

A Project Report
On

AN END TO END SYSTEM FOR WORKOUT MANAGEMENT

Submitted in partial fulfillment of the requirement of
the Degree of

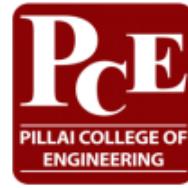
Bachelor of Technology
In
Computer Engineering

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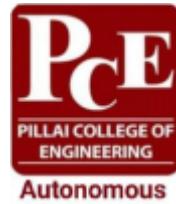
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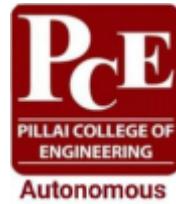
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DECLARATION

We declare that this written submission for B.E. Project Report Declaration entitled "**An End to End System for Workout Management**" represents our ideas in our own words and where others' ideas or words have been included. We have adequately cited and referenced the original sources. We also declared that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any ideas / data / fact / source in our submission. We understand that any violation of the above will cause disciplinary action by the institute and also evoke penal action from the sources which have thus not been properly cited or from whom paper permission has not been taken when needed.

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Abstract

An End to End System for Fitness and Workout Management is a software solution designed to manage workout and automate the day-to-day operations of a fitness center. The system provides an easy-to-use interface for users to manage, learn, and have a proper idea about fitness. Users can easily view schedules, workout form, products required for fitness goals, etc. This system is a virtual trainer which will be more useful than a personal trainer in terms of cost, time and knowledge. Workout management System will be an end to end workout planner and everything required for muscle building and maintaining. The algorithms which we are going to use in this project are CNN for moment detection(Posture during workout), K means algorithm for customer segmentation and recommendations for the products as well as exercises (Gym products, Exercises), Random Forest algorithm for cart abandonment analysis (Gym products). By automating many of the tasks involved in maintaining fitness, this system allows users to focus on providing excellent customer service and improving the overall workout experience.

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Chapter 1

INTRODUCTION

1.1 Fundamentals

1. Exercise Science: A virtual gym trainer should have a solid understanding of exercise science, including principles of anatomy, physiology, and kinesiology. This knowledge is essential for designing effective and safe workout plans tailored to the individual client's needs.
2. Communication: Clear communication is essential in virtual gym training. A virtual gym trainer should have excellent communication skills to explain workouts, demonstrate exercises, and provide feedback on form and technique.
3. Technology: A virtual gym trainer should be proficient in using technology platforms such as video conferencing, messaging, and mobile applications. This knowledge is necessary for delivering virtual training sessions and communicating with clients.
4. Personalization: A virtual gym trainer should be able to create personalized workout plans based on the individual client's fitness level, goals, and preferences. This personalization is essential for helping clients achieve their fitness goals and stay motivated.
5. Nutrition: A virtual gym trainer should have a basic understanding of nutrition principles to provide clients with basic guidance on healthy eating habits that can support their fitness goals.
6. Motivation: A virtual gym trainer should possess strong motivational skills to help clients stay on track with their fitness goals, stay motivated, and remain committed to their workout plans.
7. Professionalism: A virtual gym trainer should maintain a professional demeanor and adhere to ethical standards in all interactions with clients. This includes punctuality, confidentiality, and respect for client boundaries.

1.2 Objectives

Building an end to end system for workout management which will perform Workout Pose Monitoring and to automatically detect, recognize, and count repetitions in different types of workout. Also to improve and manage the workout of an individual by building an e-commerce website on gym products and to build a Recommender System for Gym Products which will Classify Customers depending upon their Age, Height, Weight, Gender, Country, Language and Goals. To get a better understanding of workout for a user which could be used to increase the revenue of the company as well.

1.3 Scope

To develop a machine learning algorithm that can accurately recognize when a user starts and stops various exercises and collect user data, such as age, gender, fitness level, and workout history, to group users into different segments based on their fitness goals and preferences. Developing personalized workout plans for each segment based on their goals and preferences and to analyze users past workout data and purchase history to identify patterns and preferences. Using machine learning algorithms to recommend fitness products, such as equipment, supplements, and apparel, that are relevant to each user's workout routine and fitness goals.

To provide personalized product recommendations within the mobile app, as well as via email or push notifications.

1.4 Outline

The report is organized as follows: The introduction is given in Chapter 1. It describes the fundamental terms used in this project. It motivates me to study and understand the different techniques used in this work. This chapter also presents the outline of the objective of the report. Chapter 2 describes the review of the relevant various techniques in the literature systems. It describes the pros and cons of each technique. Chapter 3 presents the Theory and proposed work. It describes the major approaches used in this work. The societal and technical applications are mentioned in Chapter 4. The summary of the report is presented in Chapter 6.

Chapter 2

Literature Survey

2.1 Introduction

The use of machine learning and computer vision in various applications has gained significant attention in recent years. This literature review explores the application of machine learning and computer vision in analyzing indoor workouts, predicting online shopping cart abandonment, and customer segmentation in e-commerce. The papers propose a real-time indoor workout analysis system using machine learning and computer vision, a smart gym trainer using human pose estimation, an end-to-end machine learning system to mitigate checkout abandonment in e-commerce, predicting online shopping cart abandonment with machine learning approaches, customer segmentation in e-commerce using the K-means clustering algorithm. This review aims to provide an overview of these studies and their contributions to the field of machine learning and computer vision.

