



YogAI - An AI based Yoga Trainer

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1. Introduction

1.1 Abstract

The importance of yoga is renowned worldwide and its health benefits, which were preached by ancient sages, have stood the test of time. Even though yoga is becoming preeminent, there are important challenges faced while doing yoga such as performing it with incorrect form, the classes being expensive and the shortage of time in our busy lives and it provides many users to practice users in a zero judgement environment which can make a huge difference for many to help gain their confidence as well. Artificial intelligence and Machine learning techniques exhibit promising solutions for human pose estimation.

Our reagent will be trained with help of expert yoga gurus and images of correct postures for every Asan there is and integrated into the app. This reagent will check the users technique to perform the asan through live feed and in case the user is unable to perform or wrongly performing the Asan the reagent will detect it and intimate the user with the right technique to correct the pose with an image of it. As of now there are not many applications of using the technology to work as a tutor specifically in the case of yoga. We surveyed the various technologies that can be used for pose estimation and concluded the best method based on the usability for the web application. We have made the application as user friendly as possible.

1.2 Aim

We aim to make an AI based platform which will teach the customers the different yoga asanas and will check if the asana is performed with correct postures or not , taking a live video as input. The platform will provide a complete guide for a full body yoga session with do's and don'ts.

1.3 Objective

- AI Model to identify if the posture of the aasan performed is perfect or not (output will most probably be in percentage format).
- Make it into an API which will be used in the later software.
- Create an intuitive platform which will train the user ,the yoga asanas and will eventually check if the asana selected is performed to perfection or not(taking live video as an input)

1.4 Purpose

People all over the world have been quarantined this past year or so ,which gave us the idea to implement something which could help us be fit in the comfort of our homes. What better than yoga for staying fit.

Yoga, in all of its forms, creates positive energy. As a result of practice, our mindset becomes positive. In an atmosphere of positive energy one becomes successful, and lives a life where powerful visions become reality.Yoga training has so many good health aspects from which a person can benefit. Considering the above scenario and the booming online fitness world ,this platform could be a great success if executed perfectly.

1.5 Scope

Yoga, being there for 1000's of years in our society, can be performed by anyone,of any age and condition.Being a very feasible option which can be done anywhere with limited resources, is a great exercise for mind and body. Gymming on the other hand requires equipment and proper guidance which when performed without ; results in major injuries.

2. Past work

Youtube has become a great platform for acquiring new skills on our own. But the content there is huge to identify if it's useful or not.

- Apps like Cult.fit provide live fitness sessions on yoga but lack one to one communication and scope to find if asanas performed are correct or not.
- Trainers on ZOOM and other video calling platforms charge too much for their time.

3. Problem Statement

Yoga is one of the most sought after activities in the world and with the pandemic coming lockdowns being imposed the number of people wanting to to practice yoga at home has only gone up exponentially for numerous reasons such as Raja yoga helps increase positivity, ability to focus on the task given at hand, be more self aware, etc. Power yoga helps boost one's immunity, posture, flexibility, lung capacity, etc . Yoga is not only limited to above but is a very vast practice and we are motivated to combine it with current technology to deliver it to each of us at our home

requiring very limited resources and cost can be very beneficial. Yoga can be dangerous if the steps are not performed as they should be. So beginners need to have some guidance while starting out to avoid any major injuries or side effects . Considering the below scenario and the booming online fitness world , our platform could be a great success if executed perfectly.



4. Process Model

4.1 Project Description for choosing the Model

Our project has too many modules to work with and since the AI world is constantly developing new resources , our requirement isn't clear at the start of the project. To make the AI model more and more efficient ,improvements have to be made with time. Flutter which we will use to make our app and web-app is comparatively a new technology with a lot of potential and scope. It is difficult to master in one go.

4.2 Choosing the Model

So considering the above points , we plan to go with Iterative Model in which we'll develop the app in iterations ,starting with the AI part .With the completion of the AI model ,we'll have a clear idea about what our app can do at the backend and can start working on the Flutter part after that.

4.3 Why not other Models

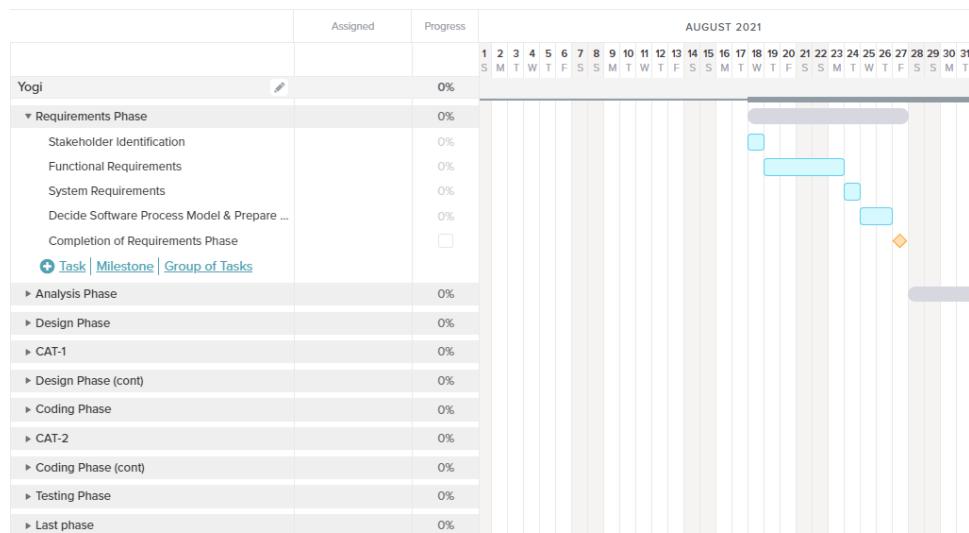
The major concern is the unclear project requirement .With limited knowledge in AI, making the backend at one go is very difficult, thus rejecting the idea of Waterfall

model and V-Model. Incremental Model was a good option but since our project doesn't have any stand-alone modules that can be released and used, we rejected the idea. As we identified all the risks at the start of the project, we don't require access to it at every iteration. Hence rejecting the Spiral model.

