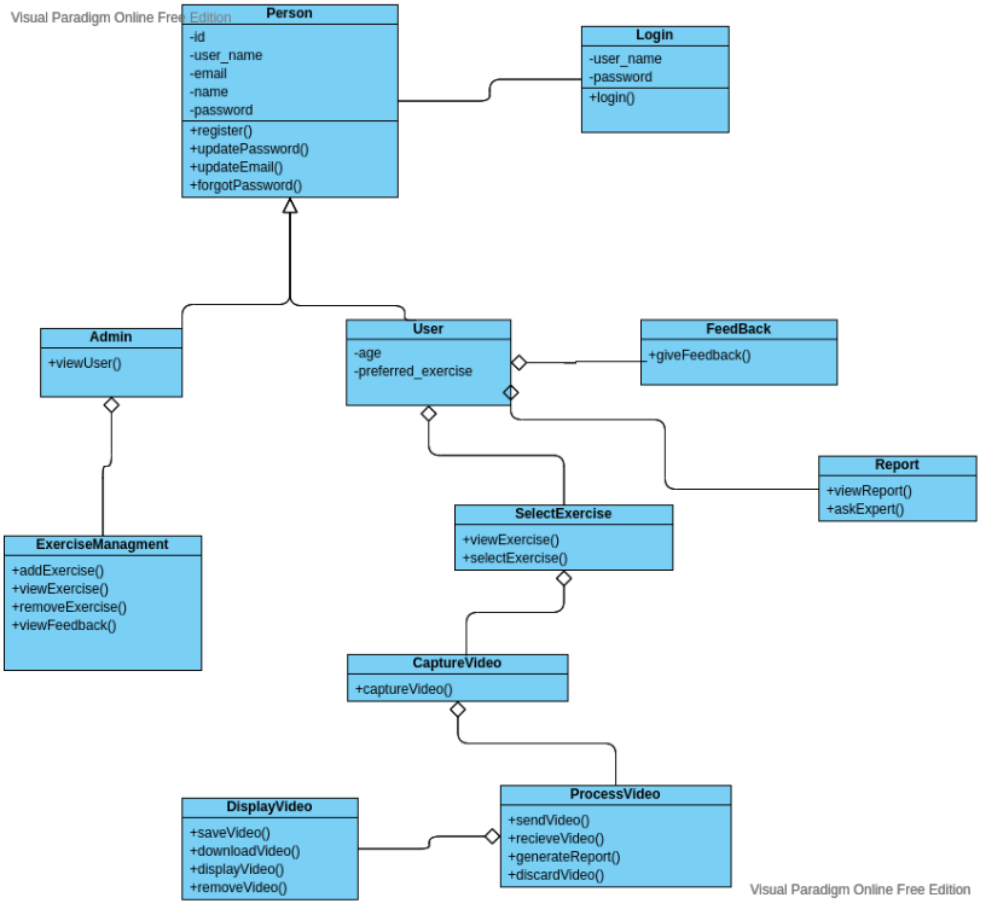


Figure 4.1 – Class Diagram of Guide Pose

All the Entities with required field names and the functions that have the implementation of the functions are shown in Figure 4.1.

4.5 Use Case Diagrams

4.5.1 Admin

Admin in the application is the administrator, who has the authority to perform these activities with user. Figure 4.2 show some functions that can be performed by admin like add exercise delete exercise view exercise.

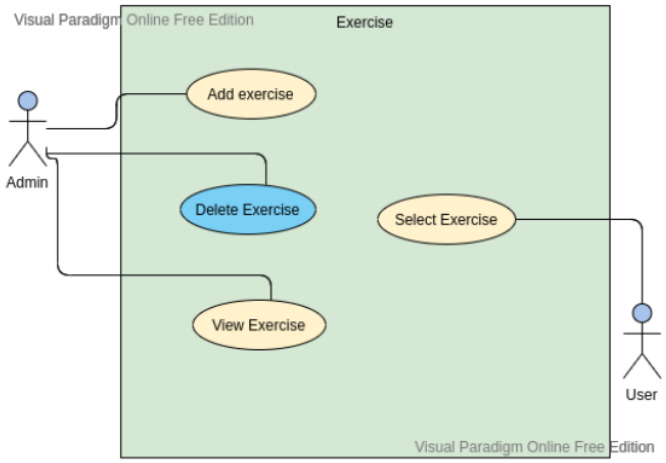


Figure 4.2 - Admin ---> Manage Exercises

4.5.2 User

User have the right to update his/her own info like name, password, email. User can also view the profile of its own and delete the profile.

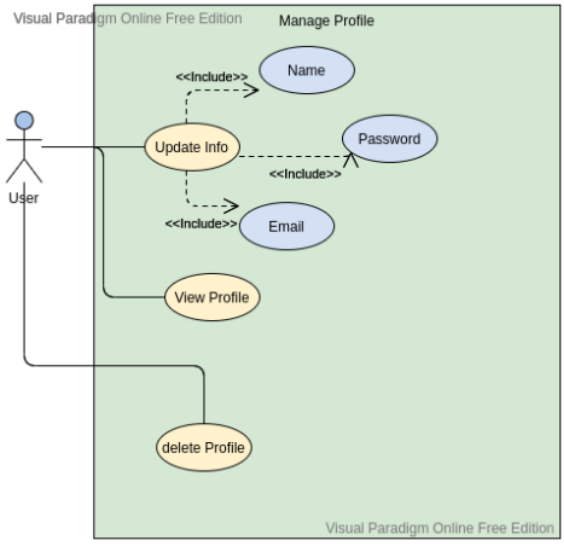


Figure 4.3 - User---> Manage its own profile

4.5.3 Registration Use Case Diagram

Full process of registration is shown in the below use case diagram

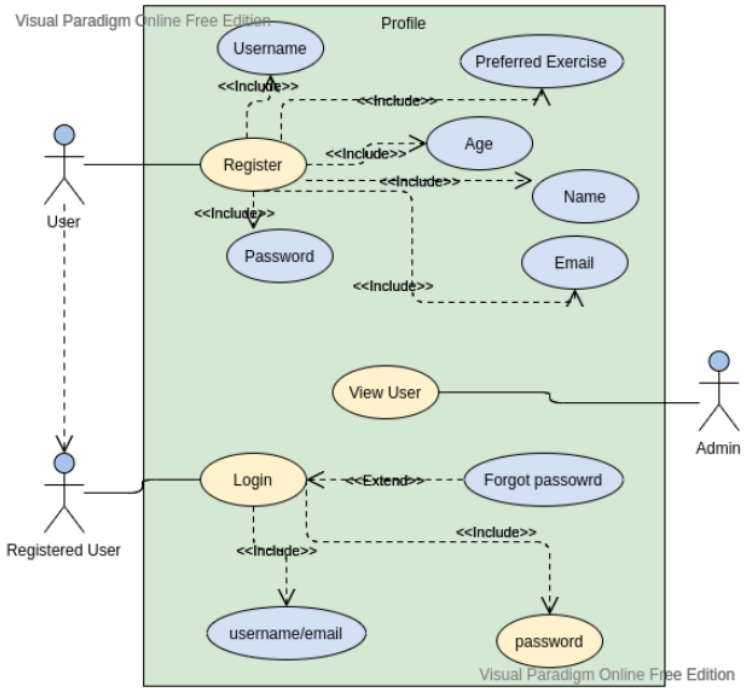


Figure 4.4 - Registration use case Diagram

4.5.4 Feedback

User can give feedback about the exercise and admin can see it and do act according. Like to improve or to add new exercise.

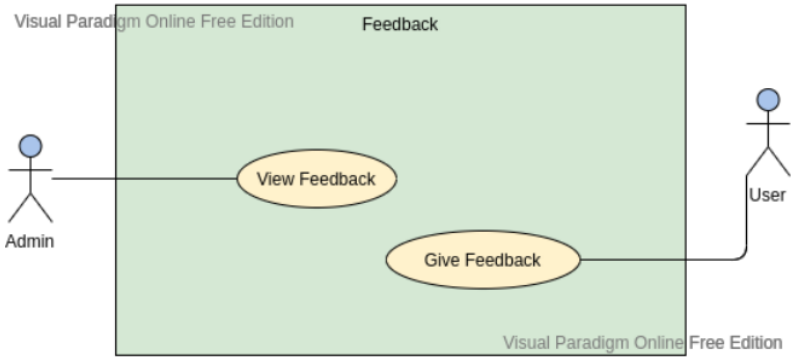


Figure 4.5 - Feedback use case Diagram

4.5.5 User Exercise Report

User can also generate the report of its exercises and can download it or delete the report.

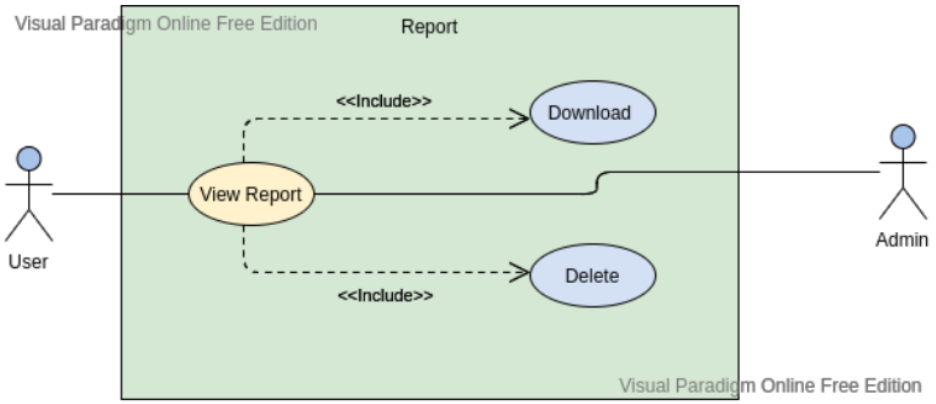


Figure 4.6 – User exercise report use case Diagram

4.5.6 API

Basically, the video is sent to the server is through the API. The video is sent through the A API pi and can also receive through the flask API. When the server receives the video, it processes and then API receive it.