2.2 Literature Review

The paper by Nagarkoti et al. proposes a system for analyzing indoor workouts in real-time using computer vision and machine learning techniques [1]. The system is designed to monitor body postures, identify exercises, and provide feedback to the user. The authors tested their system on a dataset consisting of 2000 images and achieved an accuracy of 90% in detecting exercises.

The paper by D'souza et al. proposes a smart gym trainer system that uses human pose estimation to monitor the user's body posture during workouts [2]. The system is designed to provide feedback on posture and suggest corrective exercises to improve posture. The authors tested their system on a dataset consisting of 4000 images and achieved an accuracy of 80% in detecting posture.

Both papers focus on using computer vision and machine learning techniques to monitor workouts and provide feedback to the user. While Nagarkoti et al. focus on analyzing exercises, Dsouza et al. focus on monitoring body posture. The proposed systems have the potential to improve the effectiveness and safety of workouts by providing real-time feedback to the user.

M. R. Islam Rifat, M. Nur Amin, M. H. Munna, and A. Al Imran presented an end-to-end machine learning system for mitigating checkout abandonment in e-commerce in their 2022 paper [3]. The proposed system consists of four main steps: data preprocessing, feature engineering, model training, and model evaluation. The authors used the XGBoost algorithm to predict cart abandonment, achieving an accuracy of 86.39% and a recall rate of 85.33%.

In a related study by Rausch, T., Derra, N., and Wolf, L. (2020), machine learning approaches were also used to predict online shopping cart abandonment [4]. The authors collected data from an online retailer and used various machine learning algorithms such as decision tree, logistic regression, and random forest to predict cart abandonment. The best-performing algorithm was random forest, achieving an accuracy of 90.1%.

Both studies highlight the effectiveness of machine learning in predicting and mitigating checkout abandonment in e-commerce. The use of machine learning algorithms can help retailers identify potential cart abandonment early on and take appropriate action to retain customers.

E. Y. L. Nandapala and K. P. N. Jayasena's paper, "The practical approach in Customers segmentation by using the K-Means Algorithm," presents a practical approach for customer segmentation in e-commerce using the K-Means algorithm [5]. The paper proposes a four-step approach for the segmentation process, including data pre-processing, clustering, cluster interpretation, and cluster profiling. The study showed that the proposed approach can effectively segment customers based on their purchasing behavior.

L. Rajput and S. N. Singh's paper, "Customer Segmentation of E-commerce data using K-means Clustering Algorithm," proposes a similar approach to customer segmentation in e-commerce, using the K-means clustering algorithm [6]. The study used a dataset of customer behavior data and showed that the K-means algorithm could effectively segment customers into distinct groups based on their purchasing behavior. The study also performed cluster analysis to identify the characteristics of each customer group, providing insights into customer behavior patterns that can be used to optimize marketing strategies.

2.3 Limitations of Existing Systems

Some of the common and major limitations of these systems are:

Limited sample size: Some studies may have been conducted with a limited sample size, which may not be representative of the larger population. This can affect the generalizability of the results.

Limited scope: Some studies may have been conducted with a narrow scope, which may not be applicable to all situations. This can limit the usefulness of the findings.

Limited data quality: The accuracy and completeness of the data used in the studies can affect the validity of the results.

Limited algorithmic complexity: The studies may have used relatively simple machine learning algorithms, which may not be suitable for more complex problems. This can limit the accuracy of the predictions.

Limited real-world applicability: The studies may not have considered all the practical issues that could arise when implementing the proposed solutions in the real world, such as the cost and feasibility of implementation, user acceptance, and privacy concerns.

2.4 Literature Summary

The literature survey covers five different research papers from various IEEE conferences and the International Journal of Market Research. The first two papers, "Realtime Indoor Workout Analysis Using Machine Learning & Computer Vision" and "Smart gym trainer using Human pose estimation," focus on the development of machine learning-based systems that can analyze and monitor indoor workouts in real-time. The next two papers, "An End-to-end Machine Learning System for Mitigating Checkout Abandonment in E-Commerce" and "Predicting online shopping cart abandonment with machine learning approaches," explore machine learning-based approaches to reduce checkout abandonment rates in e-commerce platforms. The last paper, "The practical approach in Customers segmentation by using the K-Means Algorithm" and "Customer Segmentation of E-commerce data using K-means Clustering Algorithm," investigate the use of K-means clustering algorithm for customer segmentation in e-commerce platforms.

Table 2.1 Summary of literature survey

SN	Paper	Advantages and Disadvantages
1.	Realtime Indoor Workout Analysis Using Machine Learning & Computer Vision [1]	<p>Advantages: It presents a novel approach for analyzing indoor workout sessions in real-time, which can be useful for monitoring and providing feedback to gym-goers or athletes, the study integrates computer vision and machine learning techniques to detect and track human poses during the workout, which can help in identifying incorrect postures or potential injuries and the system can be customized to track different exercises and workout routines, making it versatile and adaptable.</p> <p>Disadvantages: Works only for motion along 2 dimensions</p>
2.	Smart gym trainer using Human pose estimation. [2]	<p>Advantages: Improved Workout Technique, Personalized Workout, Automated Monitoring, Cost-effective, Real-time Feedback</p> <p>Disadvantages: Low quality videos and graphics , Cannot detect muscular defect</p>
3.	An End-to-end Machine Learning System for Mitigating Checkout Abandonment in E-Commerce[3]	<p>Advantages: Addresses a common problem, End-to-end system, Personalized recommendations, Real-time processing and Improved conversion rates</p> <p>Disadvantage: Limitation on the number of products a customer has purchased .</p>
4.	Predicting online shopping cart abandonment with machine learning approaches [4]	<p>Advantages: Improved customer experience, Increased sales, Cost savings and Data-driven insights</p> <p>Disadvantage: It does not consider the abc features which would give better results and solve the abc problem.</p>

