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Fitness Trainer Application Using Artificial Intelligence

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Abstract - *Artificial intelligence in fitness is revolutionizing the fitness industry which is making home workouts smarter and better. In our work, we introduce DietFit, which is a combination of diet planner and exercise tracker. This is an application that detects the user's exercise pose, counts the specified exercise repetitions, provides an alert on each set of repetitions, also alerts how many calories are burnt during the workout and how the user can improve their form by providing the user with complete dietary plan. The application uses the MediaPipe to detect a person's pose, later analyses the geometry of the pose from the dataset in real-time video and counts the repetitions of the particular exercise. In this application we use the Harris-Benedict formula for BMR calculation and for recommending the diet. In that Breakfast, Lunch, Dinner all these three things are recommended along with snacks. We have used TDEE (total daily energy expenditure) formula to calculate the amount of energy in calories you burn per day. This application allow users to do their regular exercise with the help of an AI trainer at home, also this application is beneficial to users to maintain their physical fitness and diet in order to get solved their various health problems.*

Key Words: Media Pipe, TensorFlow, Opencv, Harris Benedict Formula, Total Daily Energy Expenditure

1. INTRODUCTION

In our work, we introduce an application that is useful for both exercise tracking and diet planning. This is an AI-based workout assistant and fitness guide to guide people who don't have access to a gym but are still willing to work out at home.

In the 21st century people are moving towards an unhealthy nature and bad health. there are various reasons because the people are getting lazy in case of their physical fitness and getting crazy about food due to the food vloggers for example, social media is there, then their workload, lack of motivation, and there are so many people who think that physical fitness and dietary plans require a lot of investment in case of a gym or for fitness equipments and may lead to lack of taste for their tastebuds if they go with dietary plans. But in fact, if you don't have any equipment and tasty dietary plans, then also you can able to perform the exercise along with your dietary plans and become fit and healthy.

Our application will be useful for the following categories of people:

1. People who have a very huge workload: From that people, we are going to take very less time around 20-25 min per day from there 24 hours to make their physical fitness, healthy and make them feel fresh.

2. People who feel gym fees are not Affordable to them: For that people, we are making an online AI-based trainer, which will help them to do the correct exercise and also alerts them for each set of repetitions along with to know how many calories burnt to make them live a comfortable life.

3. People who feel dietician's fees are not Affordable to them: For that people, we are making an online AI-based dietary plans, which will help them to maintain their dietary plans and keep them healthy.

2. EXISTING SYSTEM

In the current system, people has to go to the gym to keep their physical health in a balanced state, but many people cannot afford them, and also now a days they may not be able to do workouts in the gym properly due to the huge crowd, and also for some people its lack of motivation, and also if we come to the dietary plans for their food diet, most of them are not able to take dietary plans due to the food cravings, now a days it happens mostly because of the food vlogs which tempts the people to their favorite food items and ruin their food diet and people are not able to maintain the healthy life.

DISADVANTAGES OF EXISTING SYSTEM

1. The requirement of a personal trainer for the workout.

2. The cost is expensive to pay for gym trainers and dieticians.

3. The repetition counts may miss.

4. Hard to remember the diet plan.

3. PROPOSED SYSTEM

The suggested method is detecting postures of the workout along with displaying repetitions count, set count also alerting the user with a beep sound for each set and also give information regarding how many calories are burnt during the workout and the proper dietary food plan is

recommended. Here we develop an application in which user will get artificial intelligence-based trainers with the help of image processing & video processing. And also dietary plans using artificial intelligence without any dieticians.

ADVANTAGES OF PROPOSED SYSTEM

1. There are numerous applications available in the market which guide the user about the exercises to be performed. But through our application, we not only guide the user regarding which exercise to perform but also correct the posture and count the repetitions using computer vision along with alerting system for each set.
2. Monitor the user in real-time keeping track of the quality repetitions of a particular exercise, thus keeping his form intact and correct throughout their workout. This will educate newbies about different exercise routines and their correct postures to prevent injuries.
3. The application also offers personalized health advice and nutrition ideas while keeping the daily calorie log in the database.
4. The application can not only be used by individuals at home but by increasing the scope can be used in gyms as smart trainers thus reducing human intervention.
5. Our main motive is to spread awareness about the importance of good health and fitness among the common people.