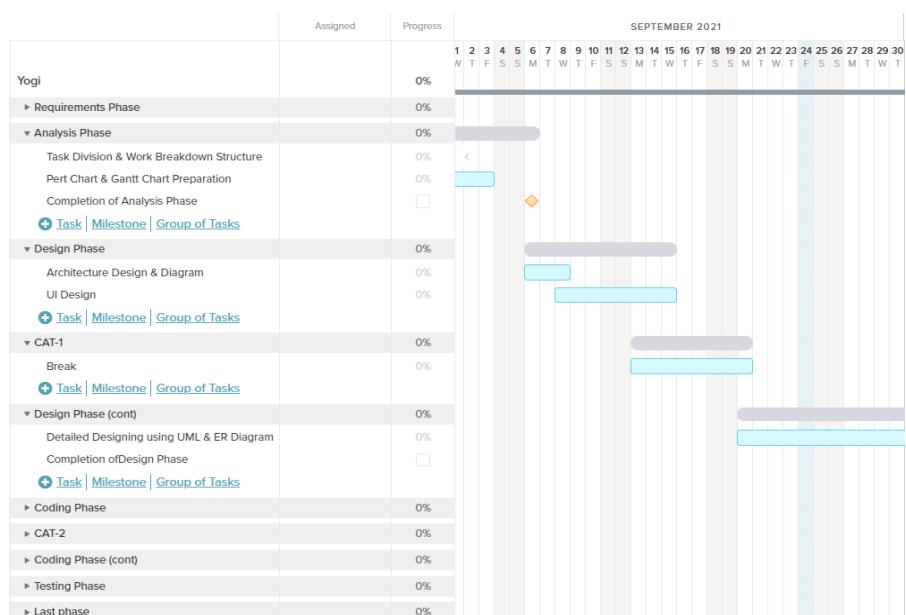
5. Project plan

5.1 Gantt Chart

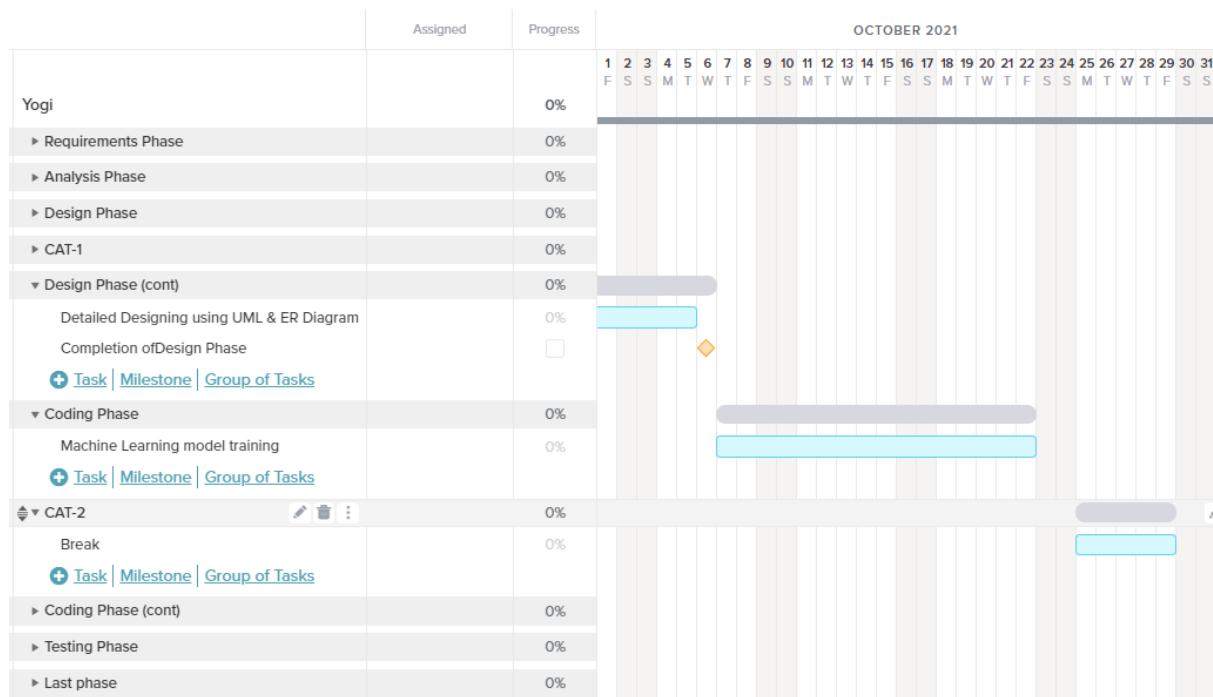
August



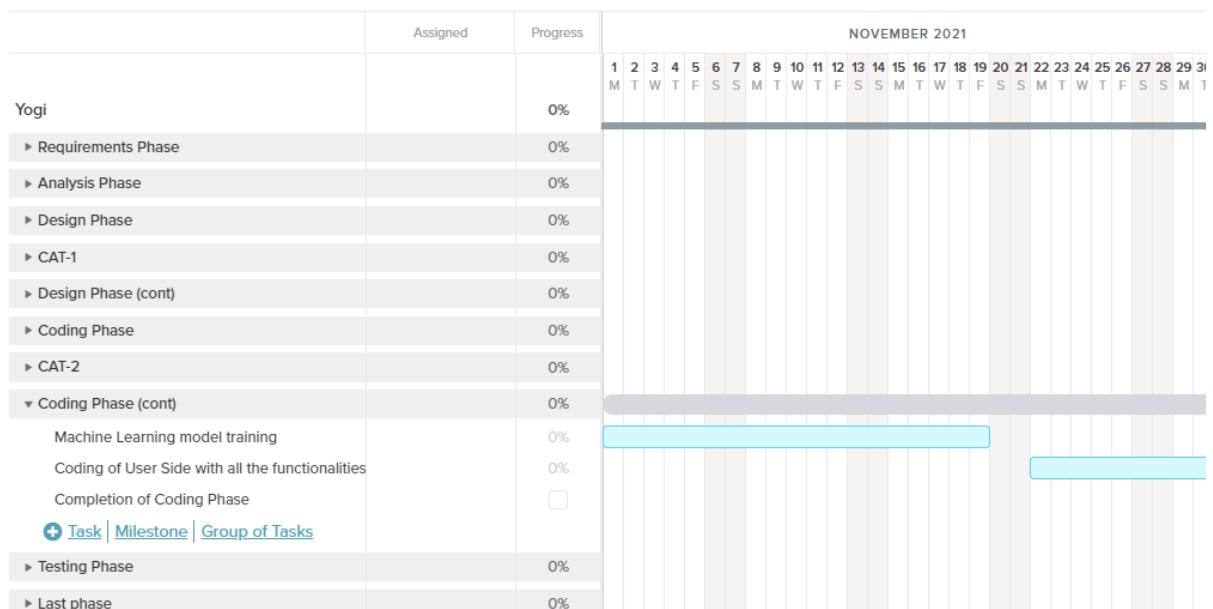
September



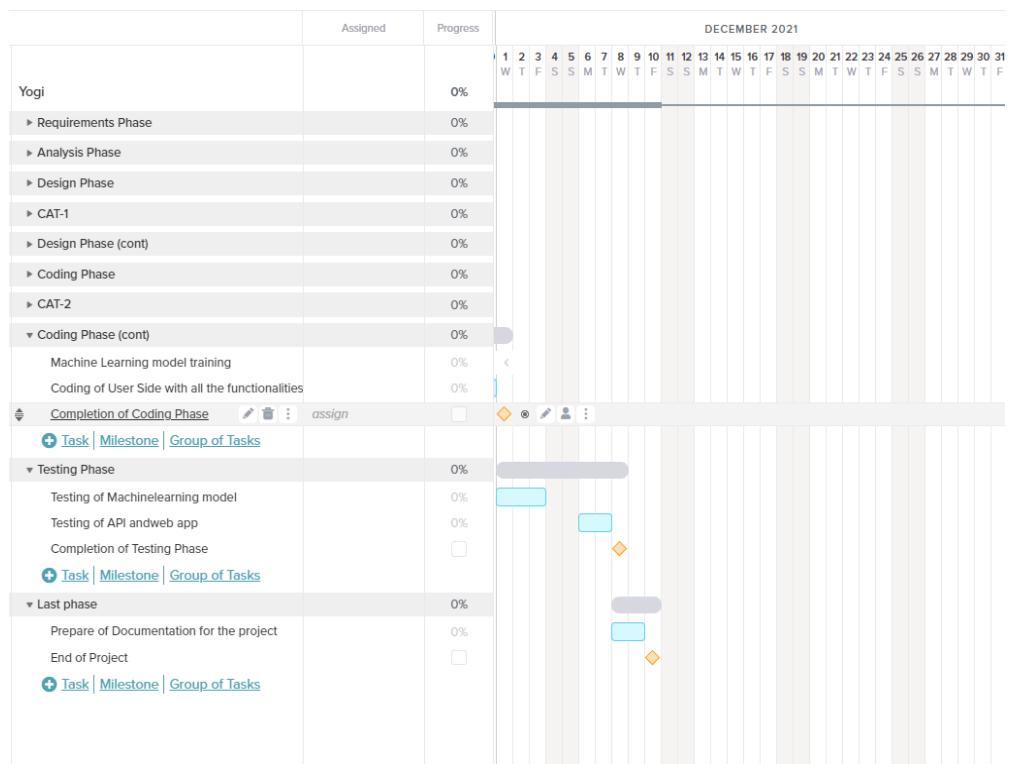
October



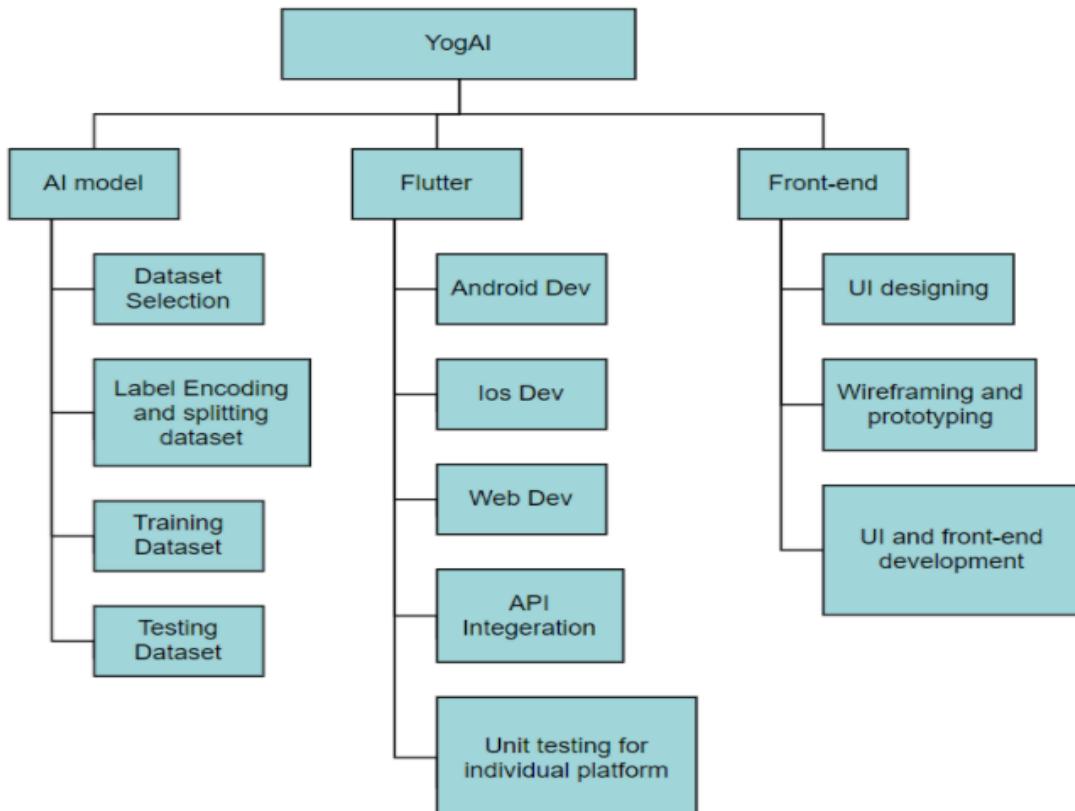
November



December



WBS



6. Requirements (Functional and non-functional)

6.1 Functional Requirements

- **User's password should be in encrypted form.**
