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Anonymous

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Estimation of Distance of People from Video Camera without Dedicated Depth Sensors

Abstract—The invention detects using computer vision algorithms, for the video conferencing system user, whether in call or outside call, the user has been sitting or standing at one location for the set duration of time and need to stand-up or take a walk. This experience is currently available through wearable technology where if user is wearing smart watch embedded with appropriate sensors, then the watch can detect such scenarios and then users can stand-up and take a walk. The computer vision-based detection methodology can run from any compute resources, be in the camera compute (CPU, GPU, DSP, specialized AI compute) or desktop application for the purpose of practicality; it can also be realized through the cloud computing infrastructure, though there is an additional element of cost and connectivity associated with sending the images to the cloud through internet. That makes the proposed invention applicable to wide range of products: All video camera products, desktop application, and cloud-based solutions. It also opens the possibility of exposing this service in the form of API to third party video calling services such as Zoom, Teams, Meet, BlueJeans, etc.

Keywords—computer vision, fitness, wearable, video calling, video camer

I. INTRODUCTION

To the best of our knowledge there has been no Video Conferencing system and infrastructure solving the problem of fitness recommendations. There are techniques available to detect sitting people, standing people, tracking, gaze detection, etc. The proposed innovation combines the known techniques with application and user experience embodiment to create the unique proposition.

The use-case can be described in terms user experience as the following:

- As a user, I am concerned about my overall health and wellbeing while at work
- Immersive work experience is important, however, that makes me sit or stand still at one location for a long period of time and I forget to stretch or take a short walk
- As a user of personal or group series camera, I am interested in:
 - Video conference system camera to detect that I am sitting / standing still for T1 amount of time, and I would like to be able to configure T1
 - Recommend me to stand-up and take a walk if standing still or sitting
 - Detect whether I am standing if I was sitting still earlier and taking a short walk within the FOV of camera; track me as I walk and stand and after the set amount of time T2 declare I have taken a short walk for the purpose of fitness/wellness at my personal work-place

- Video conferencing system camera and associated software to recommend me certain yoga postures to try at work.
- A camera software-based field of view that is sub-region of the full field of view where I can stand straight so that the camera can detect all the keypoints of my posture; eyes-ears-nose-shoulders-knees-hips.
- Based on the detection of the keypoints give me the score on how good the posture I am making.

As a group using cameras for video conferencing for long hour workshops or extended meeting sessions, e.g., > 1 Hr, we are interested in:

- Video conference system to detect whether people are all sitting still for long duration, e.g., > 60 minutes and needed a break
- Or people are looking at their laptops (through gaze determination) instead of active participation in the seminar, conference, workshop and needed a break

The invention proposes to address these use-cases by multiple methodologies based on people detection, detection of body key-points, and gaze estimation. The invention then connects the outcome of these detectors to the application layer responsible for sending the alerts to stand-up and walk → detects and measures the standing up and walk time, recommends yoga postures, quantitatively measures the correctness and timing of postures, and maintains the fitness statistics daily, weekly, monthly, etc.

The invention also provides the fitness dashboard keeping track of standing work, walks taken, postures, calories burned, etc. The invention can be implemented on video endpoints, desktop app, and can also be offered as a software service by downloading the SW package through the cloud-based platforms.

II. KEY TECHNOLOGY DISCUSSIONS

The invention can be made available in the form of Software suite; that can be downloaded from cloud-based platform or can be implemented straight inside the cameras if has enough compute power.

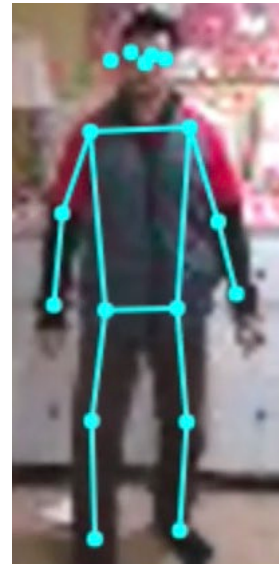
The Software and AI models then constantly determine the state of the user Idle, Sitting, etc. and recommend standing up and take a walk → then monitor the walk and stand-up time through detections and tracking of individuals or group.

The yoga postures portion of the invention recommends some pre-loaded yoga postures that need whole person in upright standing position viewed in the FOV of the camera.

The AI models to detect the poses are pre-trained and loaded in the software on the desktop app or on the codec itself.

While doing the yoga posture, person need to stand in a specific FOV visual box shown by the UI element of the camera. After standing in a particular predefined field of view, the yoga posture will be detected by means of person key-points detection and tracking algorithms and time of the posture would be computed.

For example, see how the body key-points detections can distinguish clearly persons sitting or standing positions.



The block diagram shown below in Fig-1 and Fig-2 describe the key technical steps for the execution of the invention.

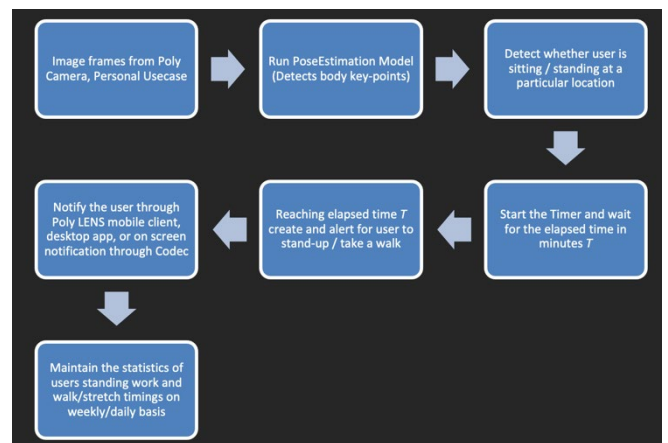


Figure 1: Wellness recommendation engine

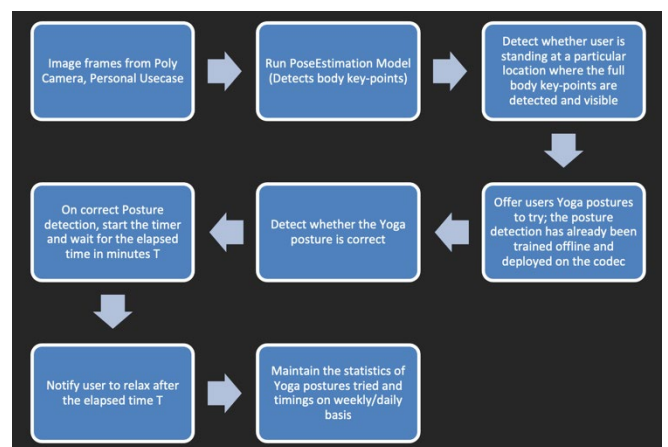


Figure 2: Yoga posture recommendation and evaluation engine

III. USER INTERACTIONS AND ADVANTAGES

The following user interactions can be developed for the system when deployed in the product.

- Control the alerts / alarms timings for sitting, standing, and taking a walk
- A wellness dashboard showing daily, weekly, ..., analysis of work standing, standing, yoga postures timings, calories burned. The dashboard can be made available by multiple means, desktop app, phone app, or in the cloud interface.
- User interface to select the yoga postures available

The invention provides the following advantages.

- Create a new value-added feature for video cameras
- Through the combination of products, cloud-based solutions, and services offerings, video conferencing solutions can be made more appealing for remote and flexible work force.