

Capstone Project CS 506 – 8 Credits

Project Title : Posture Guidance

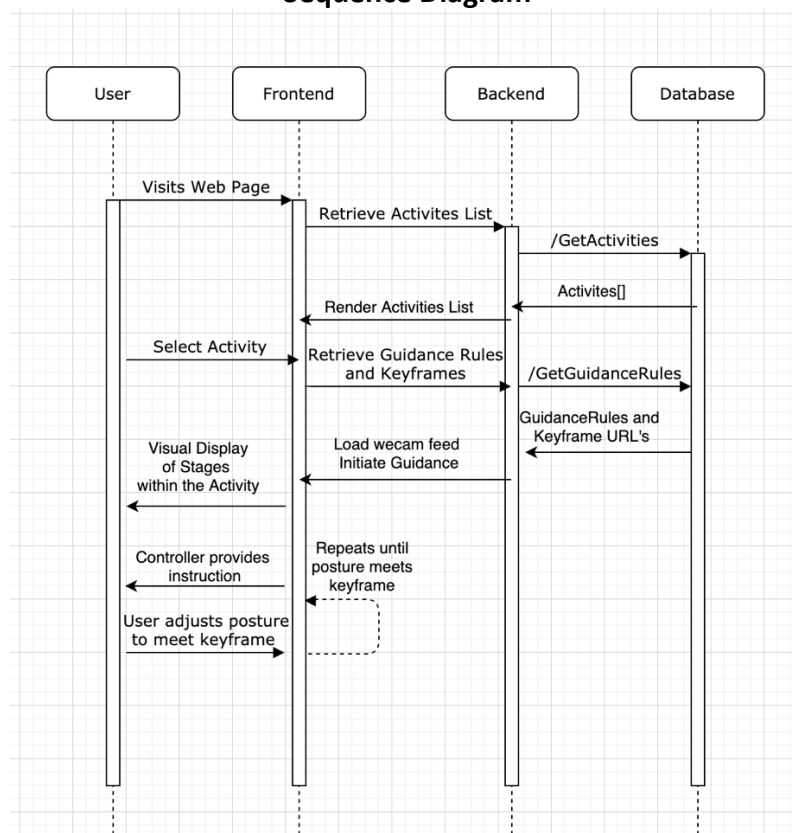
Description:

Maintaining correct posture while performing physical tasks like following an involved Yoga pose routine, doing Squats or Push-ups for the first time is a difficult task for beginners. When following through online videos we get an idea of what to do but lack feedback in terms of 'but am I doing it right?'. The project idea comes from the thought, if you had a coach/master watching, how would they guide you.