- Should display invalid email/password combinations for unauthorized access.
- Should not allow multiple accounts with the same email id.
- Email id should be legitimate.

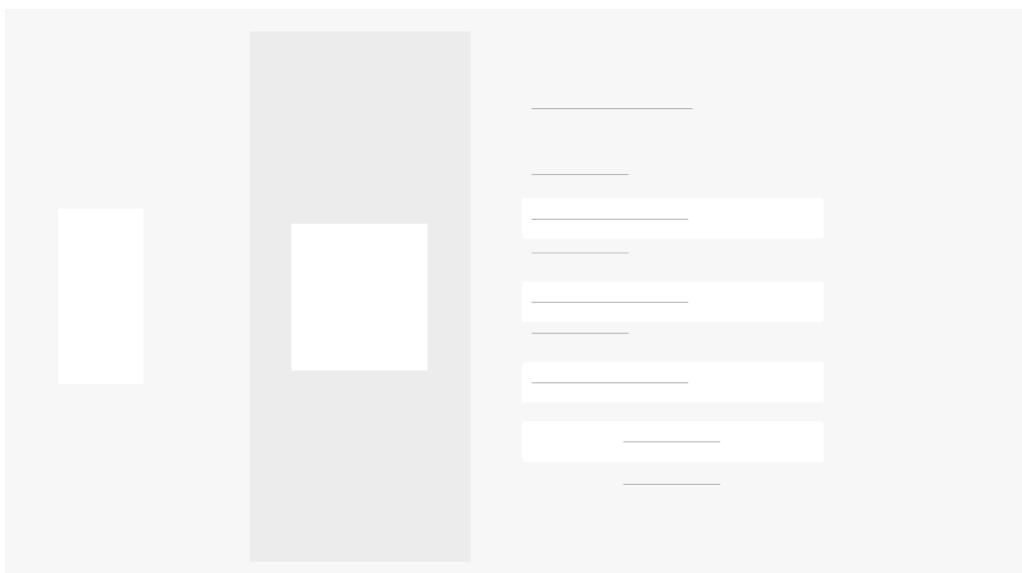
6.2 Non-Functional Requirements

- We have the following inexcusable performance requirements:.
- Average page load (from a user perspective) must be less than 500 milliseconds.
- Slowest page load cannot take more than 4 seconds.
- The app must be available almost 24*7.

