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# **FitSync - Computer Vision-Based Body Measurement System for E-commerce**

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**ABSTRACT:** Computer vision-based body measurement involves using image processing and deep learning models to detect key body landmarks and calculate essential measurements like chest, waist, hips, and arm length directly from digital images. These measurements are then matched with size charts of various clothing items to recommend the most suitable size for each user. The system operates on consumer-grade hardware and is designed to run entirely on the user's device. The development of a computer vision-based body measurement system tailored for e-commerce platforms, specifically to solve the problem of size uncertainty in online clothing purchases.

**KEYWORDS:** Computer Vision, Body Measurement, Pose Estimation, E-commerce, Size Recommendation, Deep Learning,

## **I. INTRODUCTION**

Computer vision-based body measurement is a modern approach that uses image processing and artificial intelligence to estimate human body dimensions directly from images. This technique leverages advanced pose estimation and segmentation models to identify body landmarks and calculate measurements like chest, waist, hips, and inseam without the need for physical contact or manual measurement tools.

With the increasing popularity of online fashion retail, one major challenge remains unresolved—accurate sizing. Customers often struggle to select the right size when shopping online due to the lack of physical try-on options and the variability in sizing standards across brands. This leads to high return rates, customer dissatisfaction, and increased operational costs for retailers.

The proposed system aims to address this issue by enabling users to capture their body images using a standard webcam and receive personalized size recommendations. The system employs pre-trained computer vision models such as MediaPipe for pose estimation and DeepLabV3+ for body segmentation. These models process the user's image to detect key body landmarks and extract precise body measurements. A custom algorithm then matches these measurements with product-specific size charts to suggest the most appropriate size.

This paper is organized as follows. Section II describes the methodology, including image capture, landmark detection, and measurement extraction. Section III explains the size recommendation algorithm and system architecture. Section IV presents the testing procedures and evaluation metrics used to validate the system. Finally, Section V discusses results, limitations, and future improvements.

## II. LITERATURE SURVEY

The proposed body measurement system operates in two main stages: (1) Body Landmark Detection and Measurement Extraction, and (2) Size Recommendation. These stages are supported by calibration and preprocessing mechanisms to enhance accuracy and ensure efficient execution on consumer-grade hardware. In the first stage, the system captures an image of the user using a webcam. Image preprocessing techniques such as resizing, normalization, and background handling are applied to optimize the image for analysis. MediaPipe's pose estimation framework is then used to identify 33 key landmarks on the human body, including shoulders, hips, wrists, and ankles. Using geometric calculations, distances between these landmarks are computed to derive body measurements like chest circumference, waist width, hip width, inseam length, and arm length. To enhance measurement reliability, a calibration step is incorporated. Users are asked to input their known height, which is used to compute a pixel-to-centimeter scale factor. This scale factor ensures that all measurements derived from the image are accurately converted into real-world units. In the second stage, the extracted body measurements are processed through a size recommendation engine. This engine references a product-specific size chart stored in a structured JSON database. A weighted scoring algorithm is applied to evaluate how well each size fits the user's body profile. Key measurements are prioritized differently depending on the type of clothing—for example, chest and shoulder width for shirts, or waist and inseam length for pants. The system also performs a fit analysis, classifying each measurement as a perfect fit, slightly tight, slightly loose, or not suitable. This provides the user with more than just a size label—it offers insight into how well a particular garment will match their body dimensions. All processing is performed locally using Python, OpenCV, MediaPipe, and DeepLabV3+, with Flask serving the backend API. The frontend, built using HTML, CSS, and JavaScript, manages webcam input and result display. The system is designed to run efficiently on devices with minimal hardware (GTX 1650 GPU, 8GB RAM), ensuring accessibility without compromising user privacy.

