**Capstone Project**

**CS 506 – 8 Credits**

**Project Title :** Posture Guidance

**Description:**  
Maintaining correct posture which 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**

A close up of a map

Description automatically generated

**Overall Architecture and Design**

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**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>