5	The practical approach in Customers segmentation by using the K-Means Algorithm [5]	<p>Advantages: Improved customer segmentation, Practical implementation, Cost-effective solution and Enhanced decision-making</p> <p>Disadvantage: Did not carry out experimentation for real-world workload traces. Needs improvement in the algorithm.</p>
6	Customer Segmentation of E-commerce data using K-means Clustering Algorithm [6]	<p>Advantages: Improved targeting of marketing efforts, Enhanced customer satisfaction, Efficient use of resources</p> <p>Disadvantage:</p> <p>Identifying best customer and providing services is crucial task</p>

Chapter 3

Proposed System

3.1 Overview

This report outlines a project aimed at developing a virtual gym trainer program designed to provide personalized fitness solutions to individuals looking to achieve their fitness goals. The project was initiated to meet the increasing demand for virtual fitness solutions and to offer a more personalized approach to fitness training.

The objectives of the project were to create a virtual gym trainer program that would be accessible and user-friendly for clients and to deliver personalized fitness plans and nutritional guidance. The program was also intended to offer flexible scheduling options and to use technology to get the knowledge and guidance of each and every workout.

The project was executed using various technology platforms, including Workout detection and monitoring using Convolutional Neural Network(CNN), Segmenting the customers using K-means clustering and cart abandonment analysis using Random forest Algorithm. The key steps included designing the program, creating workout plans and nutritional guidance, and implementing a communication and support system for clients.

Workout detection and monitoring using Convolutional Neural Network(CNN) :

Convolutional Neural Networks have been used in workout monitoring to track and analyze movements, posture, and form. By using cameras to capture video footage of the workout, the CNN can be trained to recognize and analyze different exercises, identify any errors in form, and provide real-time feedback to the user.

Customer Segmentation using K-means Clustering :

K-means clustering has been used for customer segmentation by clustering customers based on their behavior, preferences, and other attributes that are relevant to the business. The clustering process can reveal distinct segments of customers with similar behaviors and preferences, allowing the company to develop targeted marketing campaigns and promotions for each segment.

Cart Abandonment Analysis using Random Forest algorithm :

Random Forest as a local learning approach may be suitable for online shopping cart abandonment prediction tasks since it is able to alleviate the challenge of imbalanced data.

3.1.1 Existing System Architecture

The existing system did not have proper implementation of the algorithms like the Customer Segmentation and the cart abandonment algorithm. The workout detection and analysis was also in its initial stages.

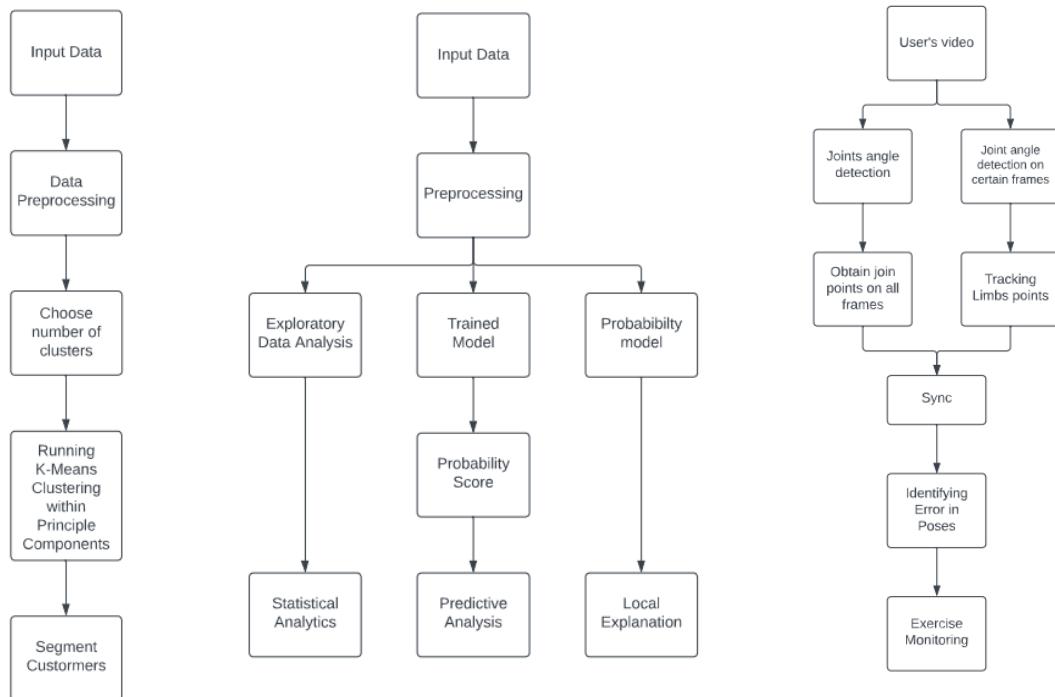


Fig. 3.1 Existing system architecture

The architecture of the existing system is depicted in Figure 3.2. All the steps were performed in three steps, each of which is handled by a separate component:

- **Workout detection :** Earlier, only a camera was used to monitor and see the workout being performed. The system was not capable of handling and pointing out errors during workouts which posed huge drawbacks during workouts. By not pointing out errors, users could get injured and could develop body dysmorphia and body aches by using incorrect form during workouts.

