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Flex-Fit Gym Tracker and Diet Recommendation System

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Abstract - *Nowadays virtual assistants are performing a very main part in our everyday activities and has enhance an indivisible one our lives. Almost 27% of nation are utilizing AI virtual assistants for operating their ordinary ventures. AI is an arising field that we aim to survey through this project of AI-based workout assistants. An AI stimulate workout tracker and diet recommender system that lets you satisfy in evident-opportunity, tries correct postures, keeps path of your reps in addition to create embodied, customizable, and optimum food set for the consumers. Diet Planner Using Open AI, generative AI and Prompt is a digital tool that influences open APIs and prompt architecture to support embodied diet approvals established a consumer's Body Mass Index (BMI). System advises Diet believe a period classification in Lunch, Breakfast and Dinner. This use streamlines the process of acquiring BMI dossier from consumers, produce diet plans the request uses the MediaPipe to discover one's pose, and following resolves the arithmetic of the pose from the dataset and real-time video and counts the repetitions of the exercises and OpenCV is used to approach the webcam on your machine.*

Key Words: AI, Virtual Assistants, Open AI, Generative AI, open CV, Mediapipe.

1.INTRODUCTION

Nowadays, a human being faces a variety of health issues, including fitness issues, improper diet, mental health issues, and so on. Various studies show that improper and inadequate dietary intake is a primary cause of a variety of health problems and diseases. Human-computer interaction, clinical assessment, activity tracking, and sports performance all benefit from seeing, classifying, and evaluating human movements. Sport coaching and training still largely rely on visual observation and subjective feedback, and they could benefit from quantitative input supporting decision making. The major goal of this project is to prescribe a diet to various people as well as provide a guide for their workout.

The first part of the diet recommendation system is built upon the Django web framework and utilizes the powerful capabilities of OpenAI's language models. With a user-friendly interface, it calculates Body Mass Index (BMI) using open APIs, and then employs prompt engineering to interact with the AI model. By seamlessly combining BMI data with AI-generated diet recommendations, this system provides users with personalized and scientifically-informed dietary advice, fostering healthier lifestyles and improved well-being.

The recommender system also works with a vast amount of data by filtering the most important information based on the data provided by the user and other criteria such as the user's preferences and interests. It determines whether a user and an item are compatible and assigns similarities between users and things for suggestion based on their physical characteristics (age, gender, height, weight, and body fat percentage), as well as their preferences (weight loss or weight gain). The information collection phase, learning phase, and recommendation phase are the three stages of the recommendation process. The information is first gathered regarding a specific problem, after which the numerous solutions to that problem are classified. In our project the output of recommendation is based on the user's physical aspects, preference and their Body mass Index (BMI).

2. LITERATURE SURVEY

In the year 2022, Saniya Shaikh, Sai Sanjana Prodduturu, udraksh Naikh, Anushka Shrirao and Anand kumar Birajdar [1] observed that an Computer vision enables computers and systems to extract useful information from digital photos, videos, and other visual inputs and to conduct actions or offer recommendations in response to that information. They implemented a method for recognizing and categorizing the joints in the human body i.e. Human Pose Estimation (HPE). In simple terms, it's a method for capturing a key point—a set of coordinates that can characterize a person's position—for each joint (arm, head, torso, etc).

In Year 2022, Sakitha Anna Joseph, Reshma Raj K., Sony Vijayan [2] examined the diverse needs of users which are served by these apps, which offered personalization and also provide diet and nutrition besides exercise and workouts. The user's stance on fitness apps available in mobile devices is aimed to be understood by this study. Requisite information regarding various related aspects was collected through primary data from one hundred respondents. The means to increase and improve the user participation towards using the apps are also alluded to by the study. For conducting the study they applied convenient random sampling technique. The primary data was gathered from the users through personnel interview and questionnaires.

Secondary data was collected from various website, journals and publications.

Elise Li Zheng [3] approached the topic from post phenomenological perspective, in combination with empirical studies of design analysis and interviews of fitness apps, to reveal the human-technology link between the design elements and people's perception through the direct experiences and interpretations of technology in Year 2021.Daily and constant interactions are encouraged by a personalized "plan". The "check-in" Footnote8 has been set as one of the most visible features displayed on the user's home screen and during the interaction by the newest update in the fall of 2019. Users are encouraged to participate in some daily activities for a certain goal while their participation is marked with a "streak" on a calendar that shows continuous engagement.