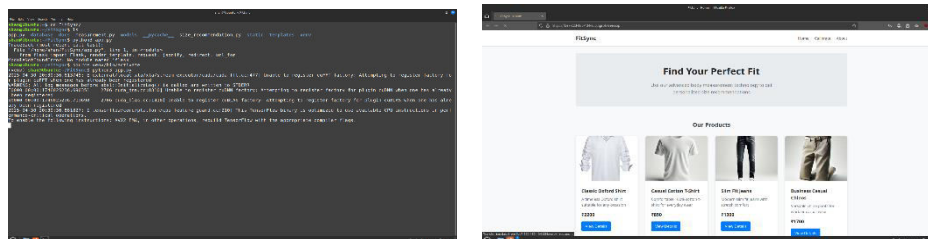
## III. METHODOLOGY

The proposed system uses a webcam-based image capture combined with deep learning techniques to extract human body measurements. After capturing an image, preprocessing steps like resizing and noise reduction are applied to ensure clarity. MediaPipe is used for detecting body landmarks such as shoulders, hips, and ankles. Based on these landmarks, key measurements are calculated using geometric formulas. A calibration step converts pixel distances to centimeters using the user's height for scaling. The measurements are then compared with product-specific size charts stored in a database. A scoring algorithm selects the most suitable size, and a fit analysis shows how well each size matches the user's body dimensions. The entire process runs locally on the user's device, preserving privacy and ensuring quick execution.

The algorithm automatically generates mask image without user interaction that contains only text regions to be inpainted.

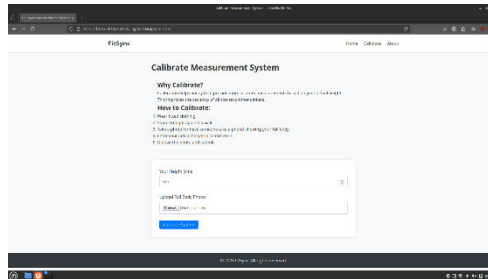
## IV. EXPERIMENTAL RESULTS

The below screenshots are of initialising of the application. Where the 1<sup>st</sup> figure is backend initialising and second figure is the home page of the application.

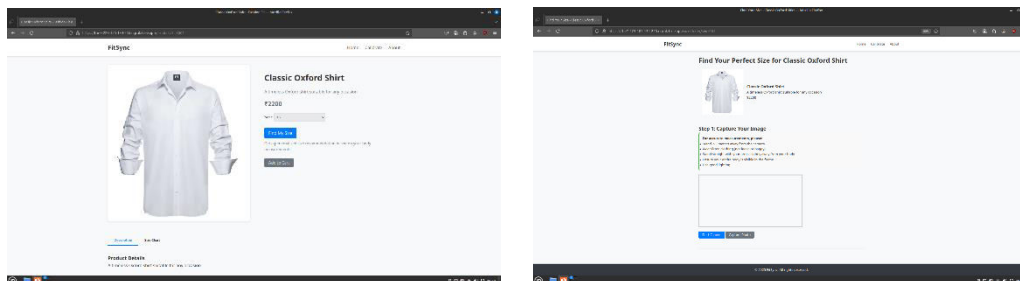


We have to click on calibrate from the navigation bar as shown in Figure 3 and upload a full size picture of the user and enter his height. This will make understand the machine the height of the user.

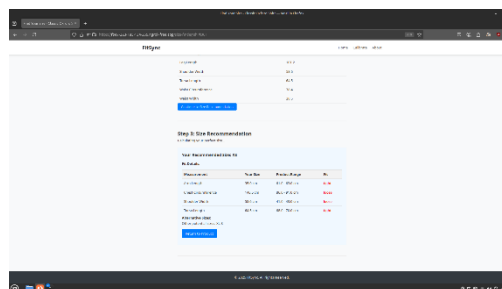




Then go back to home and click on any product for example, Classic oxford shirt as we can see in Figure 4 and click on find my size button that leads to Take picture page as in Figure 5. Click a clear full size picture and click start capture.



The output (Figure 6) will show the size recommendations and the alternative size labels which helps the user to select the product.



## V. CONCLUSION

We have developed an automated computer vision-based system for extracting body measurements from user images to assist with online clothing size recommendations. The system uses pose estimation and image segmentation techniques to accurately identify key body landmarks and calculate essential measurements. Our algorithm was tested on various images and demonstrated reliable accuracy in both measurement extraction and size prediction. The results showed that the system can operate effectively on consumer-grade hardware, offering a privacy-friendly and efficient alternative to manual size selection in e-commerce platforms.

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