ISSN No:-2456-2165

Sweat It – Anytime Fitness

Konte Sanjana, Modugu Bavitha Reddy, Muppalla Anupama Lohitha
Students, Department of Electronics and Computer Engineering,
Sreenidhi Institute of Science and Technology, Hyderabad

Dr. D. Mohan
HOD, Department of Electronics and Computer Engineering,
Sreenidhi Institute of Science and Technology, Hyderabad, India

Abstract:- Almost a quarter of the population is reliant on Artificial Intelligence technology to make their lives easier. Various applications have been developed to assist in a variety of fields, ranging from medical to military. A domain of fitness is one such application. 'Sweat It - An __ System' aspires to be the solution to replace gyms and personal trainers by leading users through their fitness journey from the comfort of their own homes. Because of the pandemic, there is no choice except to exercise and stay fit while at home. Sweat It aids in the tracking, identification, and counting of calories burned by the user. Whenever the user selects an exercise from a list, the user is also provided exercise-specific instructions. We can detect the number of repetitions and calories burned in real-time utilizing modules like Mediapipe and OpenCV. A webpage is designed to guide the user through workouts, instructions, and calories burnt.

Keywords:- *Artificial Intelligence; Mediapipe; open CV ; Pose.*

I. INTRODUCTION

Intoday's world, a sedentary lifestyle has become an inescapable aspect of many occupations. Due to the pandemic, many people are working from home, which makes them tied to their screens and thus do not move during the day. To make matters worse, gyms and training centers have been shut down due to the lockdown. To address these issues, our suggested system intends to create a system that assists in enhancing physical activity and lowering life flatness. We are introducing an application in our work that is targeted toward the implementation of a personal training system where users can follow the steps to perform an exercise; the system can detect the number of reps (repetitions) accomplished and can also tally the calories burned during that workout. This app assists those who are unable to access gyms due to the pandemic or other factors,but who still want to exercise and keep fit, by providing personalized calorie counters and pose detection for each workout. Staying at home for an extended period can be tiresome, as most amusing and physical activities require going outdoors, which has become more difficult since the pandemic outbreak and worldwide lockdowns. Given that everyone now has abundant ability to focus on their healthy lifestyle, this can't be a valid explanation for not exercising to keep in shape.

Most gyms provide a large selection of gym equipment as well as professionals who can instruct us on how to complete the exercise and in the proper posture. However, if the above-mentioned equipment and personnel are not available for some unknown cause, it becomes a justification for us to cease working out for the day. However, most laptops and mobile devices now have webcams or front cameras, which allow the system to recognize the number of exercises performed by the user.[1]

We want to create a system that can help you work out even if you don't have any exercise equipment at home. The project focuses on creating an application to assist us in working out by defining the number of reps completed and maintaining the correct stance while performing the repetitions using the pose estimation module. We're utilizing modules such MediaPipe and OpenCV to get the most out of the cameras. The important step is to identify the key points in body parts for human pose detection[2]. The community has seen an increase in these types of fitness applications over time. According to the World Economic Forum, worldwide downloads of fitness-related apps increased by about 50% in the first half of 2020. This is proof 4that as the number of users grows, so does the creation of newer and better fitness-related systems and applications. The project's major goal is to provide the audience with a much more dynamic and user-friendly individualized fitness training system.

II. LITERATURE SURVEY

Many systems and applications are being developed to guide the users when working out at home. All these systems and applications can be used as a substitute for gyms and trainers [3]. With the help of concepts like Artificial Intelligence and computer vision, it is now a reliable approach to the fitness journey. The various applications and systems have been developed and received a positive response from the users [4]. Wearable devices are developed with the advancement in the fields and responses received. Now, devices can identify, detect and track the exercise but do not identify the user. The non-wearable devices can identify the user and includes features like pose corrections, and checking if the exercise has been performed in the right way.

The researchers suggested an efficient approach aimed at addressing the multi-person problem while recognizing poses in real-time frames with many persons[5].This strategy is used to train the model to recognise the user's

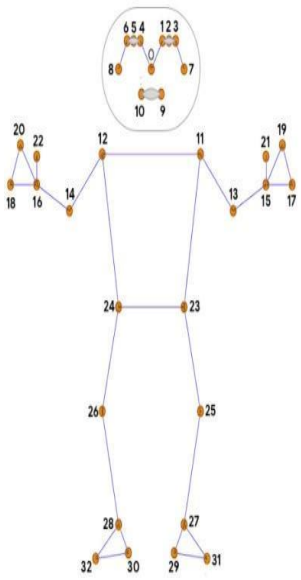
points and then differentiate them depending on the affinity of different points in the frame. This method is known as a bottom-up strategy since it is quite efficient and operates well regardless of the amount of people in the frame.This strategy outperforms the other approaches outlined above by 8.5 percent mAP for the dataset containing 288 frame pictures. The method can achieve greater accuracy and precision in real-time.