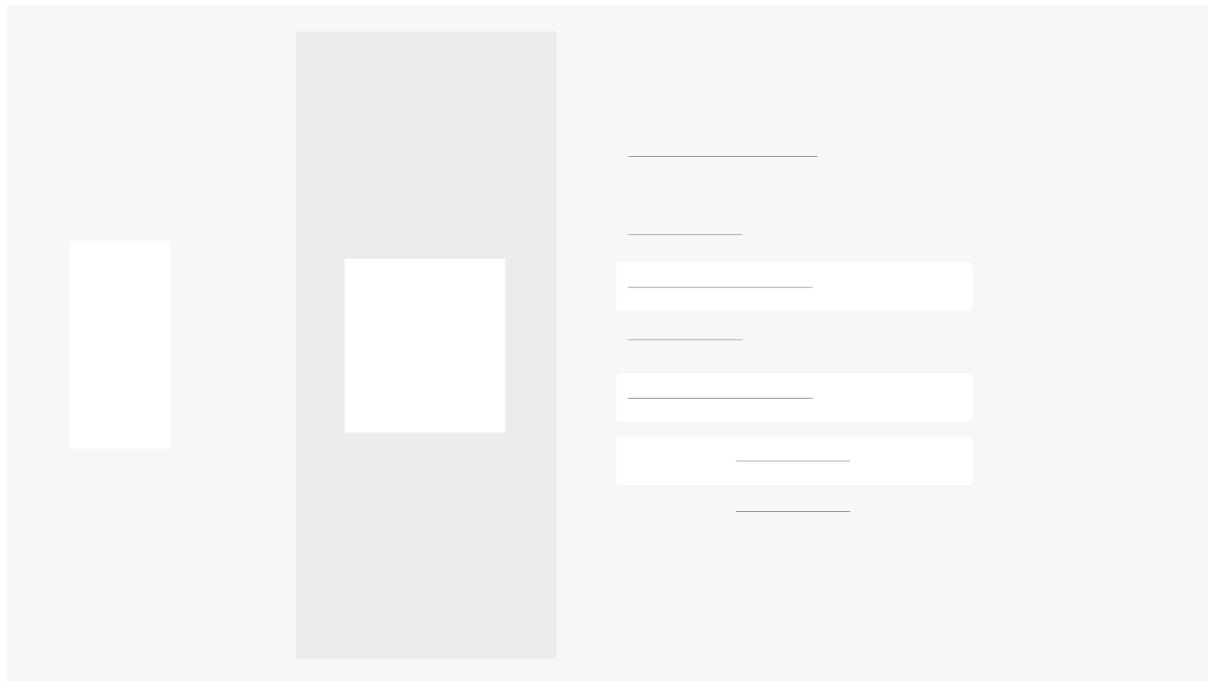
7. User Interface Design

7.1 Wireframe Design

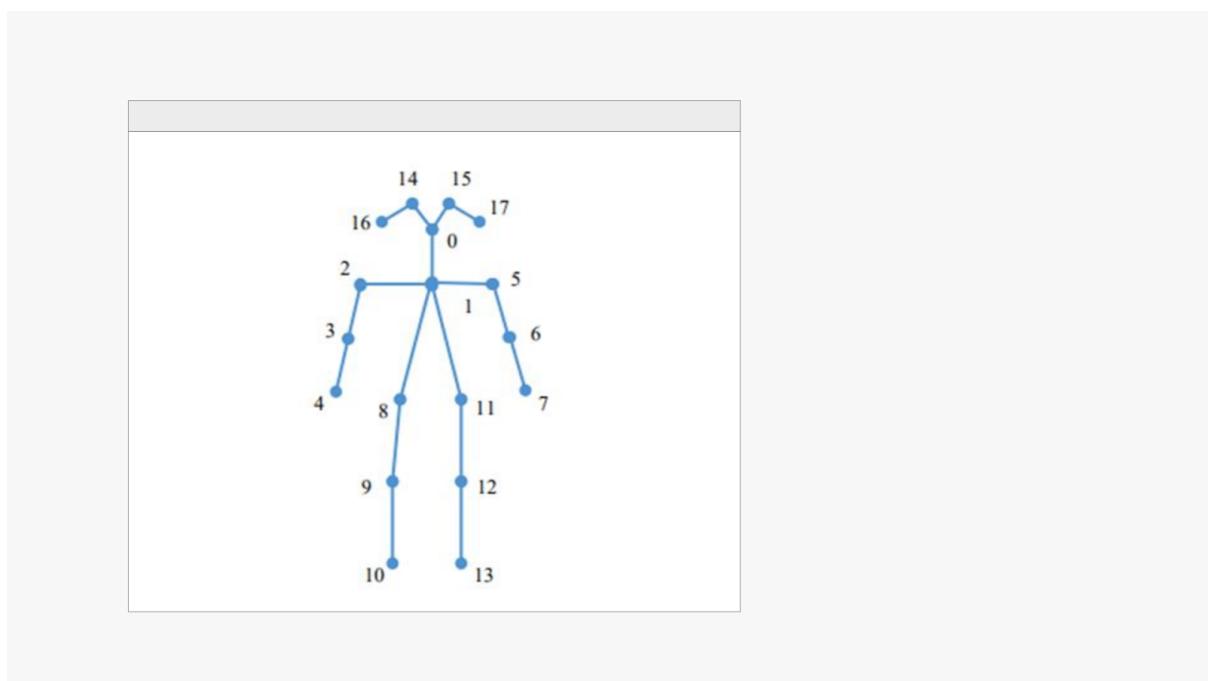
- **Sign Up Page**



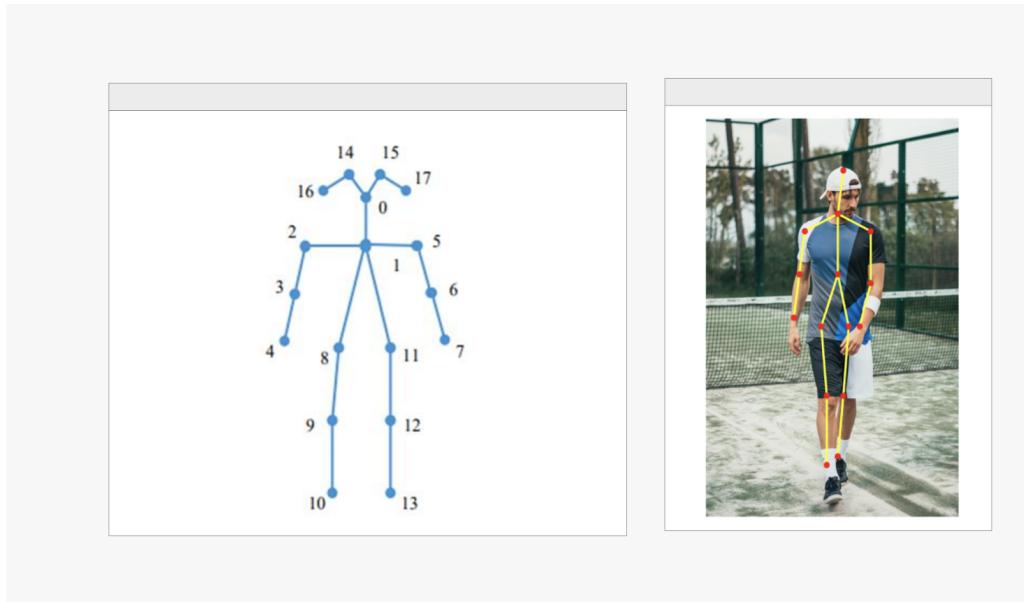
- **Login Page**



- **Opening video Camera**

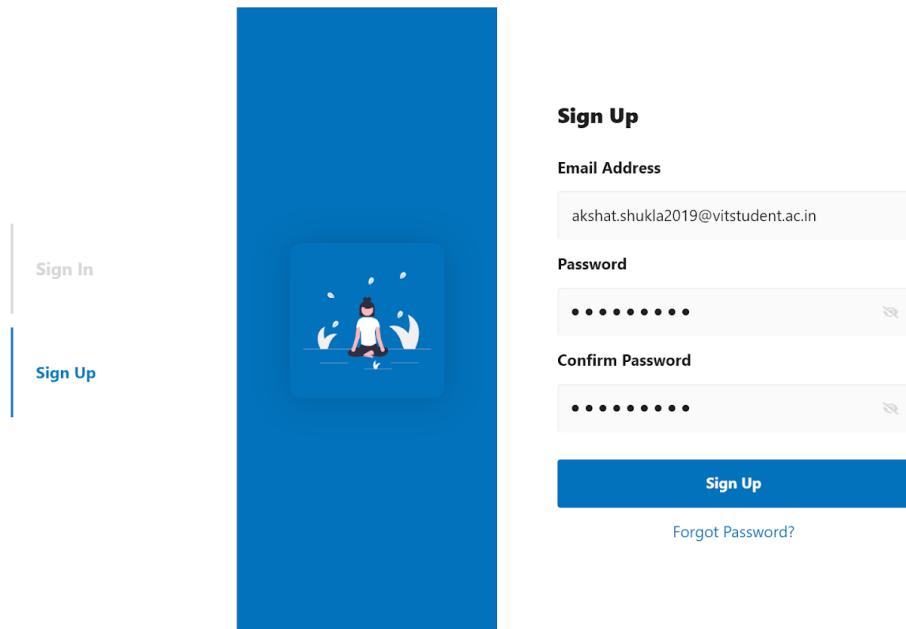