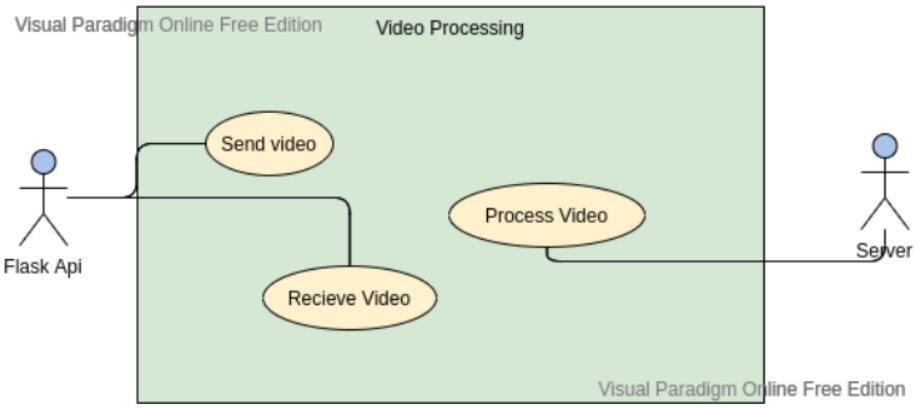


Figure 4.7 – API use case Diagram

4.5.7 User and API Use Case

The interaction of the user with the API is shown below in the sequence diagram.

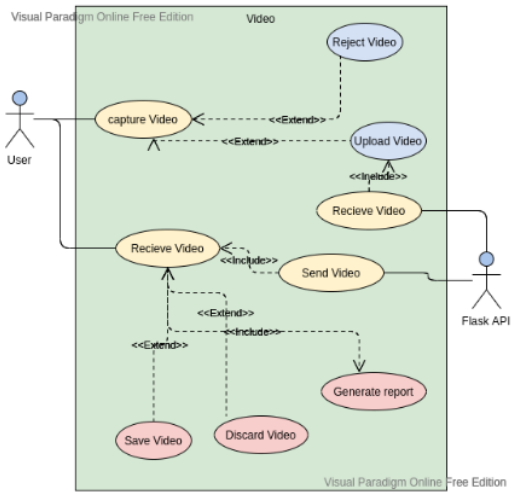


Figure 4.8 – User and API use case Diagram

4.5.8 Complete System

The complete Use-Case scenario of the system with all entities like User, Admin, and API, shown in Figure 4.9 as below.

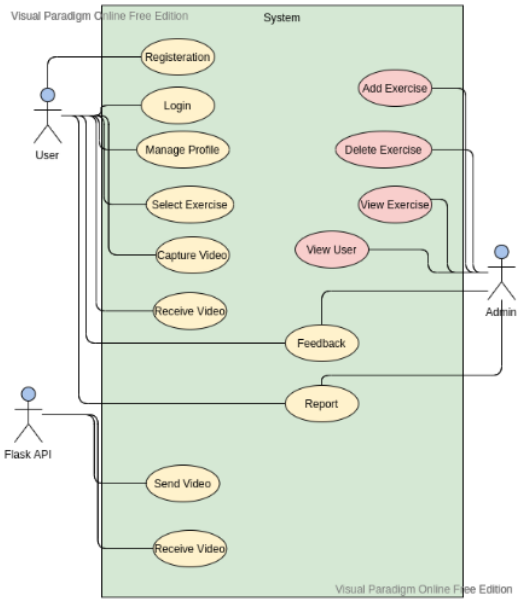


Figure 4.9 – Complete System Use Case Diagram

4.6 Entity Relationship Diagram

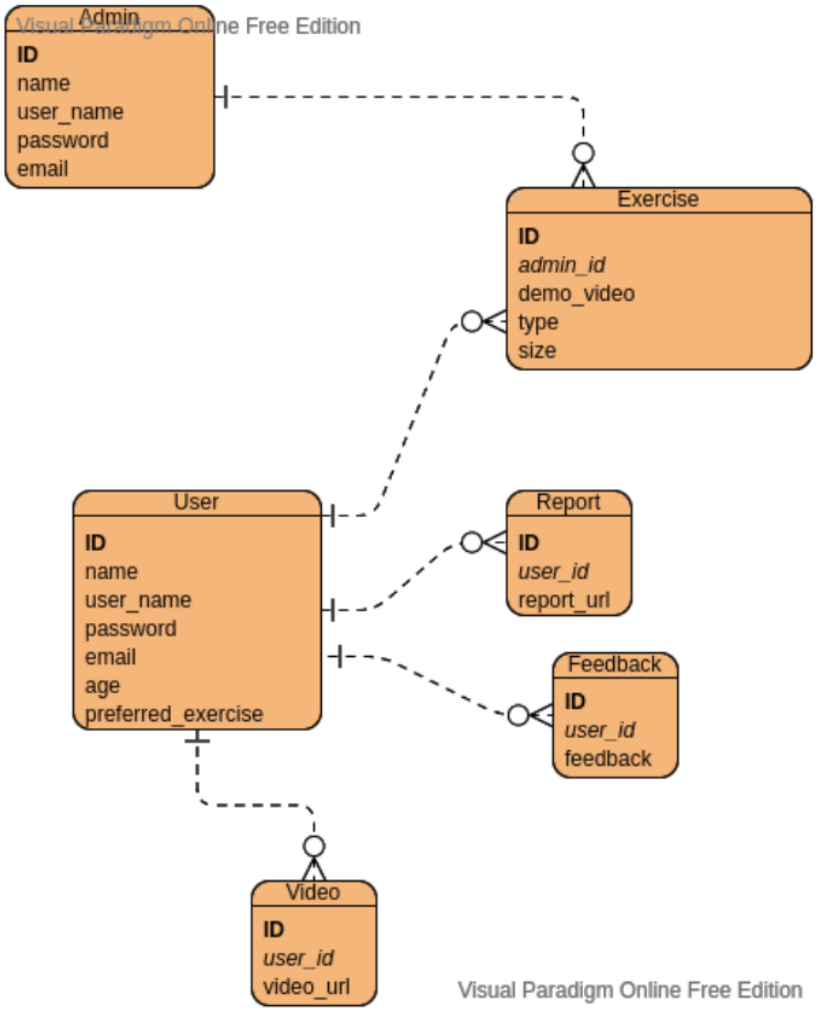


Figure 4.10 – Entity Relationship Diagram

Description of the Entities and their relationship of all the entities of the system are shown in Figure 4.10 above.

Chapter 5

Architecture Design

5.1 Architecture

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 Admin and User can interact with the system. Admin/User can simply use the system by entering login details.

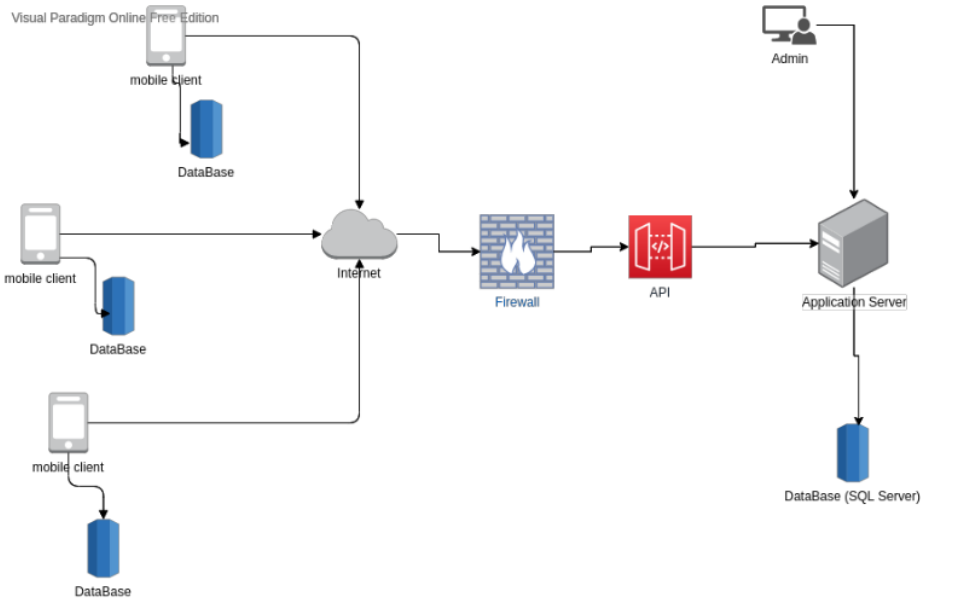


Fig. 5.1. System Architecture

5.3 Sequence Diagrams

5.3.1 Admin Sequence Diagram

This describes the "Admin" sequence that is how admin perform functions and their response from the server.

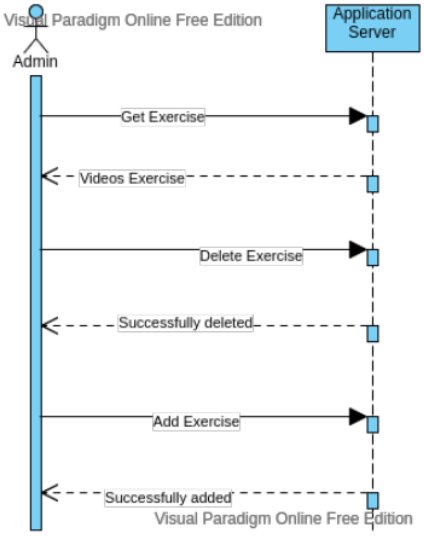


Fig. 5.2. Admin Sequence Diagram

5.3.2 Registration Sequence Diagram

The process of registration in the sequence diagram.