III. IMPLEMENTATION AND BLOCK DIAGRAM

A. Mediapipe

MediaPipe is an open-source framework for live streaming media that offers compact, ready-to-use, and fast machine learning solutions. Machine learning pipelines are available for usage on any platform and in a range of languages. Facial detection, iris movement, integration, position estimation, and face recognition were among the MediaPipe Machine Learning solutions. First, we must integrate these computer vision technologies into the system or environment in which we are working.

MediaPipe can handle multimodal graphs. Different calculators run in distinct threads to speed up the computation. Many built-in calculators provide GPU acceleration options for performance optimization. Synchronization is necessary when working with time-series data; else, the system would fail. The graph ensures that flow is properly controlled in response to packet timestamps. MediaPipe Posture is a machine learning technique that uses 33 indicators to accurately record body pose[6]. To eliminate the background from a full RGB frame, it employs BlazePose research. Pose-generated pipelines are small in comparison to standard machine learning systems.



0. nose
1. left_eye_inner
2. left_eye
3. left_eye_outer
4. right_eye_inner
5. right_eye
6. right_eye_outer
7. left_ear
8. right_ear
9. mouth_left
10. mouth_right
11. left_shoulder
12. right_shoulder
13. left_elbow
14. right_elbow
15. left_wrist
16. right_wrist
17. left_pinky
18. right_pinky
19. left_index
20. right_index
21. left_thumb
22. right_thumb
23. left_hip
24. right_hip
25. left_knee
26. right_knee
27. left_ankle
28. right_ankle
29. left_heel
30. right_heel
31. left_foot_index
32. right_foot_index

Fig. 1: MediaPipe Landmark Keypoints [6]

B. Open CV

Computer Vision technology has the ability to build systems that can function and think like a human. Its capability includes an understanding of the things around them. Open-Source Computer Vision Library is commonly known as OpenCV. It is a huge open-source library that consists of various computer vision algorithms OpenCV can be used for a variety of tasks, including recognition, detection, and analysis. When paired with additional libraries like NumPy, Python can process the OpenCV array structure for analysis.OpenCV was originally an Intel research initiative and was officially launched in 1999. OpenCV 1.0 which is its major version was released in the year 2006.

C. Web Application

A website is developed with the help of HyperText Markup Language, Cascading Style Sheets, and a scripting language such as JavaScript. HTML helps us to describe the structures of the website and CSS is able to control the design and color palette of the website. Properties of HTML and CSS include the body, headings, navbar, background colors, font size, and styles. A website is designed to provide reliable information regarding exercises and how to navigate an application. This helps users to view, select and navigate through the application.

D. Procedure of Implementation

The suggested system is a vision-based system that receives inputs from the computer/mobile device's webcam or built-in camera. The system captures the input frame and then uses several modules such as posture estimation, MediaPipe, and pose detection to determine the pose. We now compare professional trainers' pre-recorded videos to live-stream. By assigning a score of similarity and difference, we may determine whether the stance is right. Because, MediaPipe solutions are lightweight and mobile-friendly, the entire concept may be wrapped in a user-friendly application.