- **Customer Segmentation** : In this module, the data was collected from the users and the users were segmented to perform various operations on the data of the various users and tries to generalize this data, in order to construct the user profile.
- **Cart Abandonment** : In this module, the users that have some items in their carts are constantly reminded to empty their carts by buying the items in them and also checking the loyalty of the customer to our services..

3.1.2 Proposed System Architecture

The previous sections discussed the strengths and weaknesses of the existing system. In order to achieve better results, we are hoping to combine all the techniques to build a Hybrid system, which seeks to inherit advantages and eliminate disadvantages.

In general, hybrids are systems that combine multiple techniques together to achieve a synergy between them. Although there exist a number of approaches that are practical to merge, this project will mainly focus on the combination of Cart Abandonment, Customer Segmentation and Workout Monitoring techniques. The proposed architecture is shown in Figure 3.2

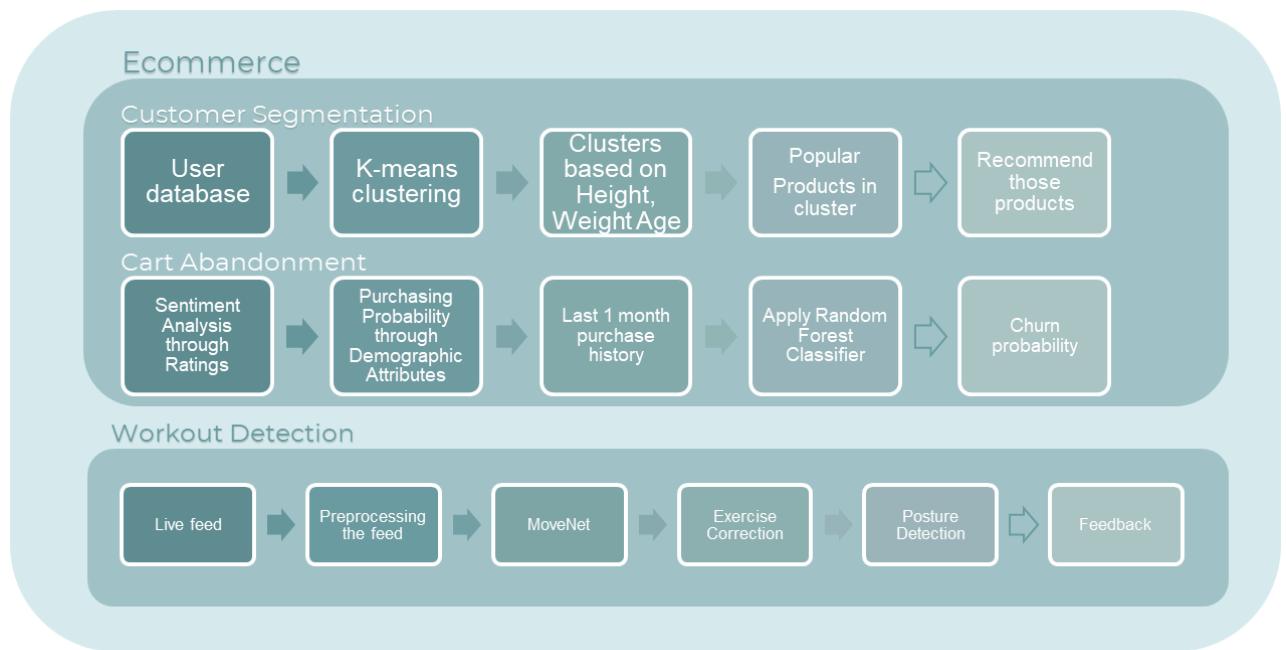


Fig. 3.2 Proposed system architecture

In the proposed system, along with doing workout analysis and rep counts, we are also implementing customer segmentation. When the data of a particular customer is entered, he is compared to all the other customers with respect to their body types and when the customer visits our E-Commerce website, he will be recommended products that other customers with the same body type have bought that can be helpful to him to achieve his dream physique. We are also adding cart abandonment which constantly reminds customers to empty their carts by buying whatever was in their carts and not keep the items in the cart for a very long time.

3.2 Implementation Details

1. Customer Segmentation :

Customer Segmentation is used to segment the customers according to their behavior and their goals. These segmentations are acquired using K-means Clustering because the scalability, speed, flexibility and effectiveness of this algorithm is high.