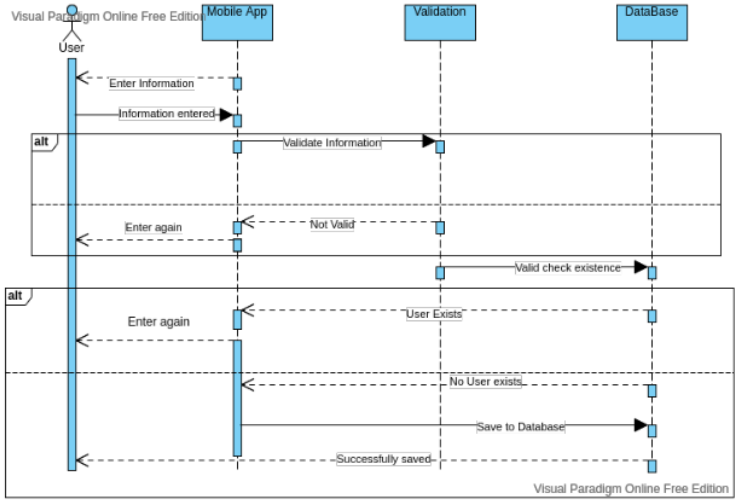


Fig. 5.3 Registration Sequence Diagram

5.3.3 Login Sequence Diagram

This shows the process of login system that firstly user enter the email then password, the sequence of that event is shown in Figure 5.4.

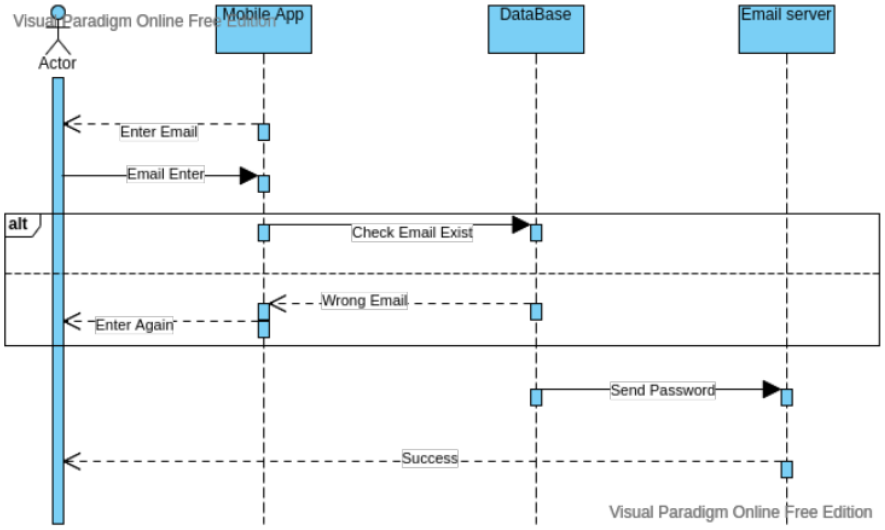


Fig. 5.4. Login Sequence Diagram

5.3.3 Forget Password Sequence Diagram

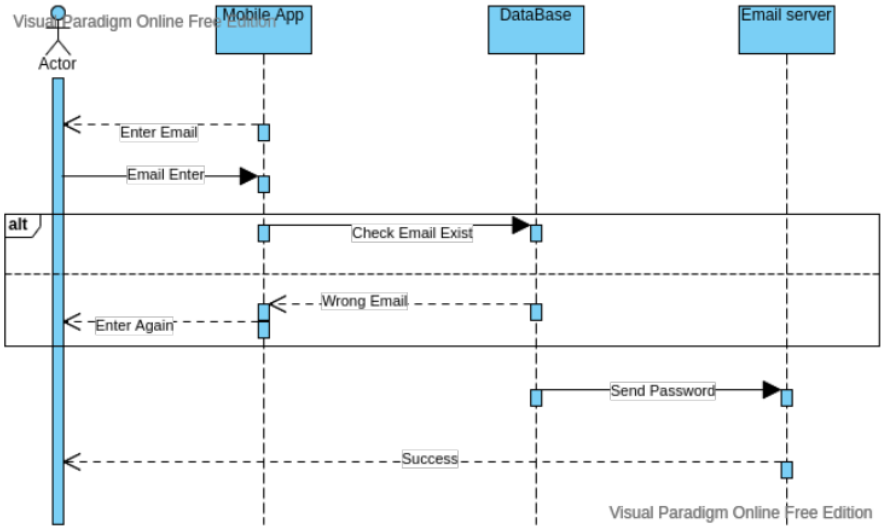


Fig. 5.5. Forget Password Sequence Diagram

5.3.4 Video Capture

This shows the how the user captures the video and send it to the server through API Figure 5.6

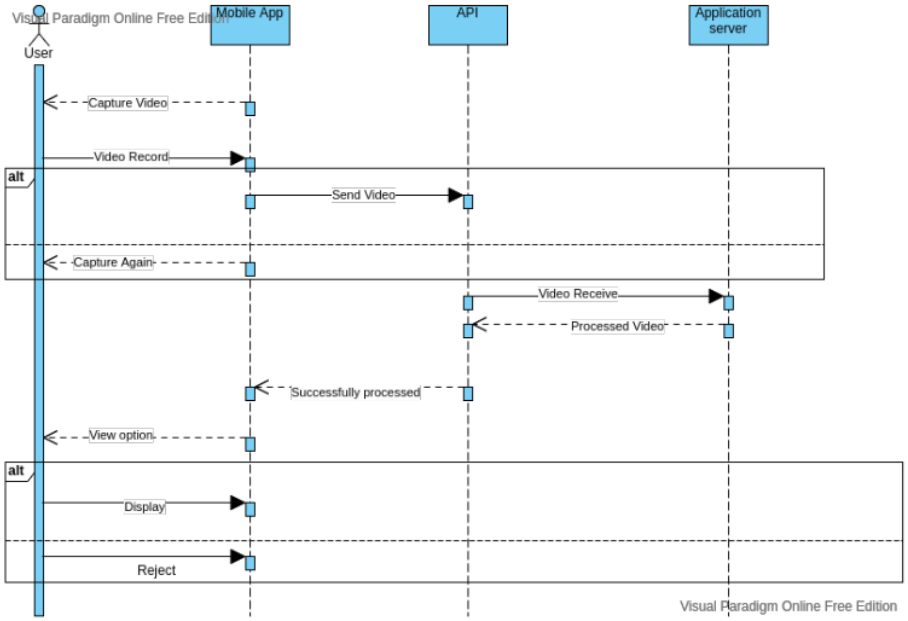


Fig. 5.6. Video Capture sequence diagram

5.3.5 User Report Sequence Diagram

This shows that how the user view and download the report of its exercises in Figure 5.7 below.

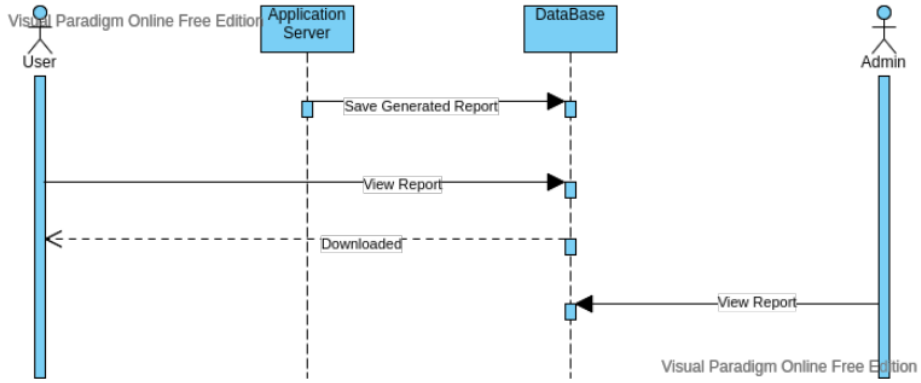


Fig. 5.7 User Report Sequence Diagram

5.3.6 Feedback Sequence Diagram

This shows the how the User enter the feedback and the admin view the feedback from the database in Figure 5.8 below.

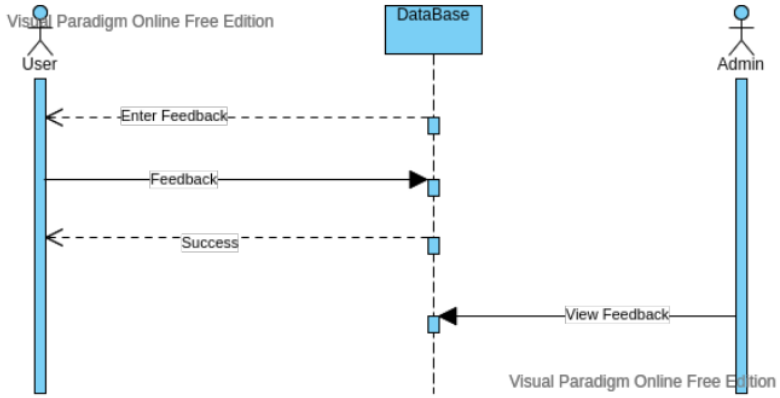


Fig. 5.8 Feedback Sequence Diagram

5.4 Activity Diagrams

5.4.1 Admin Activity Diagram

This figure describes the "Admin" Activity Flow that is how admin perform sign in. He/she enters the username and password, which then validates further and if match found then the Admin Page Loads, in Figure 5.9 below.