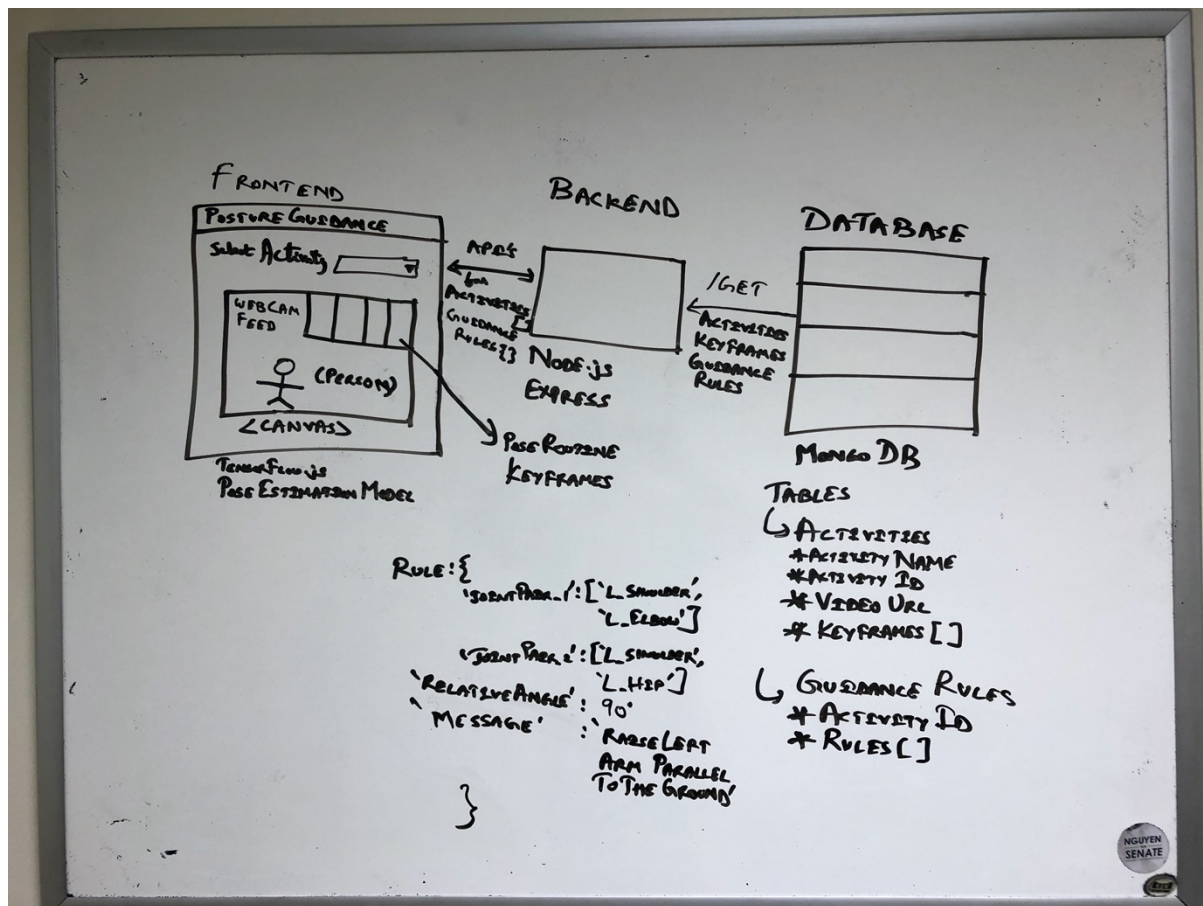
As it relates to identifying posture, we would be working with Human Pose Estimation models which estimate the key joint positions/ skeleton of a human given an image. We would be extending it to process multiple image frames (~5-10) per second, enabling it to work on live video camera feed which is nothing but ~24 frames of images per second. Identify correct posture from expert videos and use that as a step by step guide for beginners.

UML Diagrams:

Sequence Diagram



Overall Architecture and Design



Technologies Used:

Frontend – React.js/HTML/CSS/JavaScript

Backend – Node.js, Express

Database – MongoDB

Deep learning – 2D Human Pose Estimation model, TensorFlow.js, TensorFlow/PyTorch

Camera Feed Processing – OpenCV or in browser via JavaScript

Mobile Development – Flutter, Android Studio

User Stories:

1) Spike/Setup (16hrs)

Setup development environment, load pre-existing 2D Human Pose Estimation model, run build to get it working on webcam

2) User Interface Design (4hrs)

Design the interface that would allow the user to select an activity which he/she desires to learn

3) Pick Activity Options (4hrs)

Gather expert videos for sample activities which we would later process to extract key frames and calculate guidance

4) Process Activity Video (16hrs)

Process the activity video to gather keyframes, calculate guidance rules and store in a json format

5) Test TensorFlow.js Human Pose Estimation Model (24hrs)

Check pose inference accuracy for the lightweight TF.js model and see if it works across all poses, else port larger/accurate python model to the JavaScript framework

6) Check <canvas> Rendering of Guidance Instructions (48hrs)

Render the webcam feed within browser window, overlay activity keyframes and guidance instructions on the <canvas> element

7) Design Database Schema (12hrs)

Design the schema for the MongoDB database, storing tables for Activities, Guidance Rules, User Information and Login

8) Write backend API's to Retrieve Activities, Guidance Rules, Authenticate User (24hrs)

Implement the API's using Express.js web framework for Node.js

9) User Login/ Sign Up Screen (16hrs)

Add a user login/Sign Up page to allow users to create an account, save pose routines

10) Mobile App UI Design (8-16hrs)

Design screens for mobile version of the app

11) Port Pose Estimation Model to Mobile Devices (24hrs)

Port to mobile platform using TensorFlow Lite, validate performance

12) Validate Guidance on Mobile App (48hrs)

Validate if selection of activity and consequent guidance works on the mobile device via front camera feed, supports providing instructions over headphones/earpods

13) End to End Testing (48hrs)

Testing the app end to end for any bugs / flaws. Includes manual testing and writing unit tests

14) Deployment (24hrs)

Deploying Production code to cloud servers and making sure API's and database calls work across web and mobile platform

GitHub Url: <https://github.com/DhruvJawalkar/Capstone-Project>