Elbow method to find number of clusters

$$WCSS = \sum_{i=1}^n (X_i - Y_i)^2 \dots \dots \dots .i$$

K means Algorithm :

$$f = \sum_{i=1}^n \sum_{j=1}^k \|x_i^{(j)} - c_j\|^2 \dots \dots \dots .ii$$

where,

$x^{(j)}$ is the chosen data point,

c_j is the cluster center, and

$\|x_i^{(j)} - c_j\|^2$ is the distance between cluster

Recommendations will also be further added on the basis of similar kinds of customers.

first_name	last_name	gender	email	city	country	age	height	weight	phone	street_address	street name
Priscilla	Pollett	Male	ppollett@foxnews.c	Sesheke	Zambia	58	777777	93	222-398-8279	93 Fremont Drive	Green
Ana	Onge	Male	aonge1@ita.gov	Queretillo	Peru	18	136	70	650-786-5808	0841 Troy Park	Gerald
Butch	Rawls	Male	brawls2@alidshare.i	Licupis	Peru	22	143	51	325-412-0143	09450 Rowland Cen	Eggendart
Ambros	Fairme	Male	afairme3@reuters.com	Yonghe	China	18	147	59	664-380-9221	5173 Nelson Alley	Annamark
Gaylene	Tilcomb	Female	gtilcomb4@dyndns.c	Wang Yang	Thailand	40	186	80	477-429-2626	833 Vermont Drive	Clarendon
Cleveland	Lindegard	Female	clindegard5@ezinee	Tanauacá	Brazil	44	138	69	179-490-8666	2 Tomscot Court	Oak
Fredric	Gascard	Female	fgascard6@bbb.org	Filabusi	Zimbabwe	34	133	78	669-932-9006	96 Oriole Center	Hayes
Alton	Prandi	Male	aprandi7@feedburner	Pak Phanang	Thailand	29	197	428675	735-377-4981	0 Debs Avenue	Scott

company_name	department	job_title	language	linkedin_skill	products	goal	products_purchased	review	feedback
Ombo	Support	Internal Auditor	Indonesian	Lifestyle	EnergyBar	bulk	0	5	Exceptional quality,
Cogidoo	Sales	Compensation Analyst	Fijian	Healthcare Industry	Oats	lean	0	2	Average at best, not
Edgewire	Support	Health Coach II	Gujarati	Visual SVN	BCAA	cut	0	3	Just average, nothing
Digitube	Support	General Manager	Belarusian	Nanofabrication	ProteinPowder	lean	0	5	Outstanding value for
Quaxo	Engineering	Internal Auditor	Papiamento	AQL	ProteinShake	bulk	1	5	Outstanding in quality
Shuffletag	Sales	Mechanical Systems	Portuguese	Occupational Therapist	Oats	cut	0	1	This is the worst of them
Jabbersphere	Marketing	Geologist II	Dzongkha	Eagle PCB	PeanutButter	bulk	0	1	I can't understand how
Kwimbee	Engineering	Electrical Engineer	Lao	Yeast two-hybrid	ProteinPowder	lean	0	2	Could be improved,

Fig 3.3 Customer Dataset

2. Cart Abandonment analysis :

For cart abandonment, we are using customer churn prediction by which we will determine whether the customer is loyal to us or not i.e. whether he will leave our services and choose something else or will he continue to use our services. This is calculated by finding sentiment of the users through the ratings provided by them. Other columns like gender, country, goal, product, sentiment, age_group are feature variables and products_purchases_in_the_last_one_month is the target variable. By applying Random Forest Classifier, churn probabilities of every customer are obtained. By setting a threshold of 0.75 probability, we can find out the customers' loyalty.

3. Workout Detection :

As a starting point we have tried some of the pretrained model such as

- 1) MediaPipe (Google's pretrained model) : MediaPipe is an open-source framework developed by Google that provides tools and machine learning models for building applications involving real-time, cross-platform body, face, and hand tracking. It uses computer vision and machine learning techniques to analyze video streams or image sequences, allowing developers to create applications that can track and understand human body movements, recognize facial features, and detect hand gestures. MediaPipe is commonly used for a wide range of applications, including augmented reality (AR), virtual reality (VR), gesture recognition, and more. It has pre-trained models and APIs that make it relatively easy to integrate into various projects.
- 2) MoveNet : MoveNet is a specific machine learning model developed within the MediaPipe framework for real-time human pose estimation. It is designed to accurately estimate the 2D and 3D positions of a person's body joints from a video feed. MoveNet can be used to track a person's movements in a video or camera stream, making it useful for applications such as fitness tracking, gesture recognition, and animation. It's optimized for efficiency and can run on a variety of platforms, including mobile devices and web applications.

- i) Lightning : Lightning is a machine learning framework that is built on top of PyTorch. It is designed to simplify and accelerate the training and research process for deep learning models. Lightning provides a high-level abstraction for PyTorch, allowing researchers and engineers to focus more on the modeling and less on the repetitive boilerplate code. It offers a standardized and modular way to define and train machine learning models, reducing the complexity of training loops and experiment management.
 - ii) Thunder : "Thunder" by itself is a common term used to describe the sound produced by lightning. In the context of machine learning or technology, "Thunder" might refer to a project, tool, or library, but without additional context, it's hard to provide a specific explanation.
- 3) Openpose : OpenPose is an open-source computer vision library that is designed for real-time multi-person keypoint detection in images and videos. It can detect and track the key points of human bodies, including the positions of joints such as the head, shoulders, elbows, wrists, hips, knees, and ankles. OpenPose is widely used in applications like human pose estimation, action recognition, and gesture analysis. It provides a powerful tool for understanding and analyzing human body movements, and it can be used in various domains, including healthcare, sports analysis, and animation. OpenPose has been implemented using deep learning techniques and is available as a pre-trained model for developers to use.

Movenet

Workout monitoring system using MoveNet involved several key steps to ensure accurate and real-time tracking of exercise movements. Here's how the methodology was carried out:

Model Integration:

Selected the Thunder variant of MoveNet for its high accuracy in detecting body keypoints.

Loaded the MoveNet model using TensorFlow.js, initializing it with the required configuration parameters.