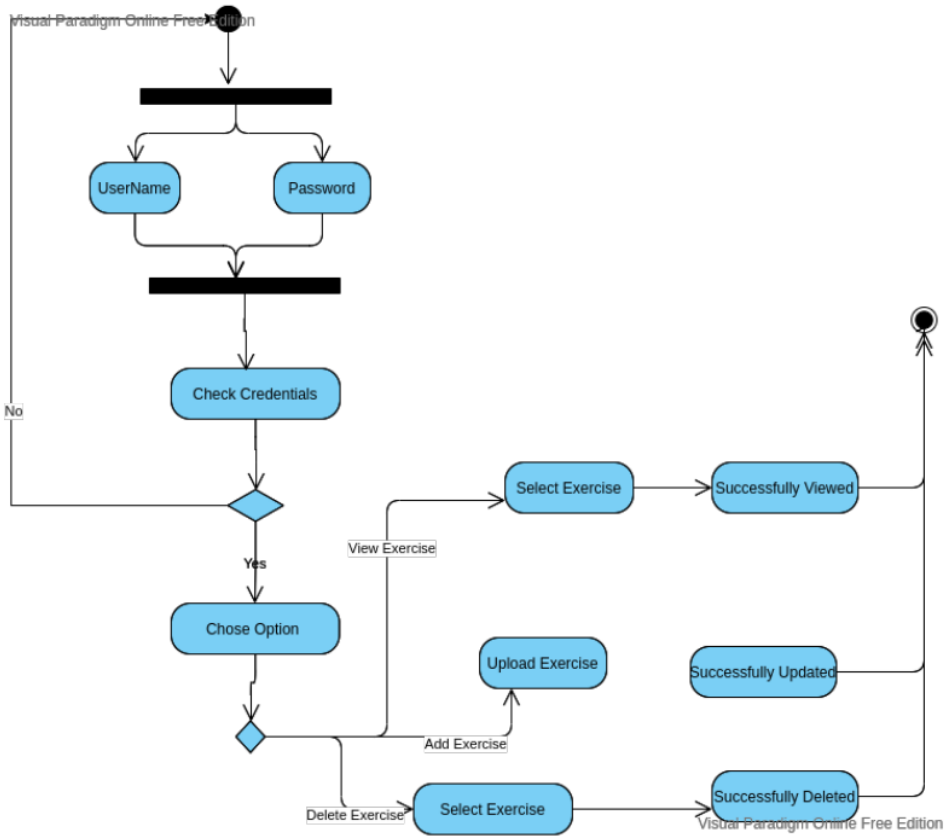


Fig. 5.9 Admin Activity Diagram

5.4.2 Admin feedback Activity Diagram

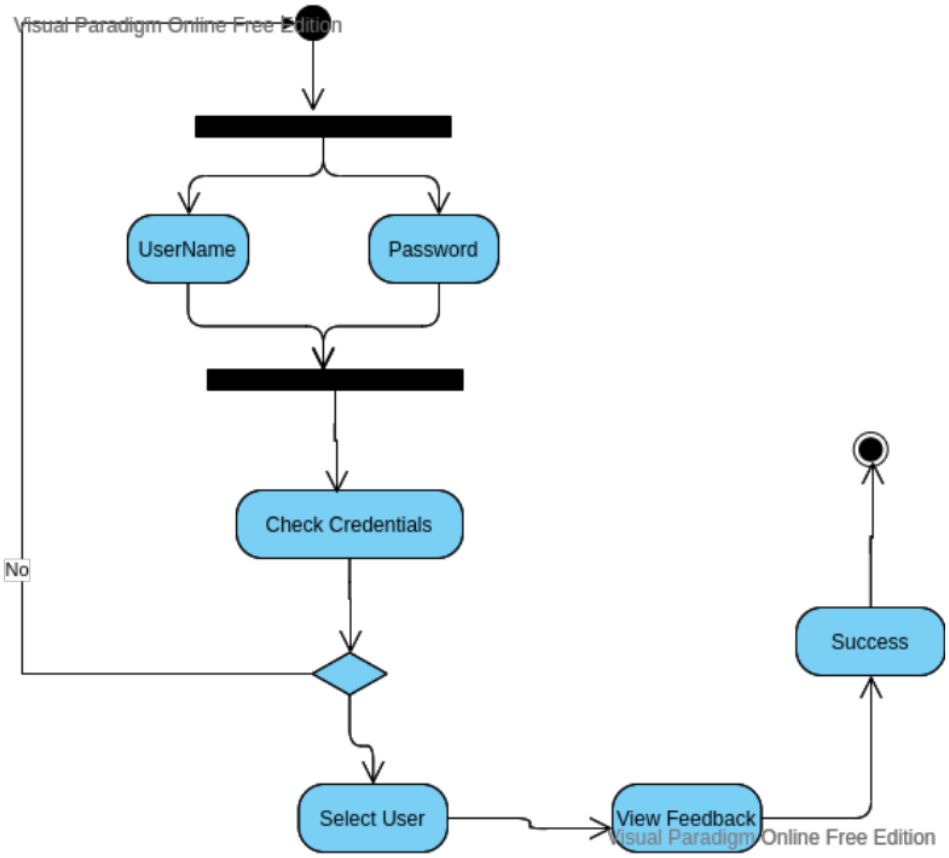


Fig. 5.10 Admin feedback Activity Diagram

5.4.3 User feedback Activity Diagram

This describes the “Sub-Admin” sequence that is how sub-admin perform sign in. He/she enters the username and password, which then validates further and if match found then the Sub-Admin Page Loads, in Figure 5.11 as below.

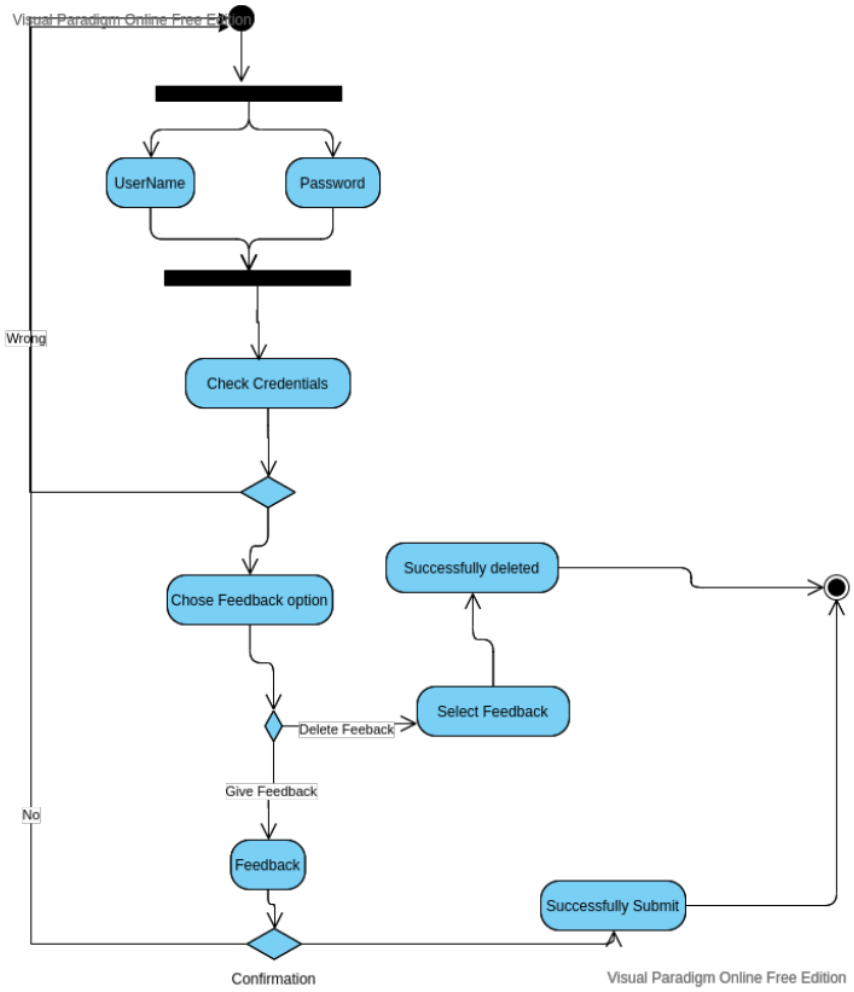


Fig. 5.11 User feedback Activity Diagram

5.4.4 Forget Password Activity Diagram

This shows the how the Sub-Admin updates his password. Sub-Admin will enter the username, old password, new password that will gathered by them which the need to update. Sub-admin will enter username that will validates then and if match found it will update that sub-admin password from the databases in Figure 5.12 as below.