4. SYSTEM ARCHITECTURE

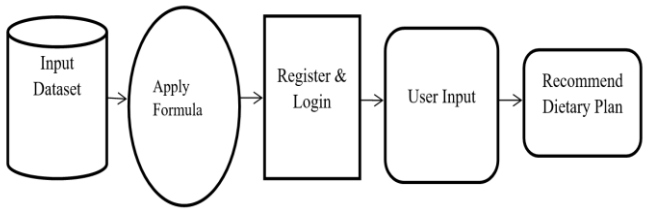

Fig -1: System Architecture of dietary plan

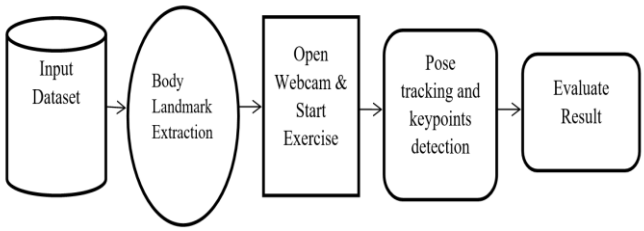

Fig -2: System Architecture of exercise

5. METHEDOLOGY

Our project is divided into two modules namely

1. Dietary Plan
2. Exercise Corrector and repetition counter

5.1 Dietary Plan

For dietary plan implementation we will use the TDEE (total daily energy expenditure) formula.

TDEE, total daily energy expenditure, is the amount of energy in calories you burn per day. TDEE is best calculated by factoring in your BMR, or basal metabolic rate, and your activity level. BMR is the amount of calories you would burn per day at rest.

Harris-Benedict formula

Male: BMR = 66 + (13.7 x weight in kg) + (5 x height in cm) – (6.8 x age in years)

Female: BMR = 655 + (9.6 x weight in kg) + (1.8 x height in cm) – (4.7 x age in years)

TDEE is calculated by multiplying BMR with Activity Factor depending on Physical Activity.

1. Sedentary = BMR x 1.2 (little or no exercise, desk job)
2. Lightly active = BMR x 1.375 (light exercise/ sports 1-3 days/week)
3. Moderately active = BMR x 1.55 (moderate exercise/ sports 6-7 days/week)
4. Very active = BMR x 1.725 (hard exercise every day, or exercising 2 xs/day)
5. Extremely active = BMR x 1.9 (hard exercise 2 or more times per day)

5.2 Exercise Corrector and repetition counter

Pose estimation is a machine learning task that estimates the pose of a person from an image or a video by estimating the spatial locations of specific body parts (key points). Pose estimation 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.

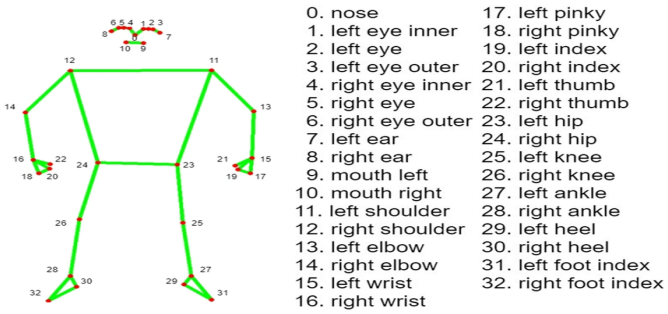

Fig -3: 33 Landmarks detected on the human body using MediaPipe

1. Media pipe

Media pipe is an open-source cross-platform framework for building multimodal machine learning pipelines. It can be used to implement cutting-edge models like human face detection, multi-hand tracking, hair segmentation, object detection and tracking, and so on.

2. TensorFlow

TensorFlow is an end-to-end open source platform for machine learning. It is a rich system for managing all aspects of a machine learning system. However, this class focuses on using a particular TensorFlow API to develop and train machine learning models.

6. DATA FLOW DIAGRAM

The DFD is also called as bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of input data to the system, various processing carried out on this data, and the output data is generated by this system.

The data flow diagram (DFD) is one of the most important modeling tools. It is used to model the system components. These components are the system process, the data used by the process, an external entity that interacts with the system and the information flows in the system.

DFD shows how the information moves through the system and how it is modified by a series of transformations. It is a graphical technique that depicts information flow and the transformations that are applied as data moves from input to output.

DFD is also known as bubble chart. A DFD may be used to represent a system at any level of abstraction. DFD may be partitioned into levels that represent increasing information flow and functional detail.