Video Input Processing:

Captured video input from the webcam using p5.js, a JavaScript library for creative coding.

Preprocessed the video frames to resize them to the input size expected by the MoveNet model.

Keypoint Detection:

Passed the preprocessed video frames through the MoveNet model to detect body keypoints accurately.

Extracted the coordinates of key body parts, filtering out keypoints with low confidence scores.

Movement Analysis:

Implemented algorithms to analyze the detected keypoints and track specific workout movements, such as push-ups and squats.

Calculated metrics such as repetition count, movement speed, and exercise form using the detected keypoints.

Visualization and User Interface:

Designed a user-friendly interface using HTML, CSS, and JavaScript to present the processed video feed with overlaid keypoints and skeletons.

Incorporated interactive elements for user input, such as starting or pausing the workout session.

Deployment and Testing:

Tested the implemented system with various workout routines like (Pushup, Bicep Curls, Deadlift, Squat and Shoulder Raise) were implemented to ensure accurate detection and analysis of movements.

Deployed the system as a web-based service, allowing users to access it from any device with a web browser.

Gathered feedback from users to iteratively improve the system's usability, performance, and accuracy over time.

3.2.1 Techniques Used :

Cart Abandonment : Random Forest

For cart abandonment, we are using customer churn prediction by which we will determine whether the customer is loyal to us or not i.e. whether he will leave our services and choose something else or will he continue to use our services. This is calculated by finding sentiment of the users through the ratings provided by them. Other columns like gender, country, goal, product, sentiment, age_group are feature variables and products_purchases_in_the_last_one_month is the target variable. By applying Random Forest Classifier, churn probabilities of every customer are obtained. By setting a threshold of 0.75 probability, we can find out the customers' loyalty.

Customer Segmentation : K-Means

Firstly, choosing the value of k, which is the number of clusters to form and initialize k cluster centroids randomly within the range of the data is done. Assign each data point to the nearest centroid based on their distance using a distance metric such as Euclidean distance. Recalculate the centroids of each cluster as the mean of the data points assigned to that cluster. Repeat steps 3 and 4 until convergence, which is typically defined as when the cluster assignments no longer change or the improvement in the objective function falls below a certain threshold. Finally, returning the final cluster assignments and centroids.

Workout Monitoring : MoveNet

Environment Setup:

Installed necessary libraries and dependencies, including TensorFlow.js for browser-based implementation.

Configured the development environment with appropriate tools for coding and testing.

MoveNet, an advanced pose detection model offered by TensorFlow, has gained prominence for its exceptional performance and accuracy in tracking human body keypoints. In comparison to alternatives like MediaPipe and OpenPose, MoveNet stands out for its superior speed, precision, and versatility.

Speed and Efficiency: MoveNet offers faster processing speed compared to MediaPipe and OpenPose, ensuring real-time performance in latency-sensitive applications.

Accuracy and Precision: With high accuracy in detecting body keypoints, MoveNet enables precise tracking of movements crucial for various tasks such as fitness tracking and gesture recognition.

Versatility: MoveNet provides flexibility with variants like Lightning for latency-critical applications and Thunder for high-accuracy requirements, catering to diverse project needs effectively.

Ease of Integration: MoveNet's availability through TensorFlow Hub and TensorFlow.js simplifies integration into existing workflows, supporting multiple programming languages and frameworks.

Resource Efficiency: Optimized to run efficiently on various devices, including smartphones, MoveNet ensures optimal performance without excessive hardware requirements.

Continual Development: As part of TensorFlow's ecosystem, MoveNet benefits from continuous development and updates, ensuring it stays ahead with ongoing improvements and advancements.

Architecture :