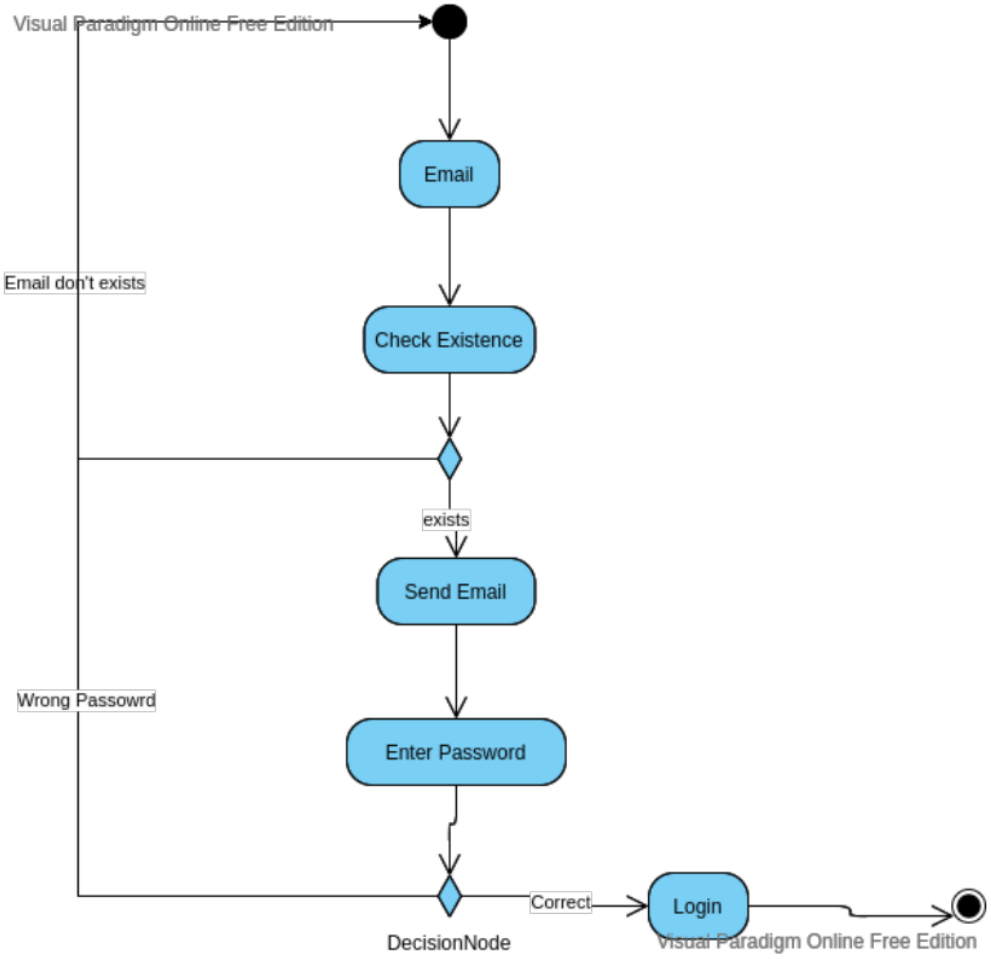


Fig. 5.12 Forget Password Activity Diagram

5.4.5 Login Activity Diagram

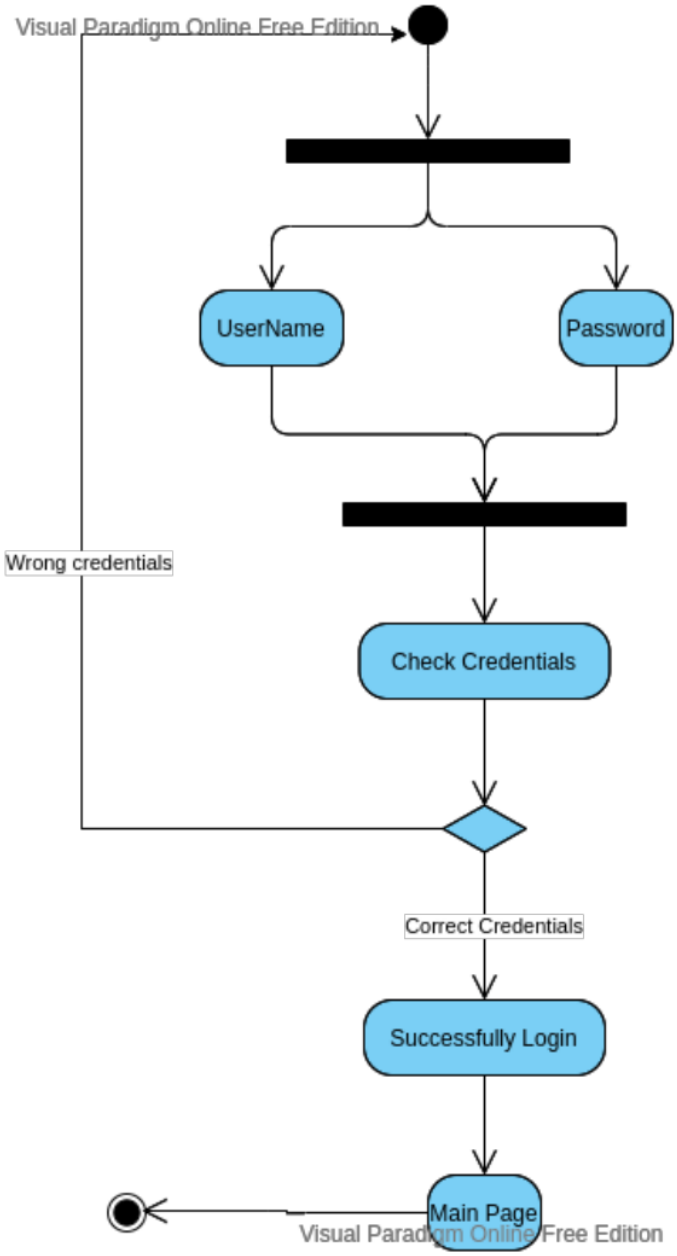


Fig. 5.13 Login Activity Diagram

5.4.6 Register User Activity Diagram

This shows the how the admin creates the account of a sub-admin. First admin will sign-in in the system, then Admin will enter the details of sub-admin like the one username that will validates and then admin enters sub-admin's username and password in Figure 5.14 as below.

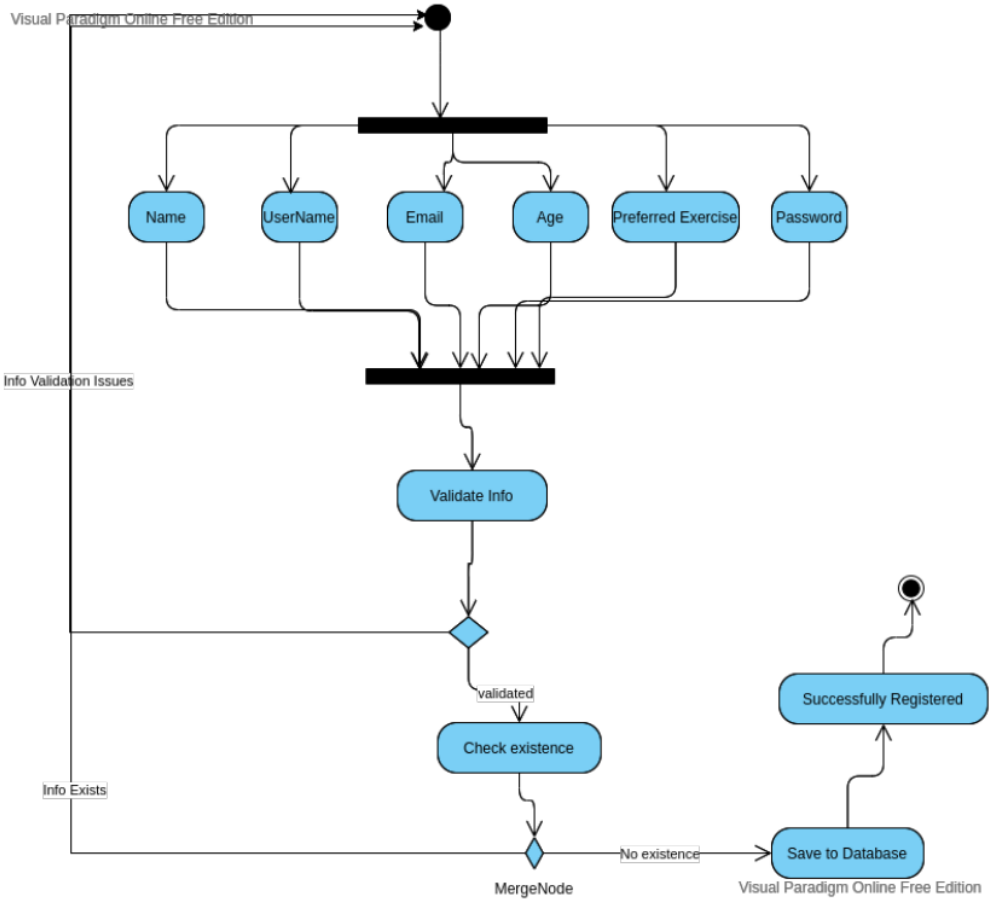


Fig. 5.14 Register User Activity Diagram

5.4.7 User Report Activity Diagram

This shows the how the admin creates the account of a student. First admin will sign-in in the system, then Admin will enter the details of student like the one registration that will validates and then admin enters student full name, registration, class. Then store it into the database in Figure 5.15 as below.