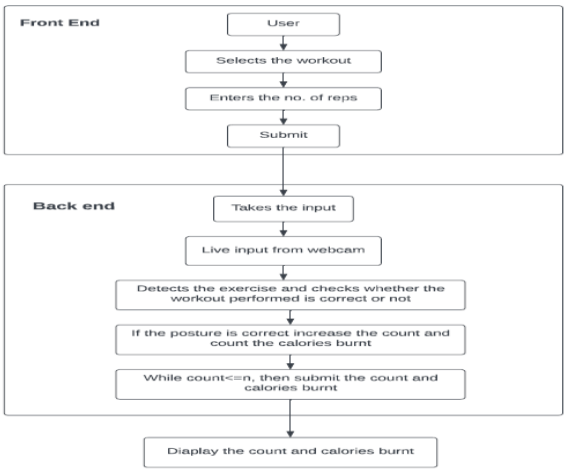


Fig. 2: Block Diagram for working of system

ISSN No:-2456-2165

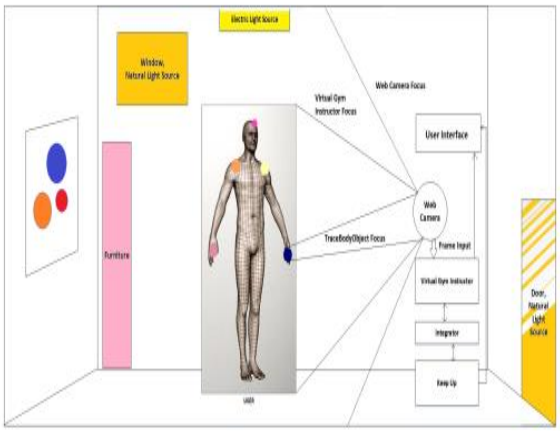


Fig. 3: User Environment [7]

E. DataSet

The dataset needed here contains tapes of exercises to see if the algorithm is capable of accurately detecting posture and incrementing the count. Pushups, pull-ups, squats, crunches, bicep curls, sit-ups, lunges, and hip thrusts are among the eight workouts available. In the beginning, we use films or live streams of the workout to test the system's functionality, such as whether it can recognize the correct workout posture; if the posture is correct, it will increment the count and be able to tally the number of calories burned during that specific workout.

In the beginning, we use films or live streams of the workout to test the system's functionality, such as whether it can recognize the correct workout posture; if the posture is correct, it will increment the count and be able to tally the number of calories burned during that specific workout.

Workout	Calories burnt for each rep
Pushup	0.3
Pullup	1
Squat	0.32
Bicep curl	0.4
Situp	0.5
Lunges	0.3
Crunches	0.2
Hip thrust	0.5

Table 1: Calories burnt

IV. RESULTS

There are three pages in the proposed application: the home page, the submission page, and the output screen. When the user first opens the program, the user is taken to the main page, which lists the available workouts. After selecting a workout, the user is taken to the workout page, where the user must input the number of reps to complete. Now, the user can see a camera window on the screen after hitting submit, which gathers video input while a user is conducting the workout and closes after completing the count. After the camera window shuts, the user is presented with the output window, which displays the number of calories burned throughout the workout. After that, the user can either return to the main page to start another workout or exit the application.

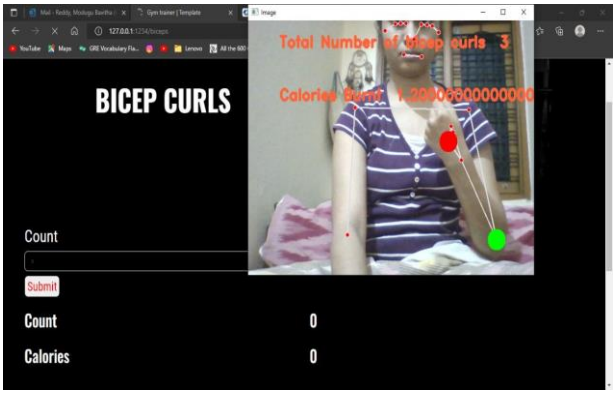


Fig. 4: The bicep curl application's user experience

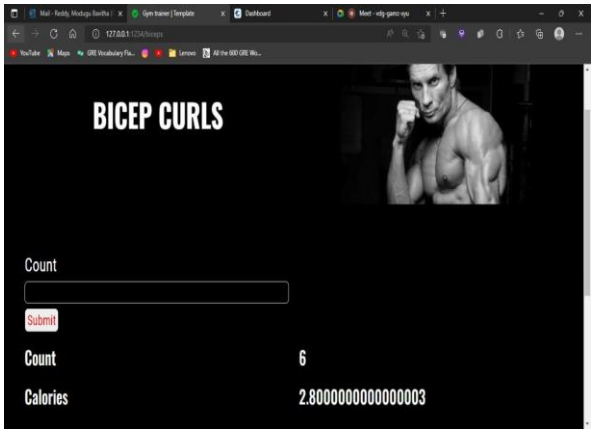


Fig. 5: The bicep curl user experience's output

Fig. 6: The squat application's user experience

Fig. 7 (a)