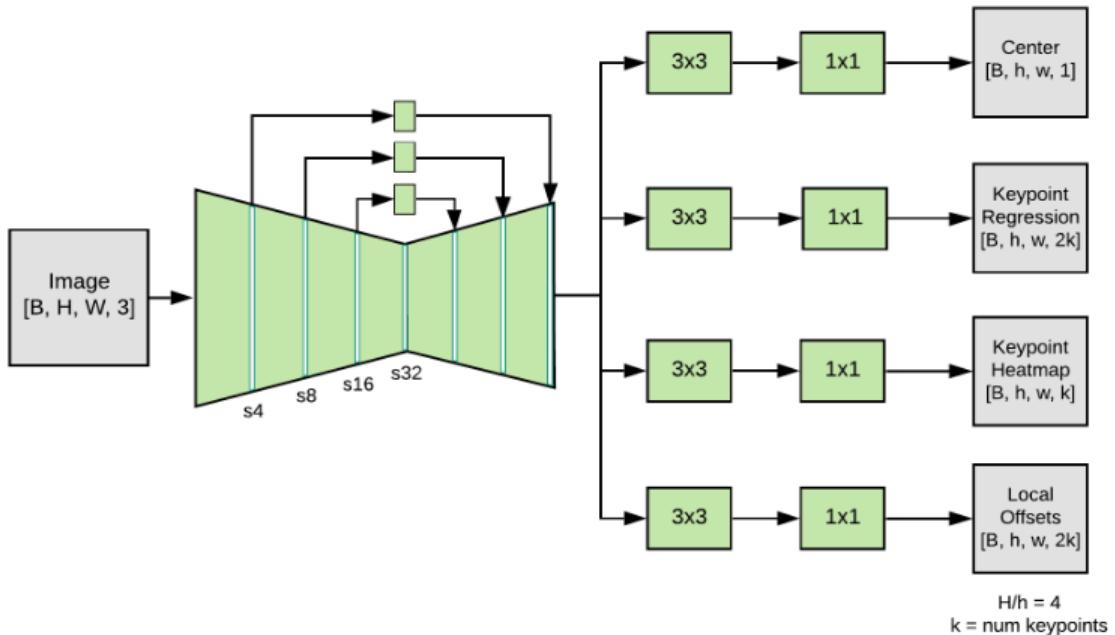


Fig 3.4 MoveNet Architecture

3.2.2 Dataset Used

To show errors in the form during workouts, doing customer segmentation and for doing cart abandonment analysis, we are using two datasets that we ourselves have constructed. The datasets used in the project are identified and given in Table 3.1

Sr. No.	Dataset	Count	Description
1	Customers	51000	Created for performing customer segmentation and Cart Abandonment

Table 3.1 Sample Dataset Used for Experiment

3.2.3 Hardware and Software Specifications

The project is carried out on a computer system which has the different hardware and software specifications as given in Table 3.2 and Table 3.3 respectively.

Processor	Intel/AMD
RAM	4 GB

Table 3.2 Hardware details

Operating System	Windows 7,8,10,11
Programming Language	Python
Database	MySQL

Table 3.3 Software details

Chapter 4

Applications

There are various applications of this domain system. The application is listed here.

4.1 Scheduling Workout

Workout scheduling is an important step to take into consideration to maintain proper fitness. Workout scheduling helps to decide what you want to achieve with your workout (i.e Fitness goals like Building muscle, Lose weight, Improve endurance, etc). It helps to choose your workout days based on your availability and your goals.

4.2 Proper guide for use of equipments

As a beginner friendly tool, this project helps to properly guide how to use a particular exercise virtually by using artificial intelligence. It shows the proper form of each and every exercise and will be flexible to use.

4.3 Used to track and monitor real time movements of exercises

Real time tracking using artificial intelligence will be a key aspect in this project because it will mainly focus on how accurately an exercise is being done and what changes will be required to make it much better.

4.4 Virtual trainer

In gyms personal training can be acquired from a personal trainer who has a proper knowledge about exercise but due to the rush/crowd proper attention of personal trainers cannot be acquired all the time and the cost of a personal trainer can be expensive as well. Therefore this project will be a better solution to overcome this problem as there will be a signal given whenever a wrong exercise is benign performed.

4.5 Workout Analysis

Remembering workout plans and diet plans and how to improve it is an important step to maintain proper fitness. Which exercise we have performed in the past and what was the diet from the past few days,etc all these analyses can be acquired easily by this project.