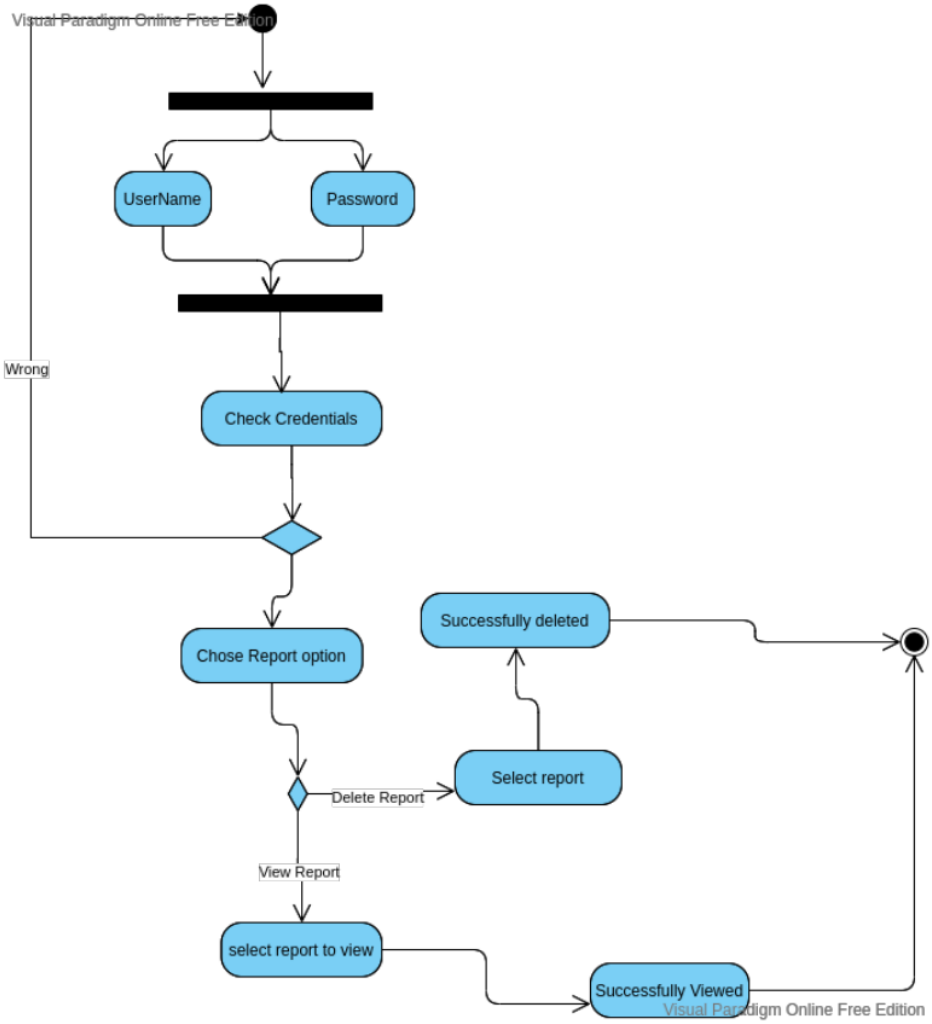


Fig. 5.15 User Report Activity Diagram

5.4.8 Report Admin Activity Diagram

This shows that how the admin marks the attendance into the database. First admin will sign-in in the system, then software will send the current time, day, and camera id either to database to validate that there is class scheduled or not at this time. If it returns true, then it will send student list and class name to mark attendance in their appropriate class table. In addition, data is stored into the database in Figure 5.16 as below.

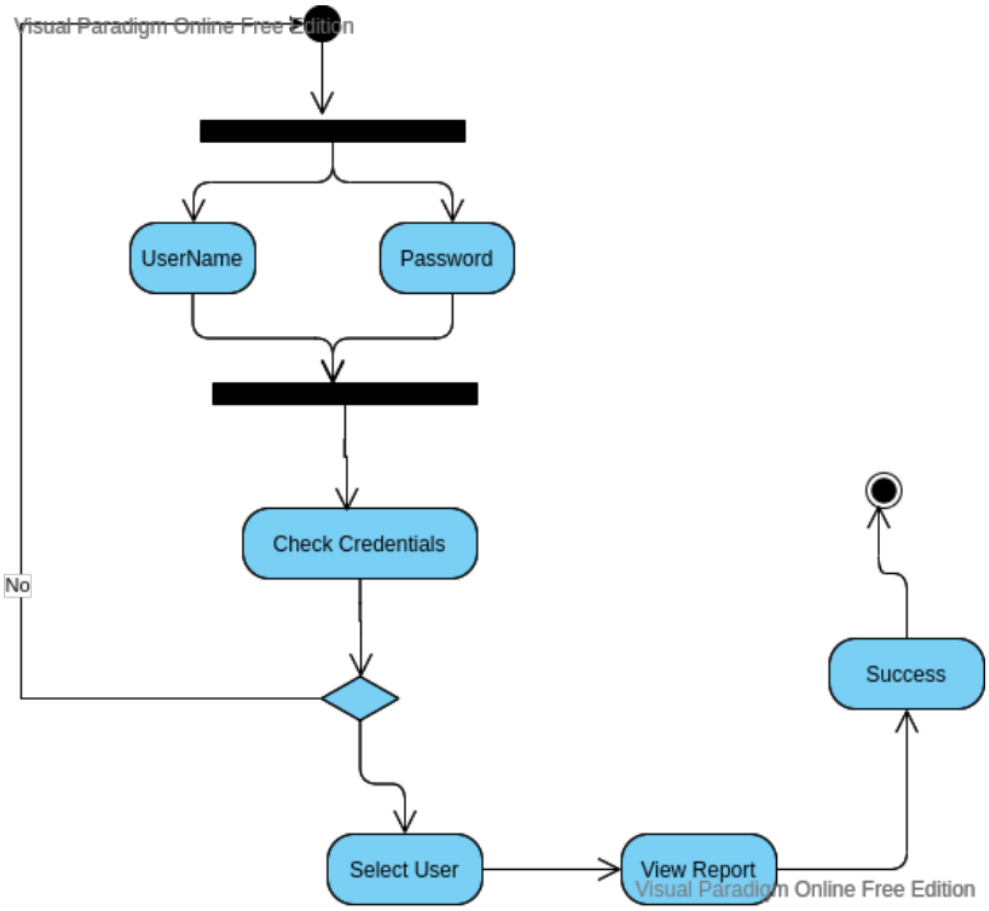


Fig. 5.16 Repost Admin Activity Diagram

5.4.9 Update User Credentials Activity Diagram

This shows the how the Admin creates the account of a teacher. First admin will sign-in in the system, then Admin will enter the details of teacher like name that will validates and then admin enters student full name and department name. In addition, after this, the data will be saved into the database in Figure 5.17 as below

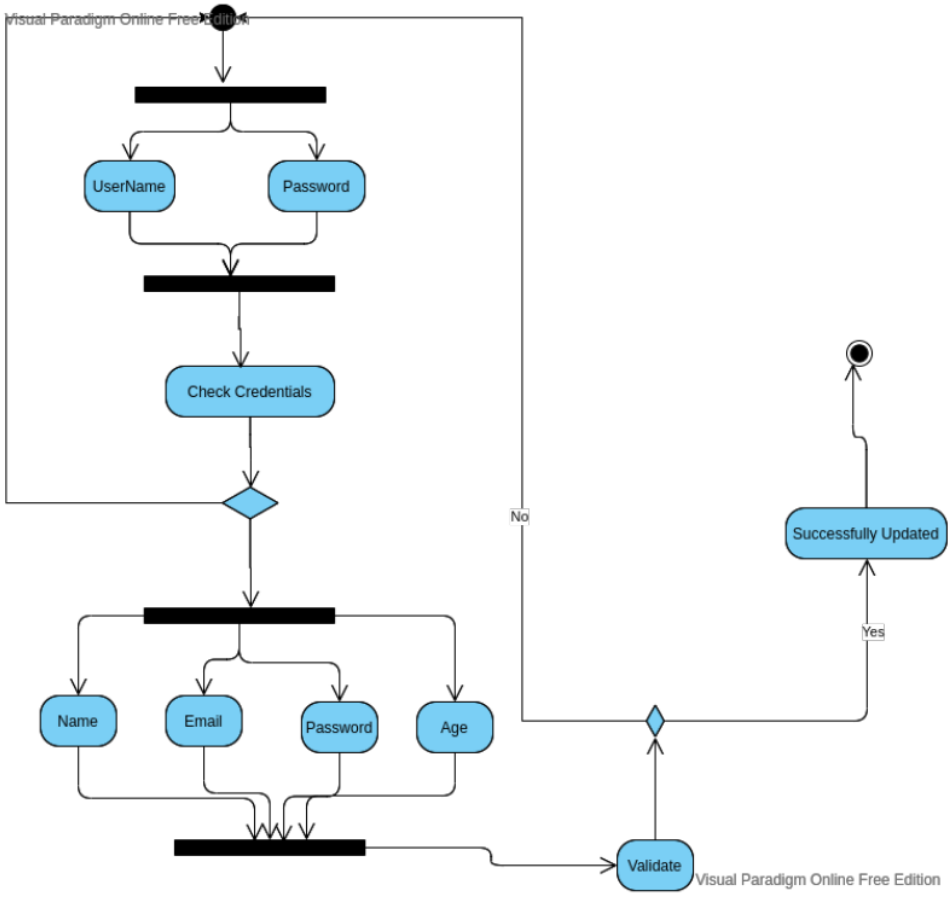


Fig. 5.17 Update User Credentials Activity Diagram

5.4.10 Video Capture Activity Diagram

This shows the how the Admin register a new course. Admin will enter the details of course like course code and title. Then after validating the data will be saved into the database in Figure 5.18 as below.