Zheng-An Zhu, Yun-Chung Lu, Chih-Hsiang You and Chen-Kuo Chiang [Year 2019] [4] proposed a multipath convolutional neural network (MP-CNN), a dynamic convolutional neural network (DCNN), and an action assessment approach. To evaluate the rehabilitation exercise, a special evaluation matrix is proposed along with the deep learning classifier to learn the general feature representation for each class of rehabilitation exercise at different levels. The distance to the best feature is used as the score for the evaluation. The classification results are superior when compared to those obtained using other deep learning models, and the evaluation scores are effective for practical applications.

YouMove is a novel system that allows users to record and learn physical movement sequences. In 2013, Fraser Anderson, Tovi Grossman, Justin Matejka, George Fitzmaurice [5] designed the recording system to be simple, allowing anyone to create and share training content. The training system uses recorded data to train the user using a large-scale augmented reality mirror. The system trains the user through a series of stages that gradually reduce the user's reliance on guidance and feedback.

In year 2020, Butti Gouthami and Malige Gangappa [6] worked on various datasets, leading to the conclusion that data will be collected from the USDA database, responsible for storing food nutrition information, and user-generated grocery data. The first level involves taking the user's BMI and daily food consumption as input. At the second level, nutrition information for the user's pantry data is queried from the USDA database. Recommendations for nutritionally complete food based on the user's BMI and health conditions are provided. The system offers tracking of daily nutrition factors, suggestions, and symptom monitoring. It employs collaborative and content-based filtering methods for personalized food recommendations.

A controlled experiment was conducted on each visualization type in Tai Chi videos to assess their effectiveness by Simon T. Perrault, Kenny Choo, Atima Tharatipyakul in year 2020 [7]. Their study aimed to evaluate the usefulness of a trainer's skeleton, user's skeleton, and user's video feed. Four conditions were tested: (C1) trainer video + user video (baseline), (C2) trainer video + user video with skeleton, (C3) trainer video + user skeleton, and (C4) trainer video with skeleton + user skeleton. The limitation to four conditions prevented overwhelming participants with excessive choices.

The above listed papers highlight diet and exercise recommendation systems. The recommendations are based on the inputs provided and on the analysis of large datasets. The analysis is done by training and testing the listed ML models on large datasets. The results are based on the observations recorded.

Overall, the papers described in the literature summary highlight the importance of using ML models and large datasets to generate personalized diet and exercise recommendations. These recommendations can help individuals make informed decisions about their health and wellness and lead to improved outcomes over time.

3. METHODOLOGY

The System is divided into 2 parts i.e. Diet recommender system and Exercise monitoring tool which works in a Machine Learning Environment. The diet recommender calculates the user data and accordingly gives the recommended Diet plan to work on. We have divided the dataset in 3 categories: Lunch_data, Breakfast_data, Dinner_data. Accordingly, we train the ML model with different inputs to get the desired results for the user. We used mainly 2 Algorithms here which are: KMeans, Random Forest. According to the choice which user takes in a healthy diet, weight gain or weight loss the model as per the data and category selected will generate a diet plan for the user.

The system leverages generative AI, specifically OpenAI's language models, to generate personalized diet recommendations based on user data and prompt engineering. The system calculates the user's Body Mass Index (BMI) using open APIs, providing a critical health metric. The Django web framework offers a robust and user-friendly platform for data collection and presentation, ensuring a seamless and intuitive user experience. This system helps users to find information by providing them with personalized suggestions. Based on the above problems of researchers, recommendation techniques will have great influence in all aspects of our life. For the Exercise Monitoring and Angle Detection model we have used OpenCV & MediaPipe, here to monitor exercise and count the reps for it. The user can use their real-time camera to feed

the data of them doing arm curls and keep a track of the number of arm curls being done.