- **Yoga Aasan predictor and checker**



7.2 GUI

- **Sign Up Page**



Sign Up

Email Address
akshat.shukla2019@vitstudent.ac.in

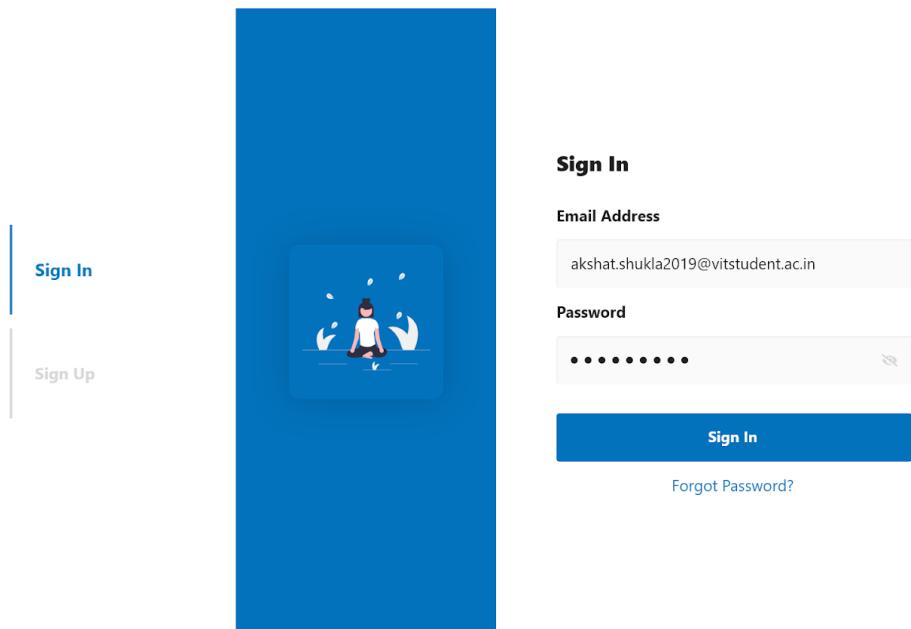
Password
• • • • • •

Confirm Password
• • • • • •

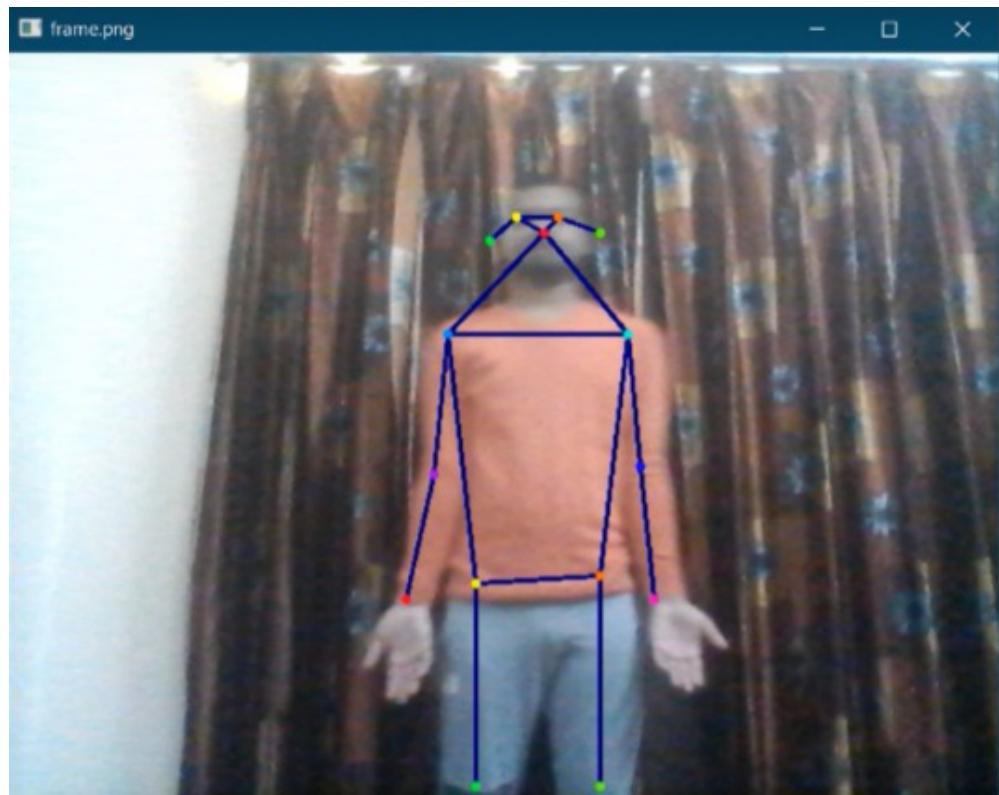
Sign Up

[Forgot Password?](#)