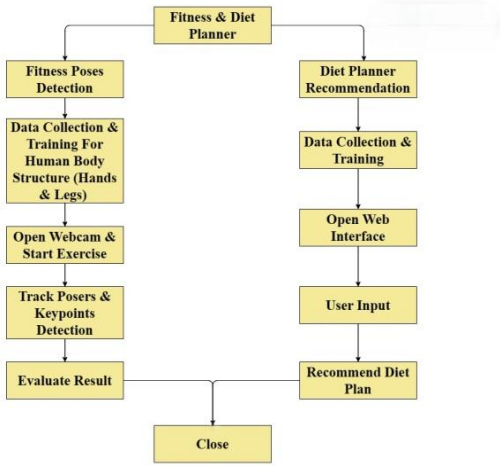

Fig -4: Data flow diagram

7. ACTIVITY DIAGRAM

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the Unified Modeling Language, activity diagrams can be used to describe the business and operational step-by-step workflows of components in a system. An activity diagram shows the overall flow of control.

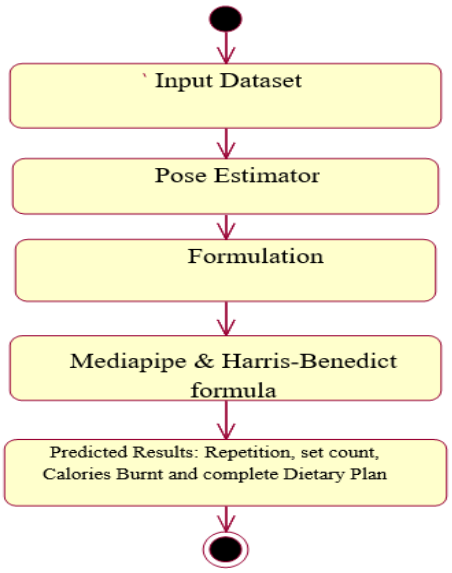

Fig -5: Activity diagram

8. LIMITATIONS

1. The application can estimate the poses and count repetitions for a limited number of exercises.

2. The application is limited with single-person compatibility at a time.

9. CONCLUSIONS

There are several applications for pose detection in real-life. Here, we develop into one such application to learn more about pose detection. We present an application for monitoring workouts without any involvement of a personal trainer. The application offers features like pose estimation, real-time workout analysis and is getting the best results. The emerging technologies like machine learning and artificial intelligence playing a important part in the development of the IT (Information Technology) industries. We have made use of these technologies and create a website for people who are consult about their diet and want to lead a healthy life. The importance of nutritional guidance is increasing day by day to lead a healthy and fit life and by accepting the user's preferences and a user's profile in the system a healthy diet plan is generated.

FUTURE ENHANCEMENT

In future we can improve this project by adding more exercises and also linking both the modules. This web application can be implemented as mobile application so that the user finds it easier to use and operate. Further, our work can also be enhanced by introducing real time voice instructions to the user so that the user can follow those instructions and do workouts more accurately.

ACKNOWLEDGEMENT

Special thanks to our team guide, Mrs. Sushma V for all of her support and direction, which helped the project to be successfully completed and yield positive results at the end.