A. Existing System Architecture

Several studies have proposed various diet and food recommendation systems. These systems provide suggestions for food, menus, diet plans, health recommendations for specific diseases, and recipe recommendations. They gather information about user preferences from sources like user ratings. For diabetic patients, a Food Recommendation System (FRS) has been developed using K-mean clustering and the Self Organizing Map. This system suggests alternative foods based on nutrition and food factors. However, FRS does not fully address the variability of diabetes severity throughout the day. Another system, an android-based meal recommender, uses tags and latent factors to offer customized recipes to users. It employs latent feature vectors and matrix factorization to improve prediction accuracy. However, nutrition and food balance are not considered. A content-based food recommender system suggests food recipes based on user preferences and ratings. It breaks down the user's favored recipes into ingredients and suggests recipes that use the same ingredients. Nutritional variables and food balance are not considered. These recommendation systems focus on specific ailments or imbalanced diet plans. They overlook factors like the severity of diseases and the importance of nutrition for maintaining a healthy diet.

B. Proposed System Architecture

1) User's will request the system by providing their physical information and after analyzing the data as a response the system (ML model) will recommend a diet which includes (breakfast, lunch, dinner) based on the user information accordingly.
2) User's will enter the necessary information like their age, gender, weight etc. on the website.
3) The information will then go through the ML model in following manner:
   a) K-Means is used for clustering to cluster the food according to calories OpenAI API
   b) Random Forest Classifier is used to classify the food items and predict the food items based on input After analysing all the data the system will respond by showing user's BMI and their current state (Overweight, Underweight, Healthy)
4) The System will then recommend diet to the users into three categories (breakfast, lunch, dinner) based on input.
5) The Users can choose from multiple recommended items and make their diet plan.
6) With the help of generative AI and prompt engineering the system will also provide a diet chart in a tabular format along with additional tips for diet plan.
7) When the user has the diet plan, they can then use the exercise monitor feature to get guidance on their workout.
8) By measuring the angle and counting the reps, the tool monitors the exercise.(Fig 1)

C. Implementation Details

The system proposed by our project primarily works as a web app developed using Django, with an initiative UI through which users can calculate their BMI, get a diet plan and get their exercise monitored. The system uses technologies such as Open AI, generative AI and K-means , Random Forest algorithms to give the users best diet plan and the Exercise is monitored using Python libraries called MediaPipe and OpenCV.

D. Identification of Dataset

The training dataset employed for the analysis is taken from Kaggle, which includes 11 attributes. Attributes are Calories, Fat, Proteins, Iron, Calcium, Sodium, Potassium, Carbohydrates, Fibre, Vitamins, Sugars.

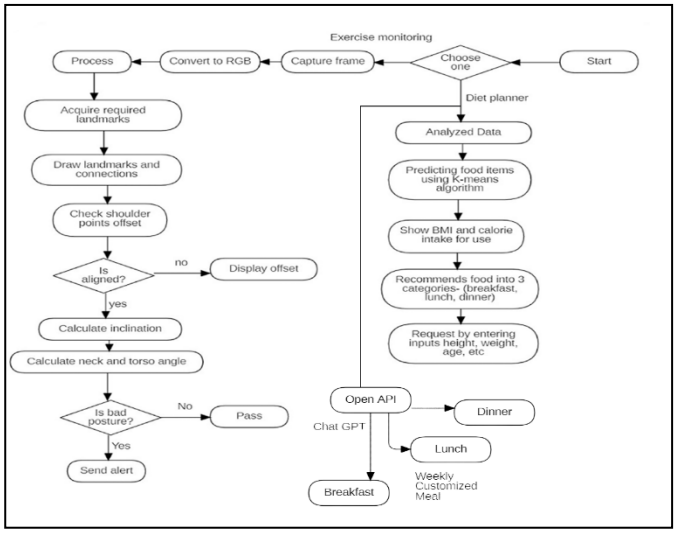

Fig -1: Proposed System

E. *Algorithms Used*

1) **Open AI-** OpenAI's API is harnessed in a diet planner to facilitate personalized dietary recommendations. After collecting user data, including height, weight, and dietary preferences, the system calculates the user's Body Mass Index (BMI) through an open API. Subsequently, a meticulously crafted prompt is presented to OpenAI's API, which, powered by advanced language models, interprets the BMI and generates context-aware diet suggestions.

2) **Prompt Engineering-** Prompt engineering is a crucial component of the system's architecture. OpenAI's models require well-crafted prompts to generate relevant responses (Fig 6). These prompts guide the AI models in generating diet recommendations based on the user's BMI, thus making the interaction more effective and personalized.