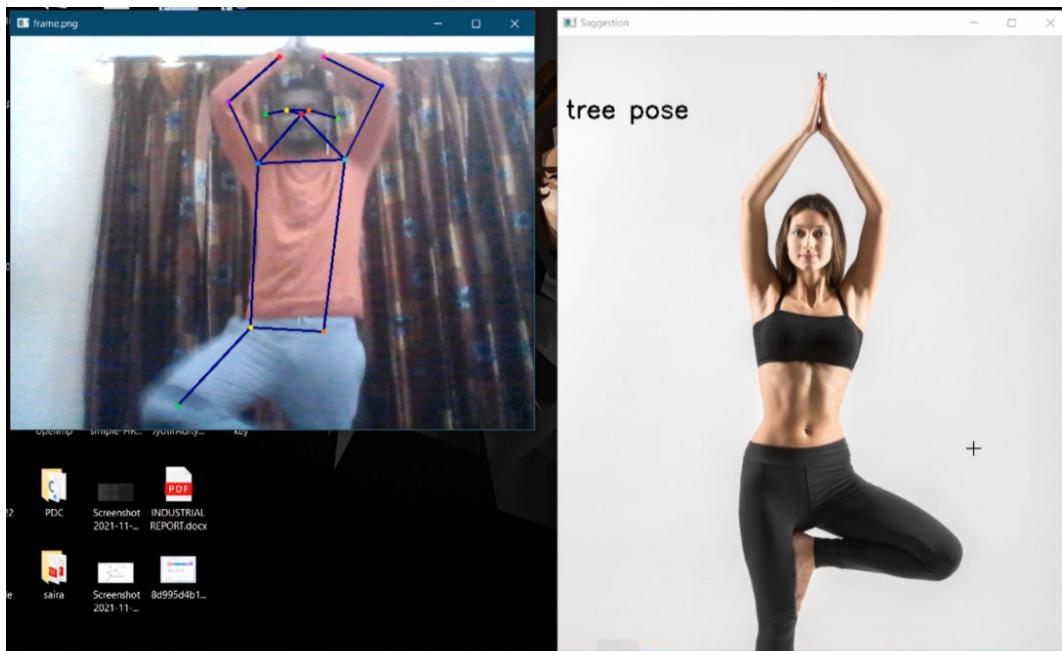
- **Login Page**



- **Opening video Camera**

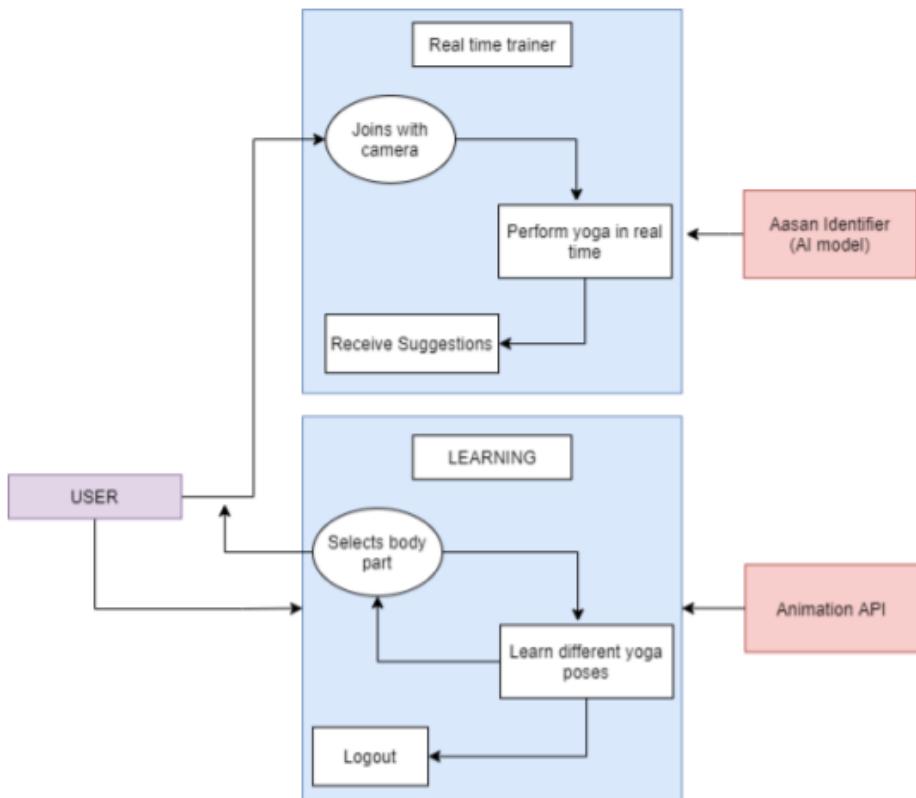


- Yoga Aasan predictor and checker



8. Design

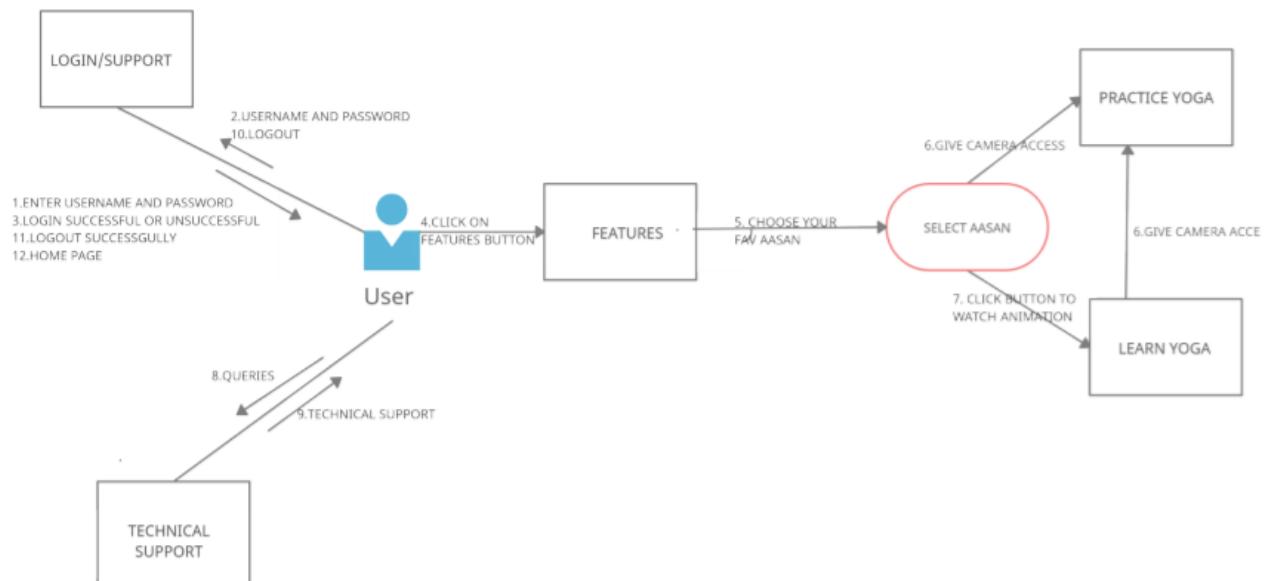
8.1 System overview



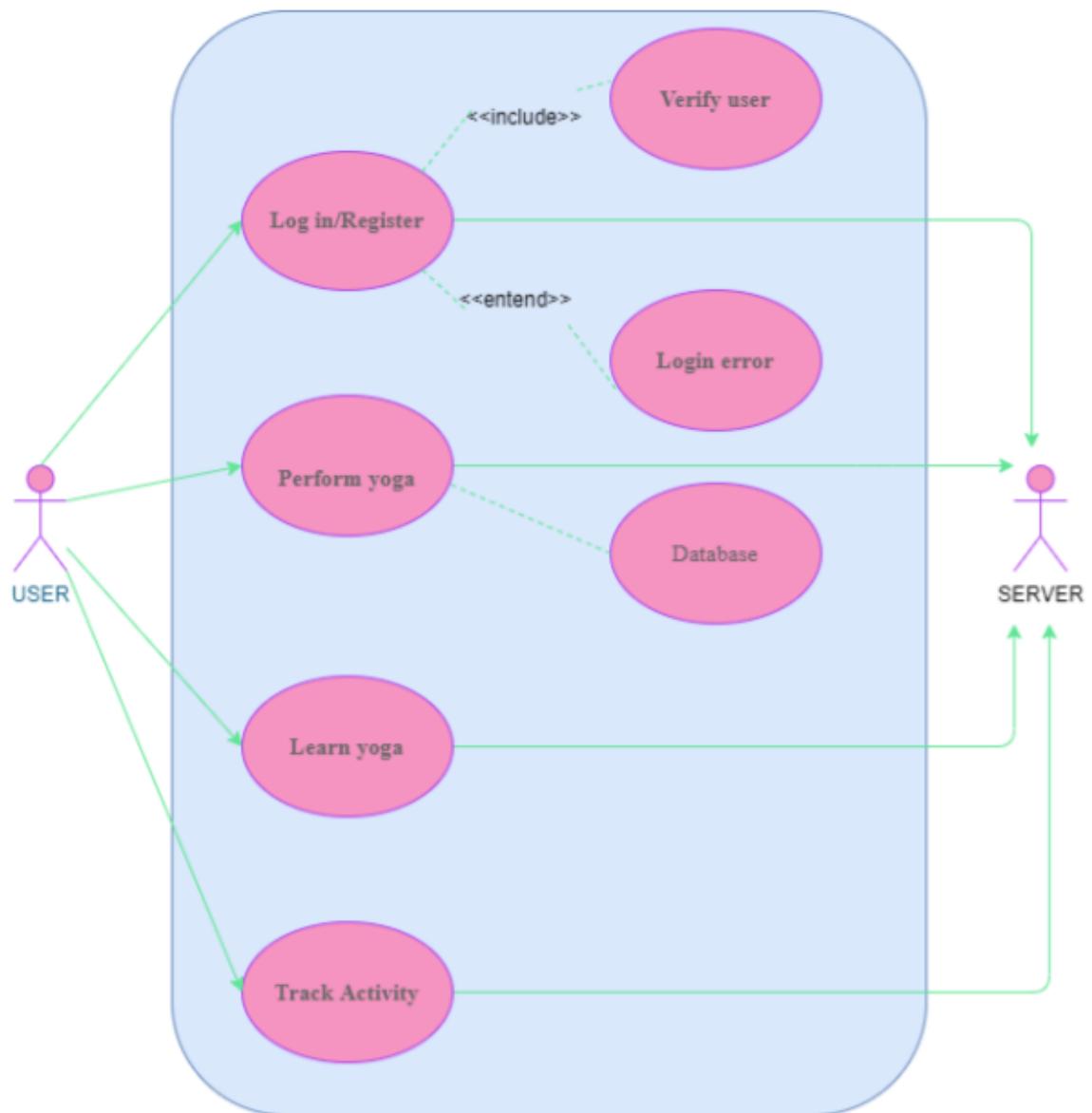
8.2 Database Tables

Table name	Field	type
USERS	name	-
	email	Primary,Foreign
	pass	-
	age	-
	gender	-
	height	-
	weight	-
tech_support	faq_id	-
Aasan	email	Primary
	aasan_name	-
	time_duration	-