SNAPSHOTS OF DIET RECOMMENDATION

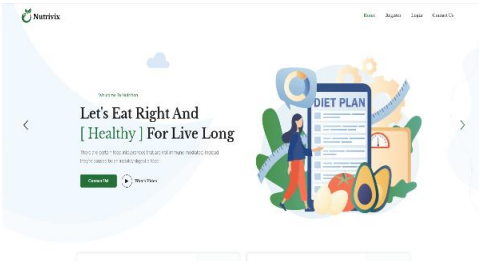

Fig -6: Home Page

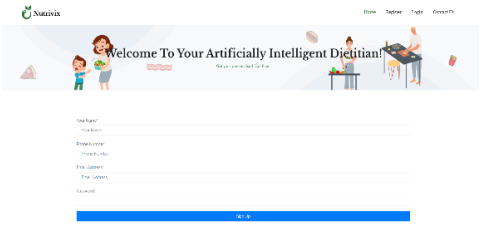

Fig -7: User registration

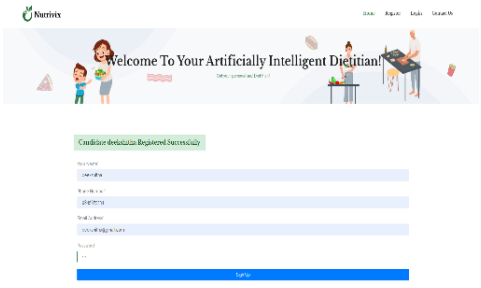

Fig -8: User registration successful

Fig -9: User login

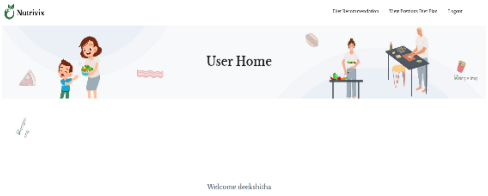

Fig -10: User home page

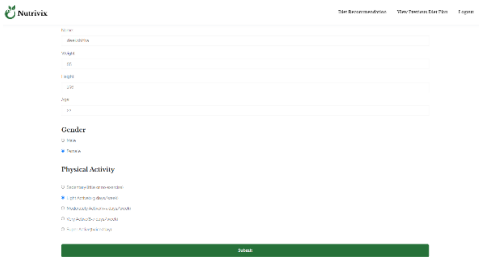

Fig -11: Taking user input

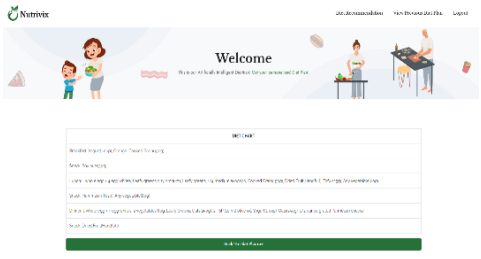

Fig -12: Diet recommendation

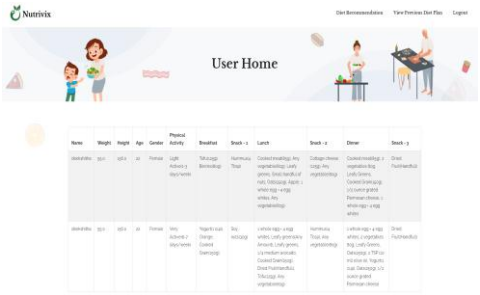

Fig -13: Preview of previous diet plan

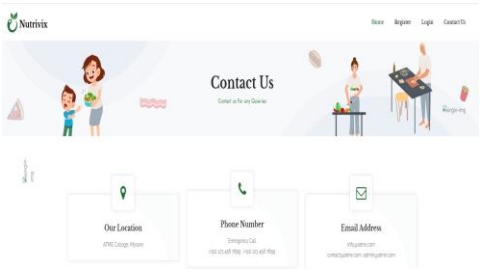

Fig -14: Contact details

SNAPSHOTS OF EXERCISE POSE DETECTION

Fig -15: Starting position of bicep curl

Fig -16: User performing bicep curl

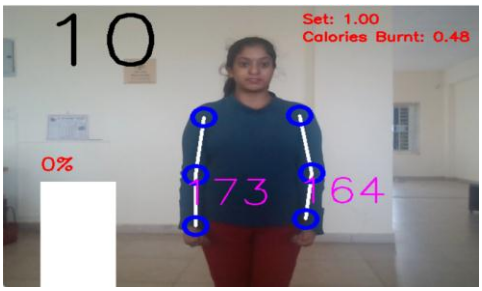

Fig -17: User completed 1 set of bicep curl

Fig -18: User performing bicep curl correctly

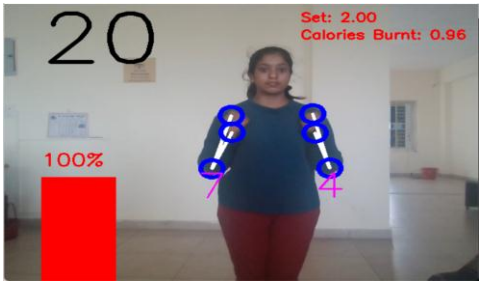

Fig -19: User completed 2 sets of bicep curl

Fig -20: Starting position of squat

Fig -21: User performing squat

Fig -22: User performing squat correctly

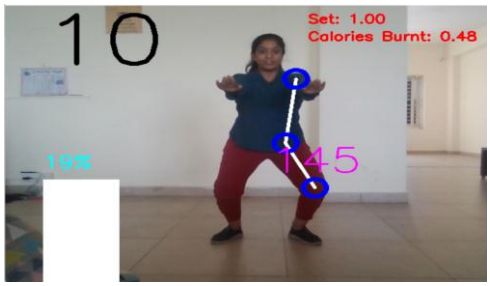

Fig -23: User completed 1 set of squat

Fig -24: User completed 3 sets of squat

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