3) **K-Means Algorithm-** K Means algorithm is an iterative algorithm that tries to partition the dataset into predefined distinct non overlapping subgroups (clusters) where each data point belongs to only one group. It tries to make the intra-cluster data points as similar as possible while also keeping the clusters as different (far) as possible. It assigns data points to a cluster such that the sum of the squared distance between the data points and the cluster's centroid (arithmetic mean of all the data points that belong to that cluster) (Fig 2) is at the minimum. The less variation we have within clusters, the more homogeneous (similar) the data points are within the same cluster. The way k means algorithm works is as follows:

   a) Specify number of clusters K.
   b) Initialize centroids by first shuffling the dataset and then randomly selecting K data points for the centroids without replacement.
   c) Keep iterating until there is no change to the centroids. i.e. assignment of data points to clusters isn't changing.
   d) Compute the sum of the squared distance between data points and all centroids.
   e) Assign each data point to the closest cluster (centroid).
   f) Compute the centroids for the clusters by taking the average of all the data points that belong to each cluster.

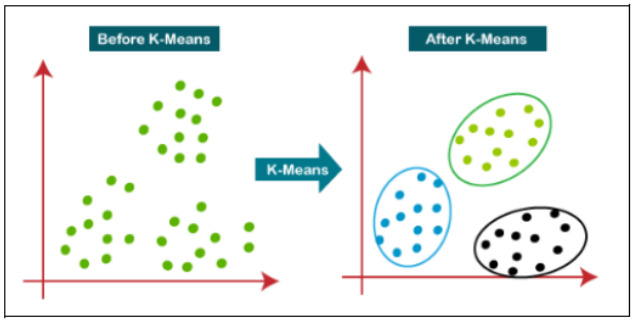

Fig -2: K-Means Algorithm

The data set is divided into three categories: lunch, breakfast, dinner with the help of k-means clustering algorithm the below diagram shows how all three categories are separated from the cluster dataset. This helps us to finally divide the dataset into train and test dataset for all three categories and further the model is built in using the random forest algorithm. The below diagram explains the working of the K-means algorithm.

4) **Random Forest Algorithm-** Random Forest algorithm is a supervised classification algorithm. We can see it from its name, which is to create a forest by some way and make it random. There is a direct relationship between the number of trees in the forest and the results it can get: the larger the number of trees, (Fig 3) the more accurate the result. But one thing to note is that creating the forest is not the same as constructing the decision with information gain or gain index approach. The decision tree is a decision support tool. It uses a tree-like graph to show the possible consequences. If you input a training dataset with targets and features into the decision tree, it will formulate some set of rules. These rules can be used to perform predictions.

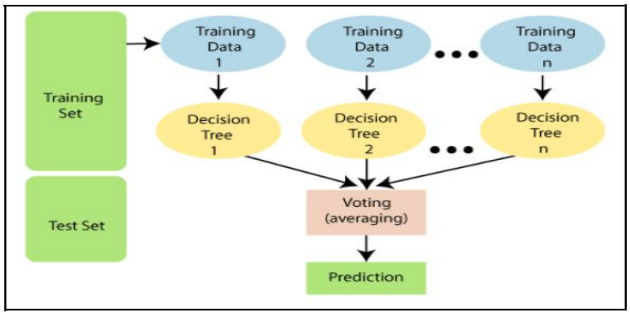

Fig -3: Random Forest Algorithm

When we have our dataset categorized into 3 categories, random forest helps to make classes from the dataset. Random forest is clusters of decision trees all together, if you input a training dataset with features and labels into a decision tree, it will formulate some set of rules, which will be used to make the predictions.

4. RESULT AND DISCUSSION

The implementation of a system utilizing MediaPipe and OpenCV for pose estimation to track exercises and provide personalized diet plans based on BMI has yielded promising results. Through the integration of advanced computer vision techniques, the system accurately identifies and tracks various exercise movements, allowing users to monitor their workout routines effectively. Moreover, the incorporation of OpenAI APIs facilitates the generation of personalized diet plans, enhancing the overall health and fitness experience for users.

One significant outcome of this system is its ability to precisely capture and analyze exercise movements in real-time. The combination of MediaPipe and OpenCV enables the system to detect key points on the user's body, allowing for accurate pose estimation during various exercises such as

squats, lunges, and push-ups. This real-time feedback mechanism empowers users to maintain proper form and technique, thereby reducing the risk of injury and maximizing the effectiveness of their workouts.