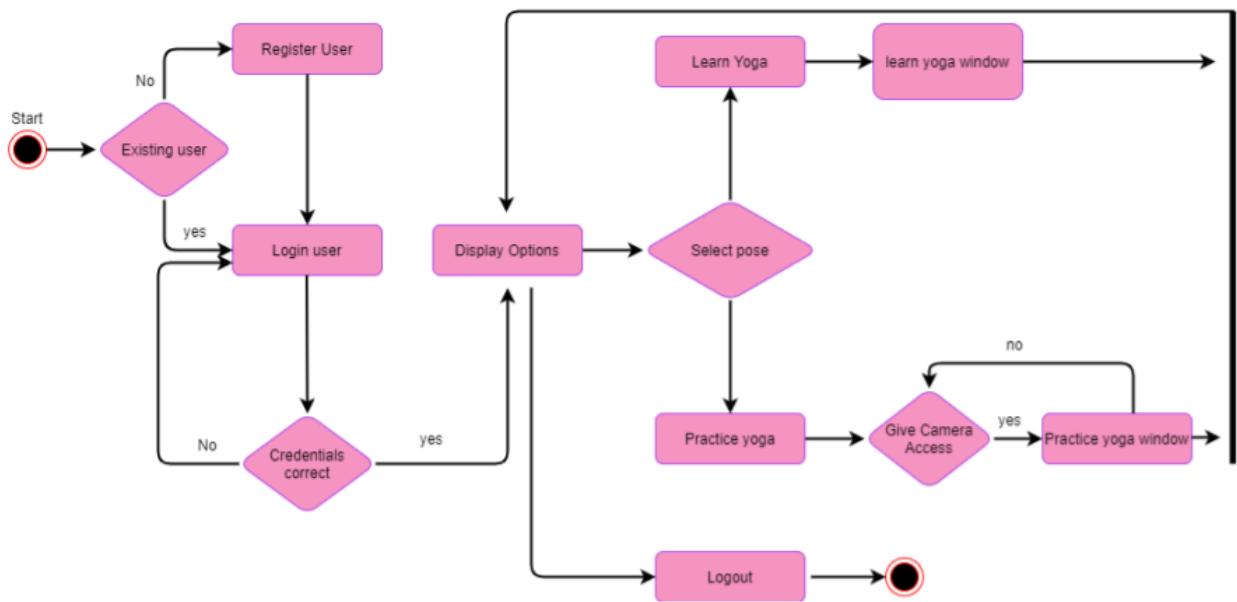
8.3 Collaboration Diagram



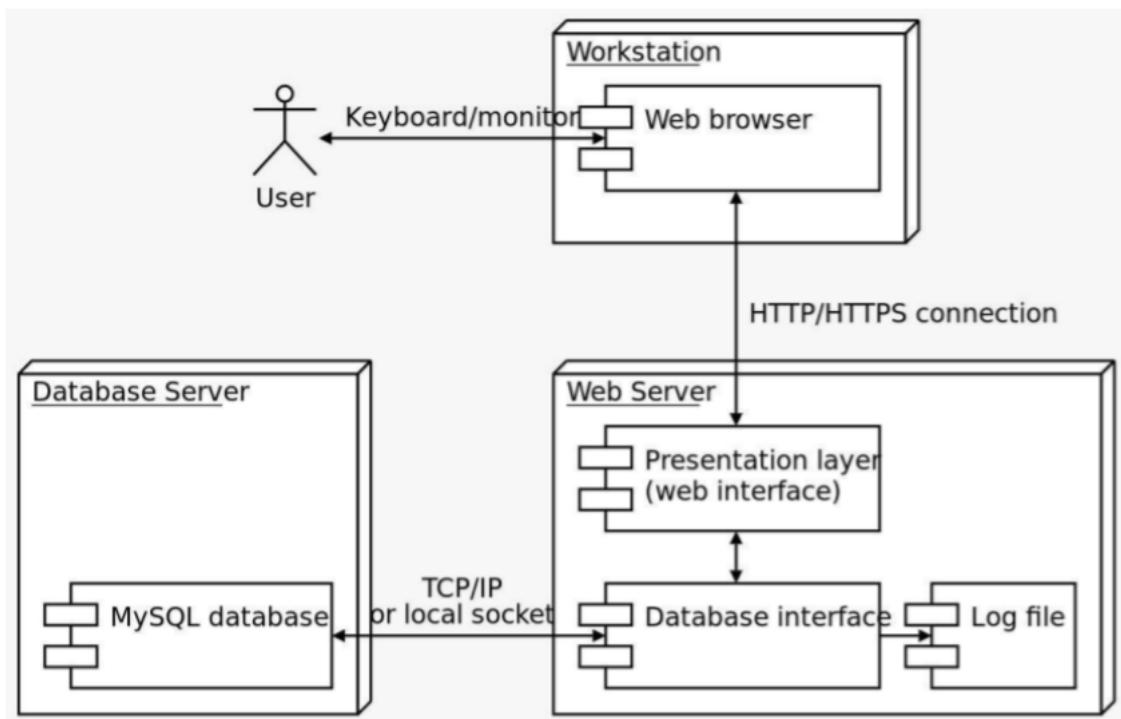
8.4 Use Case Diagram



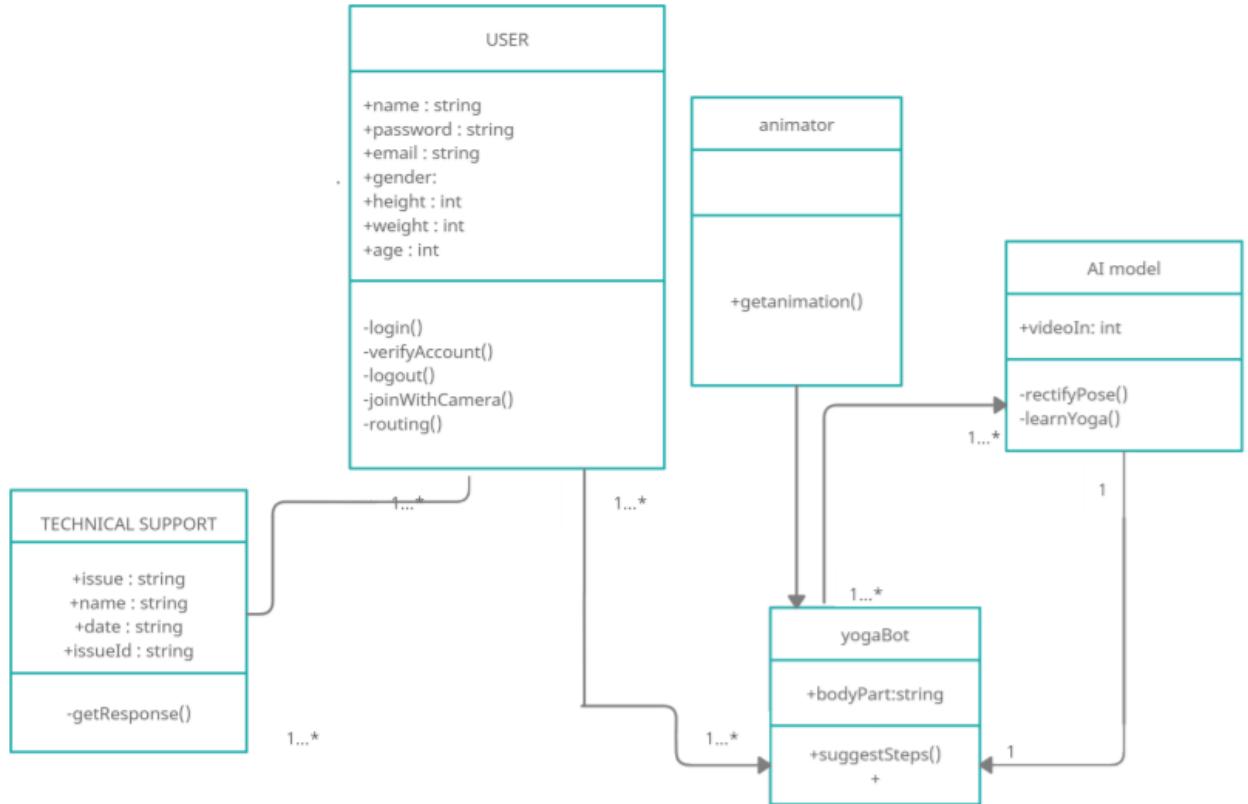
8.5 Activity Diagram



8.6 Deployment Diagram



8.7 Class diagram



9. Code

LINK : <https://github.com/JyotirAdi/yoga-project>

The above link contains 3 files namely:

- MLP.py - This file is the ML model
- Get_keypnts_data.py - This file converts image datasets into .txt data points
- Grid_search.py - It is to find Best hyperparameters for our MLP based ML model

10. Testing

10.1 Test Cases

- **Registration**

Input	Output
Empty field's	Fill in all field message
Length of password < 6	Password must be 6 characters message
Existing email	Email already registered message
Correct credentials	User is redirected to login page with successfully registered confirmation message

- **Logging in**

Input	Output
Random email ID and password	Email not Registered message
Incorrect Password	Password incorrect message
Empty field/s	Missing credentials message
Correct email and password	User is redirected to home page

- **Starting The video**

Input	Output
User clicks “START” button	User is redirected to “Yoga predictor” page

Allow video permissions	User can now share their video
-------------------------	--------------------------------

Yoga predictor

Input	Output
Clicks Start Button	User is requested to allow camera permissions
N/A	User is returned a predicted yoga pose

10.2 Testing

- Test cases for Web App

Test Case	Details	Test Data	Expected Results	State Reached
1	Run App	GUI	App should open	App Opened
2	Fill Signup Page	Email: adityajyotir05@gmail.com Password: test	Validate all fields if specifications don't meet, error is thrown	Details Entered

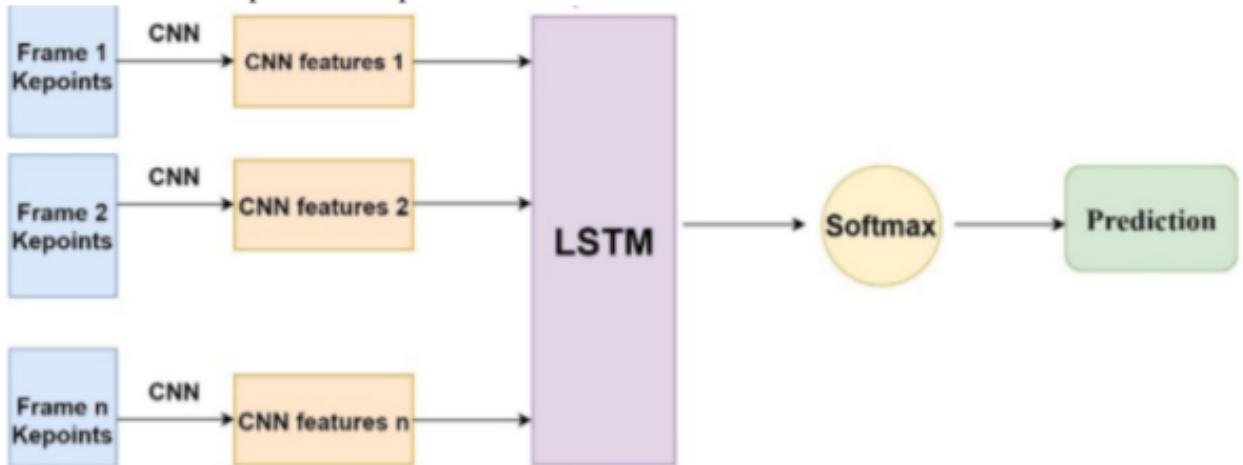
- Test Cases for ML Prediction and Notification

Test Case	Details	Test Data	Expected Results	State Reached
1	Redirect live camera to ML model	Live Video Feed	Camera output must be shown	Human body joints and face detected
2	Recognition of pose	-	HRnet must start with pose estimation	Pose is Recommended

11. Modules

Module 1 : Module developed to handle AI backend

- Identifies the pose performed is 100 percent on point or not.
- Instructs the problem in posture.



Module 2 : Navigation Environment

- Flutter based environment.
- Users can choose options among learning and practicing yoga asanas.
- Helps navigate any queries regarding the app.

Module 3: Database

- Stores login information
- Stores workout type with time durations.

12. Maintenance

Corrective maintenance

The application would go under regular testing so bugs would be discovered and solved and updated.

Adaptive maintenance:

Currently our application is only available on the web but we will expand it to android , ios , windows , etc .