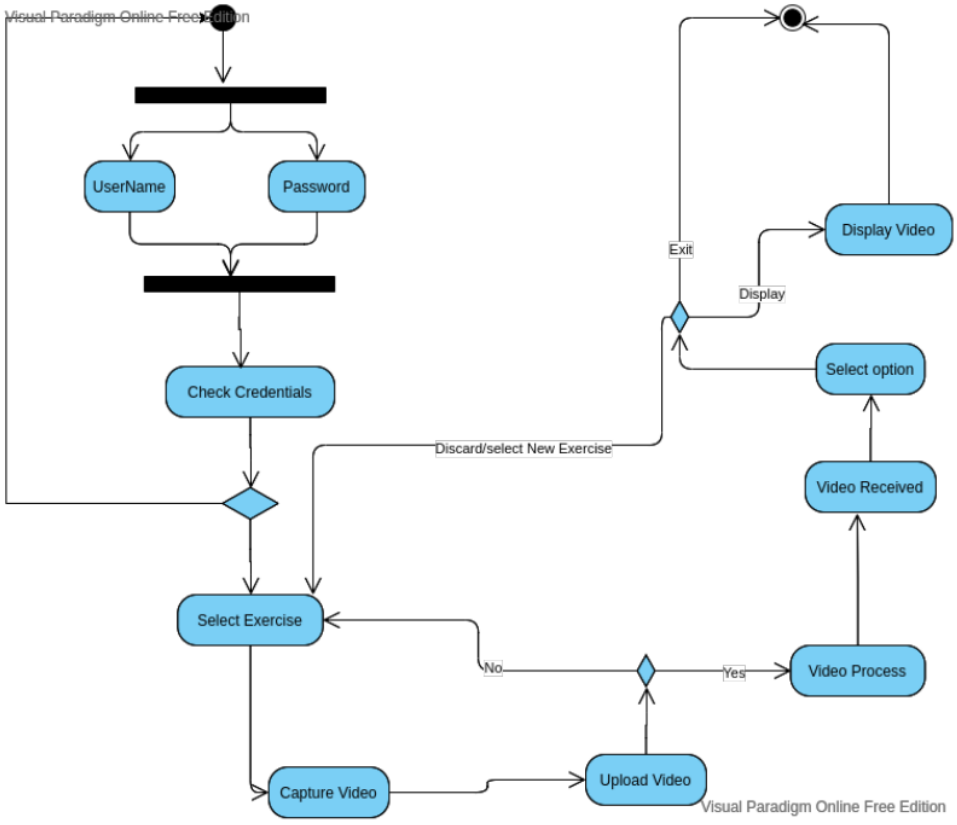


Fig. 5.18. Video Capture Activity Diagram

Chapter 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 tested by providing different inputs and results of these inputs are matched with supposed outcomes.

6.2.1 Sign-In Test Case

Login can be performed by user. Therefore, figure 6-1 shows the GUI, in which the entity will enter the user name and password to login. We will see some test cases of the current case in Table 6-1.

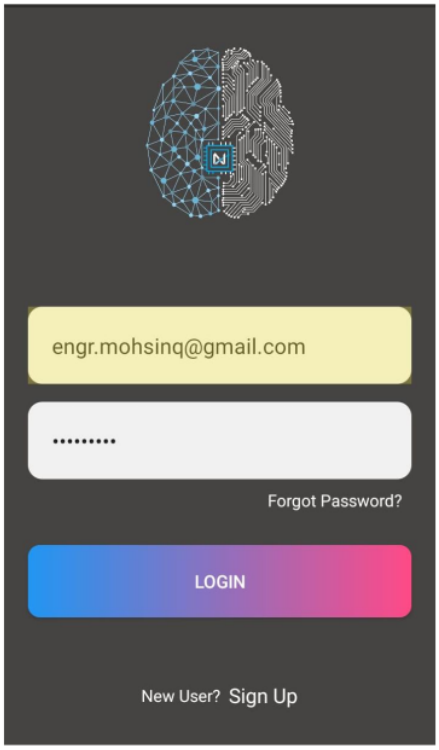


Fig. 6.1. Sign-In Test Case

Test Case	Test Scenario	Test Steps	Test Data	Result	Pass/Fail
1	Enter invalid Username	Enter Username, Password	email= engr.mohsinq@gmail.com Password= 1234567	Error: invalid username	Pass
2	Enter valid Username and password	Enter Username ,Password	email= engr.mohsinq@gmail.com Password= 1234567	Login successful	Pass
3	Enter invalid password	Enter Username ,Password	email= engr.mohsinq@gmail.com Password= abc123	Error: invalid password	Pass

Table. 6.1. Sign-In Test Case Table

6.2.2 Sign-up Test Case

Signup can be performed by User. Therefore, figure 6-1 shows the GUI, in which the entity will enter the user name and password to login. We will see some test cases of the current case in Table 6-1.

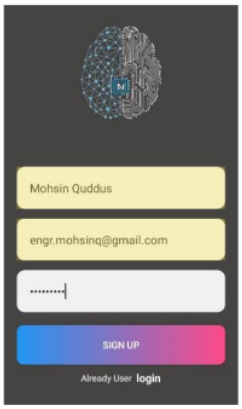


Fig. 6.2 Sign-up Test Case

Fig. 6.3 Sign-up Test Case result

6.2.3 Select Exercise Test Case

Select Exercise can be performed by user. Therefore, figure 6-1 shows the GUI, in which the user first selects the exercise then demo is shown on screen.

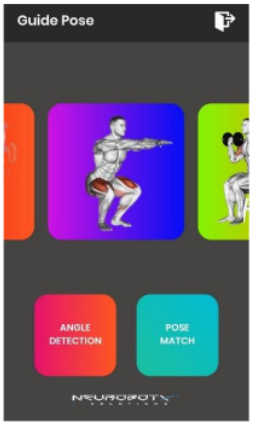


Fig. 6.4 Select Exercise Test Case

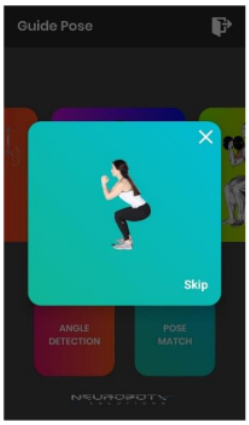


Fig. 6.4 Select Exercise Test Case result

Chapter 7

User Manual

7.1 Interface

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

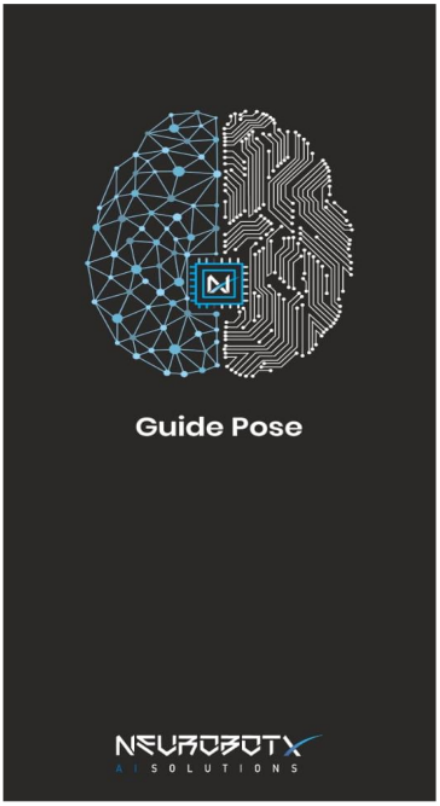


Fig. 7.1 Splash Screen

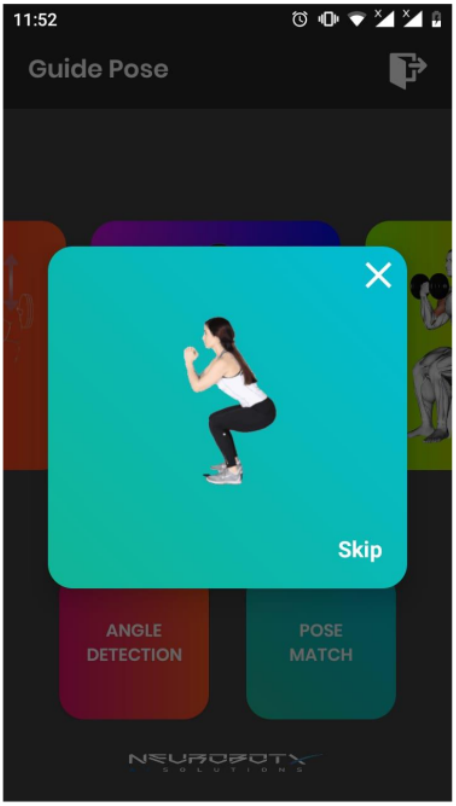


Fig. 7.2 Exercise Demo

7.1.1 Sign up & Login Interface

Sign in interface for the users, user can enter email name and password to create account in this application database after that user can login to use the functionalities of the application shown in Figure 7-1.

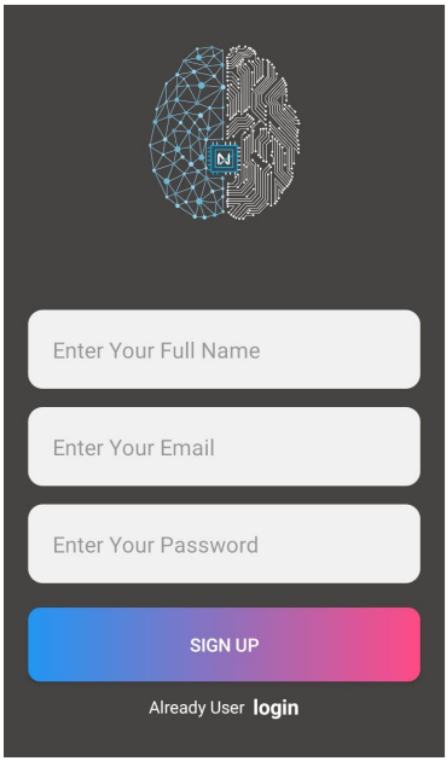


Fig. 7.3. Sign-up Login Interface

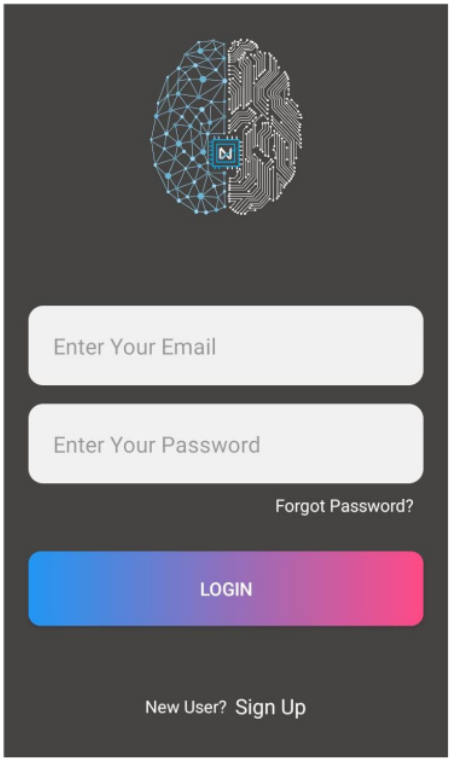


Fig. 7.4 Login Interface

7.1.2 Forget Password Interface

User can reset the password of the application after clicking forget password and provide your email and the code is send to the email and the user can reset the password.

