

# HUMAN POSE ESTIMATION IN FITNESS TRACKING AND GUIDANCE

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## **Introduction:**

Human Pose Estimation (HPE) is a way of identifying and classifying the joints in the human body. Essentially it is a way to capture a set of coordinates for each joint (arm, head, torso, etc.,) which is known as a key point that can describe a pose of a person. The connection between these points is known as a pair.

The connection formed between the points has to be significant, which means not all points can form a pair. From the outset, the aim of HPE is to form a skeleton-like representation of a human body and then process it further for task-specific applications. Knowing the orientation of a person opens avenues for several real-life applications, some of which are discussed towards the end of this blog. Several approaches to Human Pose Estimation were introduced over the years.

This is a Computer Vision project developed with the idea to implement Artificial Intelligence in the field of exercise and fitness. The main mechanism running in this project is a combination of human pose estimation and user defined constraints and functions to calculate angles. The main applications of the project include Yoga Pose Detection and Exercise Count Monitoring.

## **Objectives:**

- The main objective of this project is to provide an easy to use interface for real-time fitness tracking and yoga pose classification.
- The Project also provides information regarding the training of a specific body part.

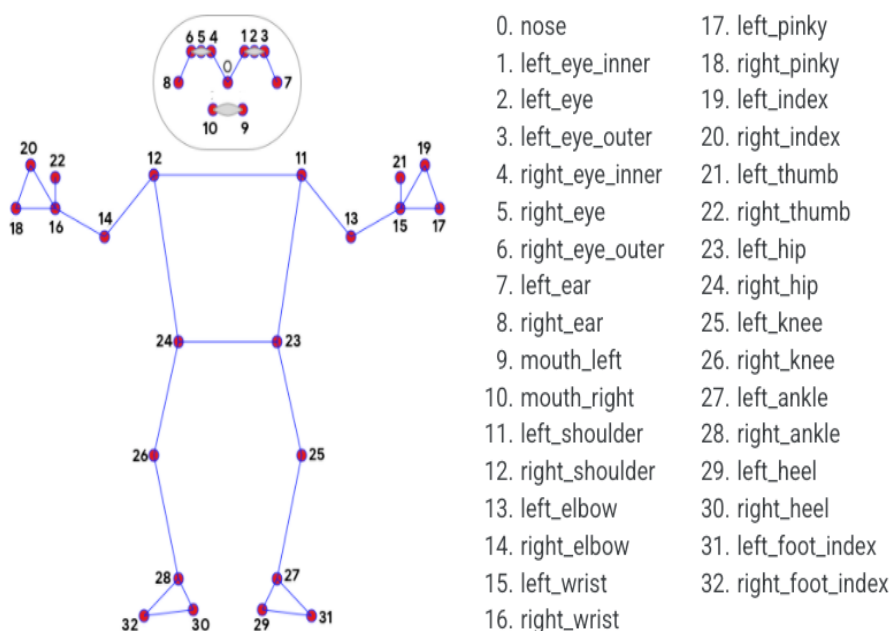
This project aims to tackle problems such as:

- The absolute need for the physical presence of a guide.
- Inefficient time management. Time as we all know is of utmost essence, hence this valuable resource can be saved to a great extent. The necessity to travel to the gym or park is eliminated as it can be performed at home at our convenience.

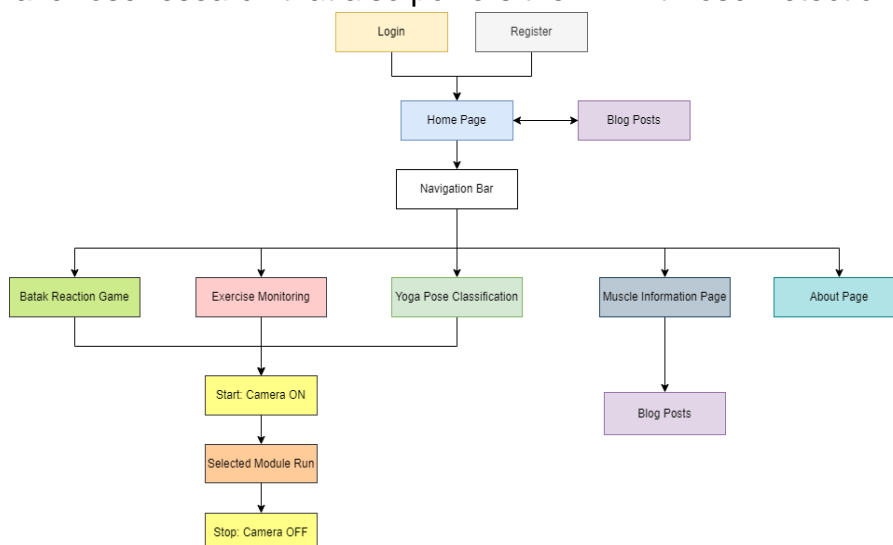
## Methodology:

We intend to implement Pose Estimation which is a computer vision technique to track the movements of a person or an object. This is usually performed by finding the location of key points for the given objects. Based on these key points we can compare various movements and postures and draw insights. Pose estimation is actively used in the field of augmented reality, animation, gaming, and robotics.