Perfective maintenance:

We will be updating the reagent with several new asanas and also develop a meditation tutor which will help users optimize their meditation duration .

13. Conclusion

We were able to develop a yoga tutor which will help users to effectively practice various yoga asanas with reformed pose and techniques at there convinnient timing , place , affordable supervised eniviorment and zero judgement eniviorment (many users feel they might be judged at a class setting in a studio due to there body type, colour, race, sex, etc). Also ensuring that users can follow an optimized set of asanas to make most use of their time.

14. References

- [HRNet/HigerHRNet-Human-Pose-Estimation: This is an official implementation of our CVPR 2020 paper "HigherHRNet: Scale-Aware Representation Learning for Bottom-Up Human Pose Estimation" \(<https://arxiv.org/abs/1908.10357>\)](https://arxiv.org/abs/1908.10357)
- [CMU-Perceptual-Computing-Lab/openpose: OpenPose: Real-time multi-person keypoint detection library for body, face, hands, and foot estimation](#)
- [PoseNet for pose estimation](#)
- An Overview of Human Pose Estimation with Deep Learning By Bharat Raj,BeyondMinds [An Overview of Human Pose Estimation with Deep Learning.pdf](#)
- Mobile Data Science and Intelligent Apps: Concepts, AI-Based Modeling and Research Directions Iqbal H. Sarker^{1,2} & Mohammed Moshiul Hoque² & Md. Kafil Uddin¹ & Tawfeeq Alsanoosy³ [Applications of AI in classical software.pdf](#)
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- Human Body Posture Recognition Using Artificial Neural Networks Manu Bali, Devendran V [Human Body Posture Recognition Using.pdf](#)
- Pose Trainer: Correcting Exercise Posture using Pose Estimation Steven Chen * Richard R. Yang * Department of Computer Science, Stanford University [pose trainer.pdf](#)
- Sitting Posture Recognition Based on OpenPose [Sitting Posture Recognition Based on OpenPose.pdf](#)

15. Appendix A

- CNN: CNN is a type of neural network model which allows us to extract higher representations for the image content. Unlike the classical image recognition where you define the image features yourself, CNN takes the image's raw pixel data, trains the model, then extracts the features automatically for better classification.
- LSTM: The LSTM model will learn a function that maps a sequence of past observations as input to an output observation. As such, the sequence of observations must be transformed into multiple examples from which the LSTM can learn.
- Flutter: Flutter is an open-source UI software development kit created by Google. It is used to develop cross platform applications for Android, iOS, Linux, Mac, Windows, Google Fuchsia, and the web from a single codebase.