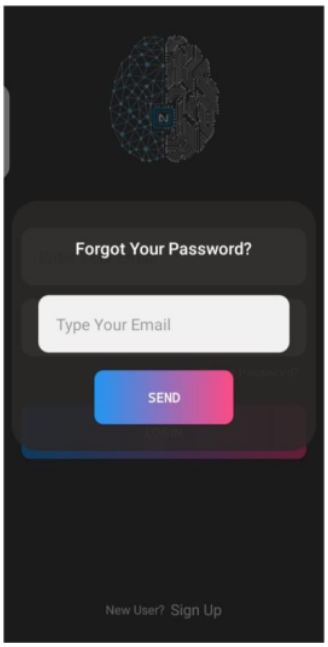


Fig. 7.5. Forget Password Interface

7.1.3 Select Exercise Interface

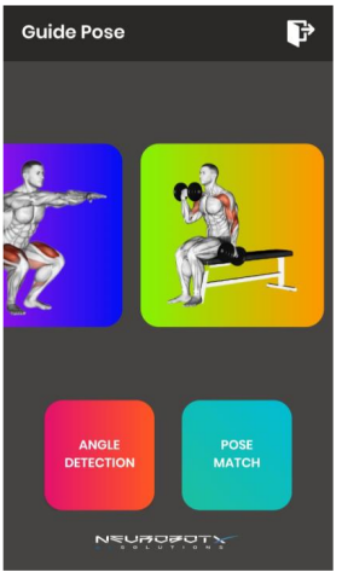


Fig. 7.6. Select Exercise Login Interface 1

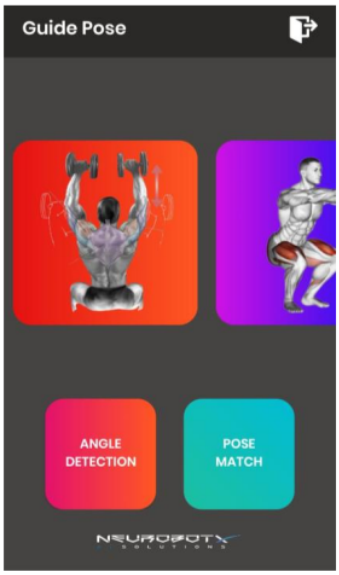


Fig. 7.7 Select Exercise Login Interface 2

In the above screen shots, the user can select the application type by clicking on the icons and then camera is open by the application and video us made then the video is send for the processing.

8 Summary

In this era of efficiency and performance machines and systems tends to be better and faster. Everything is being automate and self-aware for making lives easy and better than before. One day we are working on computer vision and found a great idea of using computer vision latest technique pose estimation in a way that we can produce a product that can change the future of body fitness. It's was a very vast about the pose estimation of human body. Pose estimation is a computer vision technique that predicts and tracks the location of a person in an image or video. We can also think of pose estimation as the problem of determining the position and orientation of a camera relative to a given person and we done it by identifying, locating, and tracking a number of Key Point's on a given person. This project is designed to tackle with the wrong angle exercise problem. Doing exercise in the wrong way not benefit the body at all, but it may cause a lot of injuries. And it may cause the player to permanent loss to its physical body part. An automated pose estimator system will be helpful for the workout users that they do not have to hire trainer. The application in their mobile helps the user to exercise anytime anywhere. The points that return from the model are used get angle of different joints and then the angles are used to predict the correct angles for specific exercises. To obtain the human body points we experiment different models like openpose, Fastpose, alphapose, alphapose by GluonCV and at last Mediapipe by google. After experimenting all these models, we are using Mediapipe. After using the model, we use hardcoded angles to combine from the angles get out after the points from the model, if the angle is correct we are communicating the user from the green or pink color that the angle is correct and if the angle is wrong red color is used for the wrong line of the skeleton. From this way the app communicates with the user and tells the right and wrong angles and user do workout without any hesitation of muscle issue due to wrong angles exercise.

9 Reference

- ✓ “Incremental Model in SDLC: Use, Advantage & Disadvantage.” https://www.guru99.com/what-is-incremental-model-in-sdlc-advantages disadvantages.html (accessed Aug. 23, 2020).
- ✓ "FastPose GitHub Directory." https://github.com/ZexinChen/FastPose
- ✓ "Fastpose Main Page." https://drnoodle.github.io/fastpose_html/
- ✓ "Alpha Pose GitHub Directory. " https://github.com/MVIG-SJTU/AlphaPose
- ✓ "GluonCV Alphapose." https://cv.gluon.ai/build/examples_pose/demo_alpha_pose.html#sphx-glr-build-examples-pose-demo-alpha-pose-py
- ✓ "Mediapipe Framework Page." https://google.github.io/mediapipe/
- ✓ "Openpose GitHub Link" https://github.com/CMU-Perceptual-Computing-Lab/openpose
- ✓ “Mean accuracy Precision” https://towardsdatascience.com/breaking-down-mean-average-precision-map-ae462f623a52
- ✓ "Accident Statistics" https://www.legalmatch.com/law-library/article/gym-accident-statistics.html

report

ORIGINALITY REPORT

13%	9%	1%	8%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.verywellfit.com Internet Source	2%
2	cs.ntu.edu.pk Internet Source	1%
3	www.coursehero.com Internet Source	1%
4	www.fritz.ai Internet Source	1%
5	towardsdatascience.com Internet Source	1%
6	Submitted to Texas A & M University, Kingville Student Paper	1%
7	Submitted to Visvesvaraya Technological University Student Paper	1%
8	www.geeksforgeeks.org Internet Source	<1%
9	Submitted to Higher Education Commission Pakistan	<1%

Student Paper

10	Submitted to Monash University Student Paper	<1%
11	Submitted to University of Greenwich Student Paper	<1%
12	Submitted to University of Hong Kong Student Paper	<1%
13	Submitted to University of Moratuwa Student Paper	<1%
14	Serign Modou Bah, Fang Ming. "An improved face recognition algorithm and its application in attendance management system", Array, 2020 Publication	<1%
15	www.legalmatch.com Internet Source	<1%
16	dspace.up.edu.ps Internet Source	<1%
17	Submitted to University of Bahrain Student Paper	<1%
18	hdl.handle.net Internet Source	<1%
19	Submitted to Kingston University Student Paper	<1%
	espace.library.uq.edu.au	

20	Internet Source	<1%
21	shoepursuits.com Internet Source	<1%
22	Submitted to Arab Open University Student Paper	<1%
23	Submitted to University of Bradford Student Paper	<1%
24	Submitted to University of London External System Student Paper	<1%
25	Submitted to Liverpool John Moores University Student Paper	<1%
26	Submitted to University of Ulster Student Paper	<1%
27	Submitted to Griffith College Dublin Student Paper	<1%
28	purehost.bath.ac.uk Internet Source	<1%
29	Submitted to Asia Pacific University College of Technology and Innovation (UCTI) Student Paper	<1%
30	Submitted to Segi University College Student Paper	<1%

31	"7 Detection and Management of Unexpected Incidental Pulmonary and Nonpulmonary Findings", Georg Thieme Verlag KG, 2018 Publication	<1 %
32	digitalcommons.unmc.edu Internet Source	<1 %
33	eprints.ru.ac.za Internet Source	<1 %
34	repository.its.ac.id Internet Source	<1 %
35	www.slideshare.net Internet Source	<1 %
36	eprints.uthm.edu.my Internet Source	<1 %

Exclude quotes	On	Exclude matches	< 3 words
Exclude bibliography	On		

report

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10

PAGE 11

PAGE 12

PAGE 13

PAGE 14

PAGE 15

PAGE 16

PAGE 17

PAGE 18

PAGE 19

PAGE 20

PAGE 21

PAGE 22

PAGE 23

PAGE 24

PAGE 25

PAGE 26

PAGE 27

PAGE 28

PAGE 29

PAGE 30

PAGE 31

PAGE 32

PAGE 33

PAGE 34

PAGE 35

PAGE 36

PAGE 37

PAGE 38

PAGE 39

PAGE 40

PAGE 41

PAGE 42

PAGE 43

PAGE 44

PAGE 45

PAGE 46

PAGE 47

PAGE 48

PAGE 49

PAGE 50

PAGE 51

PAGE 52

PAGE 53

PAGE 54

PAGE 55

PAGE 56

PAGE 57

PAGE 58

PAGE 59

PAGE 60

PAGE 61

PAGE 62

PAGE 63

PAGE 64

PAGE 65

PAGE 66

PAGE 67

PAGE 68

PAGE 69

PAGE 70

PAGE 71

PAGE 72