There are several models present today to perform pose estimation. Some of the methods for pose estimation are Open pose, Pose net, Blaze pose, Deep Pose, Dense pose and Deep cut. For this project, we will be using the Blaze pose for detecting human pose and extracting key points. The model can be easily implemented through a very helpful library, well known as media pipe.



MediaPipe Pose is a ML solution for high-fidelity body pose tracking, inferring 33 3D landmarks and background segmentation mask on the whole body from RGB video frames utilizing our BlazePose research that also powers the ML Kit Pose Detection API.

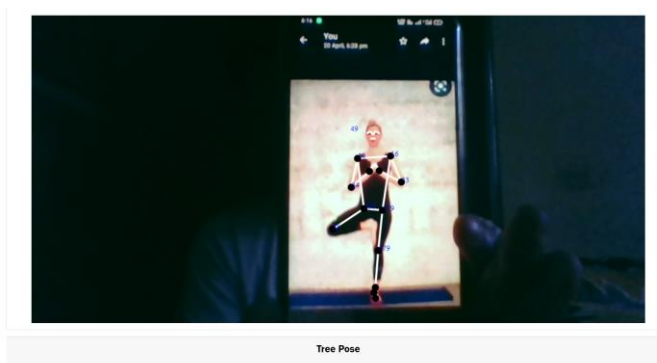


The above flowchart shows the website flow of the project containing the implemented modules such as exercise monitoring, yoga pose classification and muscle information page.

### Results:

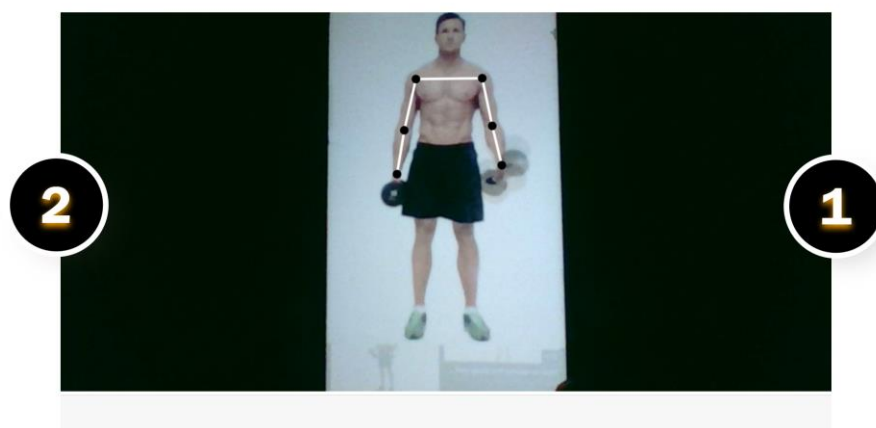
- Yoga Pose Detection

This module is concerned with Yoga Pose Detection. For the required application we are using **Mediapipe Pose**. For website application we make use of javascript solution API. The API is used to obtain mediapipe's **33 landmarks** on the image with human, which are connected using javascript functions. Example Canvas Functions. Once the whole skeletal connection is available, we define **functions and conditions** for yoga pose detection.



- Exercise Monitoring:

This module is concerned with various exercise detection and monitoring. Mediapipe module is made for this feature. The API is used to obtain mediapipe's **33 landmarks** on the image with humans, which are connected using javascript functions. 4 unique exercises are implemented in this feature. The number of repetitions performed are counted and incremented upon the performance of the exercise.



### Conclusion:

This website is designed to help the users conveniently and efficiently perform exercises which are monitored while staying indoor. It should uplift the users to try out different forms of exercises through the guider manual available on the system. It provides an efficient and portable system at our convenience to save time and acquire guidance. The Project also provides an interactive information and guidance page regarding the training of a specific

body part which allows users to gain knowledge regarding various exercises for specific body parts.

### **Scope for future work**

- The number of exercises and yoga poses can be increased and various conditions for each can be implemented.
- More insightful suggestions could be provided with respect to the user's pose while performing the exercise.
- As an exercise monitoring feature, the number of sets could be considered to form a complete exercise routine.
- A separate database could be set-up to store user specific exercise data and create necessary graphs to get better insights as a part of data analytics.
- Regular updates and reminders could be set-up to attract users and make them actively perform their routine.