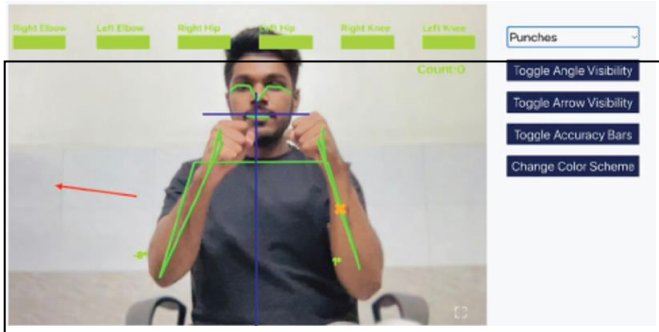

Fig -4: Exercise Monitoring

Furthermore, the integration of BMI calculations into the system enables personalized diet recommendations based on individual health metrics. By leveraging BMI data, the system can provide users with tailored nutritional guidance to support their fitness goals. Whether the aim is weight loss, muscle gain, or overall health improvement, the system delivers diet plans that align with each user's specific needs and preferences, fostering a sustainable approach to nutrition and wellness.

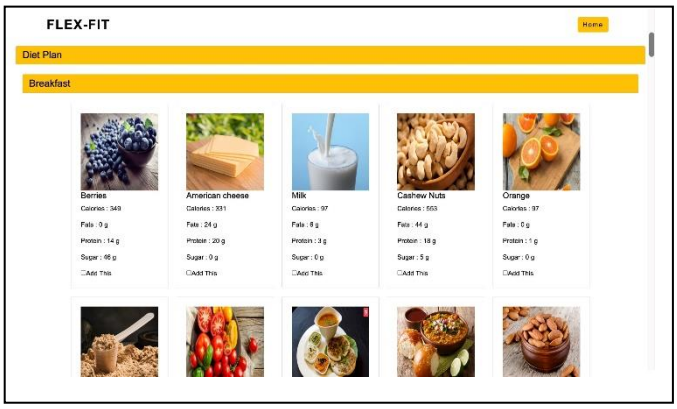

Fig -5: Diet Recommendation

The weekly meal plans generated by the system using OpenAI APIs offer a convenient and practical solution for users seeking dietary support. By leveraging natural language processing capabilities, the system curates three well-balanced meals per day, considering factors such as nutritional content, dietary restrictions, and culinary preferences. This automated meal planning feature not only saves users time and effort but also promotes healthy eating habits by offering diverse and nutritious meal options.

Fig -6: Weekly Meal Plan

Overall, the integration of MediaPipe, OpenCV, and OpenAI APIs in the development of this exercise tracking and diet recommendation system demonstrates the potential of advanced technologies in promoting health and wellness. By providing users with real-time feedback on their workouts, personalized diet plans based on BMI, and automated meal recommendations, the system offers a comprehensive solution for individuals striving to improve their fitness and nutrition habits. Moving forward, continued refinement and optimization of the system can further enhance its effectiveness and user satisfaction, ultimately contributing to the promotion of healthier lifestyles on a broader scale.

CONCLUSION

We designed a website that recommends food items wherein BMR has been incorporated primarily based at the person's age, gender, and the number of activities they engage in on a regular basis. The preliminary segment for training the system entails segregating meals merchandise consistent with the meal for which they're consumed, i.e. Breakfast, Lunch, and Dinner. It conducts the clustering of diverse nutrients depending on which can be important for weight loss, weight benefit, and normal fitness. Following clustering, the nearest food items which can be most acceptable for the right diet are anticipated the usage of the Random forest classifier (Fig 3). Our diet suggestion system virtually lets in customers to receive the preferred wholesome food regimen based on their BMI to get balanced food plan packages. emerging technologies along with machine learning and artificial intelligence are helping to propel the IT (facts technology) industry ahead. The weight loss plan advice module calculates customers' body Mass Index (BMI) using open APIs and makes use of prompt engineering to guide the AI models in delivering context-conscious nutritional recommendation. With OpenAI at its core, this project empowers customers to make informed dietary choices based on their BMI and preferences, selling healthier lifestyles and universal well-being. The need for dietary counseling is growing each day with the intention to live a healthful and in shape existence, and a healthy diet regime in

conjunction with exercising is developed through accepting the consumer's selections and profile in the device.

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