ISSN No:-2456-2165

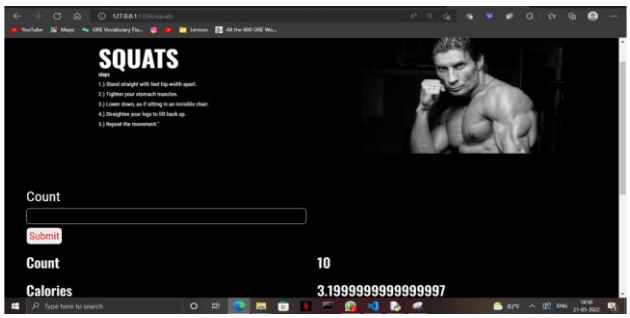


Fig. 7 (b)
The squat user experience output

V. ADVANTGES AND LIMITATIONS

There are several web-based applications that provide similar personal fitness services. Our app, on the other hand, makes detecting the proper workout position as well as measuring calories burned a breeze. This application provides real-time monitoring while the user is working out, allowing the user to maintain proper posture and form throughout the workout. This will benefit newcomers who are attempting to get in shape but have little or no knowledge of how to maintain proper posture during an exercise. It not only allows individuals to stay at home but also eliminates the need for human involvement at gyms, giving users smart training. This software seeks to assist folks who are trying to get in shape but have limited resources.

Because the poses for some of the workouts can be difficult for the pose estimation module to detect, the system can only detect the pose and count the reps for a limited selection of exercises.

The application is not tailored to you. Multiple people cannot be detected in real-time by the system. The app is only available as a web app and cannot be used on iOS or Android devices.

VI. CONCLUSION AND FUTURE SCOPE

Everyone is busier these days, and they don't have time to work out every day and stay healthy and fit [8]. Artificial intelligence can help tackle this challenge in this industry[9].Fitness-related apps and devices have made getting in shape easier and more accessible to people all over the world. Individuals can incorporate this app into their own workouts, making them more efficient and error-free. This application uses some concepts of pose detection and estimation, requires a camera to capture the body pose as input to the system generated, and will provide the stats of calories burned and exercise count as output in human-readable form with the help of a pose estimator.

There's a lot of room for improvement in this field[10]. Future work could involve more features such as accommodating more workouts and instructions to perform. A responsive user interface, web application, or mobile application can be developed for easy navigating through the exercise. A daily step counter can be added as well.The data collected can be retained and processed to provide suggested workouts and intensity. Furthermore, it can be improved by moving the camera vertically and horizontally to catch a wider range of activities, or using numerous cameras to capture the same body pose from different angles to feed the template for further workouts.

REFERENCES

[1.] "Pose Trainer: Correcting Exercise Posture using Pose Estimation". By S.Chen, R.R. Yang Department of CS., Stanford University.
[2.] Deepak Singh, Sumit Panthri, P Venkateshwari, "Human Body Parts Measurement using Human Pose Estimation"Published by IEEE in 2022 9th International Conference on Computing for Sustainable Global Development (INDIACom).
[3.] "Real-Time Virtual Fitness Tracker and Exercise Posture Correction" , Ghadekar, Premanand Pralhad; Akolkar, Prasanna; Bijawe, Sanket; Pandey, Himanshu; Mahajani, Mihir; Shinde, Aditya.
[4.] "Fitness Applications for Home-Based Training", Iman Khaghani-Far, Svetlana Nikitina, Marcos Báez, Ekaterina A. Taran, Fabio Casati.
[5.] "GymCam: Detecting, Recognizing and Tracking Simultaneous Exercises in Unconstrained Scenes",rushil khurana, karan ahuja,zac yu, jennifer mankoff,chris harrison,mayank goel.
[6.] "AI Body Language Decoder using MediaPipe and Python" Sankeerthana Rajan Karem, Sai Prathyusha Kanisetti, Dr. K. Soumya, J. Sri Gayathri Seelamanthula, Madhurima Kalivarapu.
[7.] "Virtual Gym Instructor", Dane Brown , Mixo Ndleve.
[8.] "Fitness Freaks: A System For Detecting Definite Body Posture Using Open Pose Estimation", Harshwardhan Pardeshi, Aishwarya Ghaiwat, Ankeet Thongire, Kiran Gawande, and Meghana Naik.
[9.] "Bicep Curl Count: Computer Vision Based Counting", Jatin Goel , Harshita Jain , Prabhjot Kaur.
[10.] "Human Body Pose Estimation and Applications", Amrutha K, Prabu P, Joy Paulose.