Chapter 5

Result & Discussion

5.1 Output

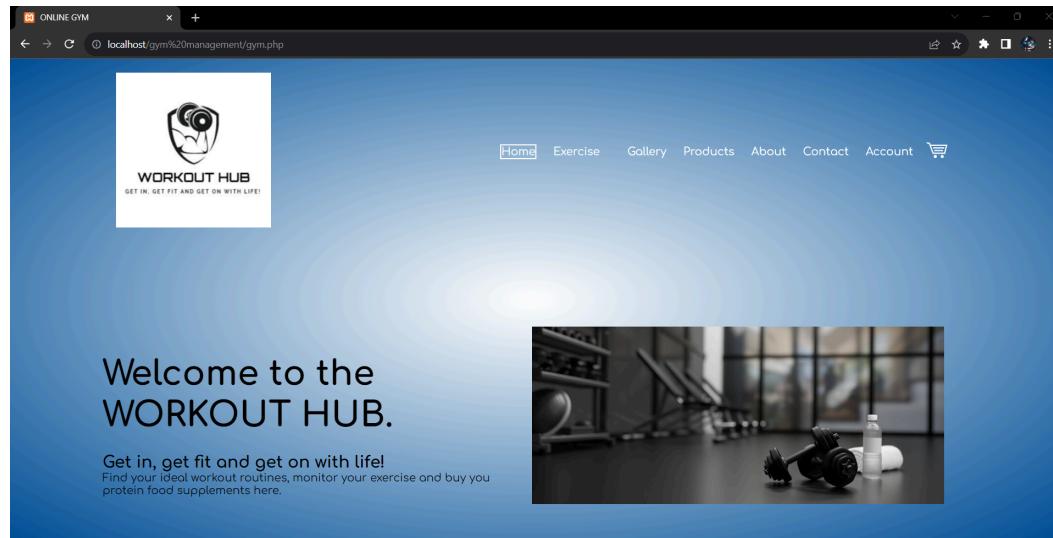


Fig 5.1.1 User Interface

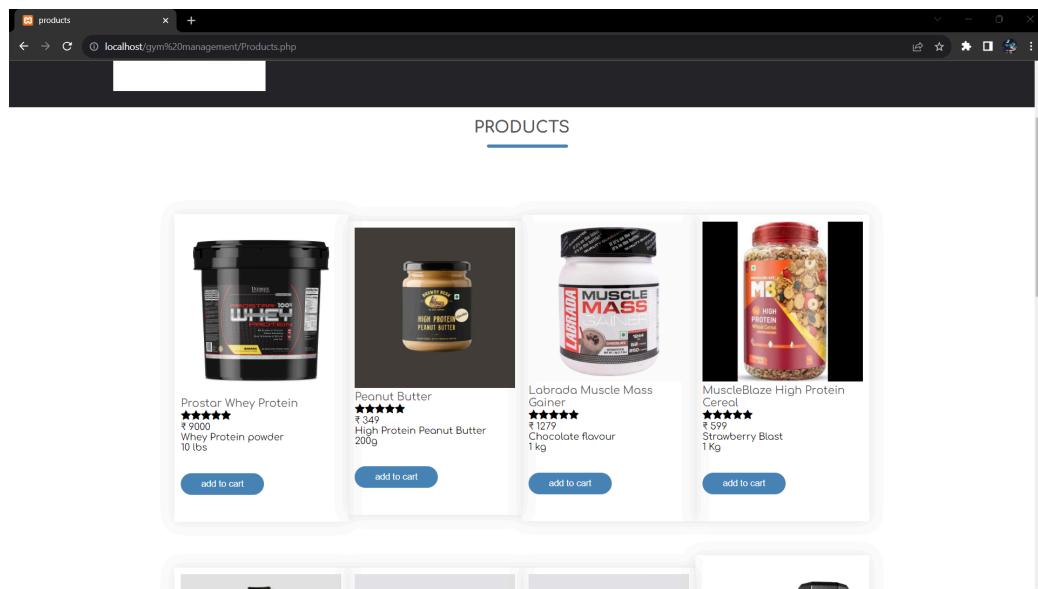


Fig 5.1.2 E-Commerce platform for gym products

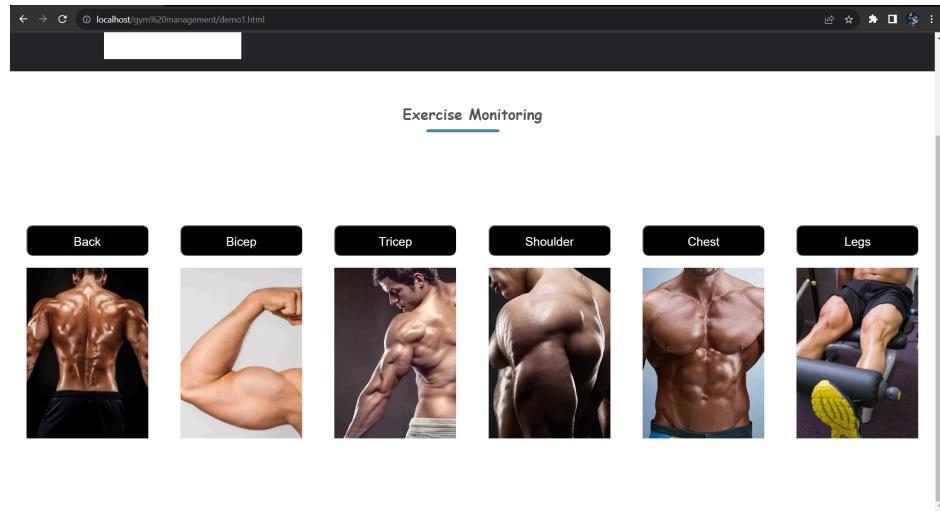


Fig 5.1.3 Workout Detection Layout

A screenshot of a web page titled "Product Recommendation". The main heading is "See What Other People like You are Buying". Below it is a form with fields for Age (18), Height (190), and Weight (90). A blue button labeled "Recommend Product" is at the bottom right. Below the form, text indicates the recommended product is PeanutButter, and frequently bought items include Oats, PeanutButter, and WholeGrainBread.

Fig 5.1.4 Demographic recommendation

A screenshot of a web page titled "See What Other People of Your Category are Buying". The main heading is "See What Other People of Your Category are Buying". Below it is a form with fields for Goal (lean) and Gender (male). A blue button labeled "Recommend Product" is at the bottom right. Below the form, text indicates the recommended product is WholeGrainBread, and frequently bought items include WholeGrainBread, PeanutButter, and Oats.

Fig 5.1.5 Physiographic recommendation



Fig 5.1.6 Geographic recommendation



Fig 5.1.7 Reviews Sentiment



Fig 5.1.8 Bicep Curl Output

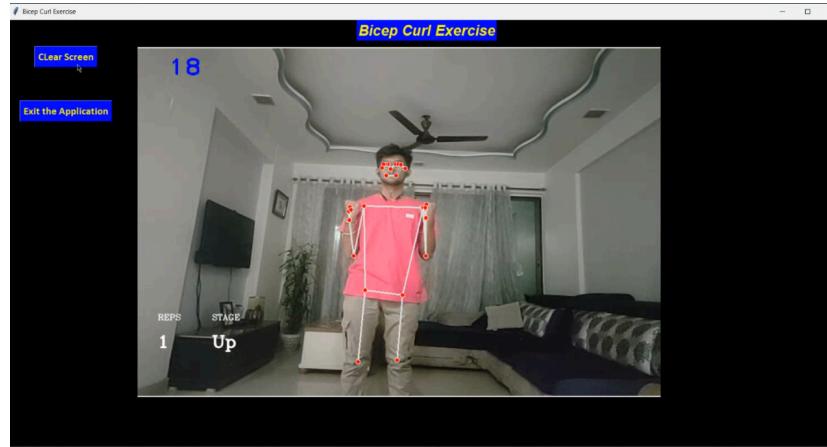


Fig 5.1.8 Bicep Curl Output

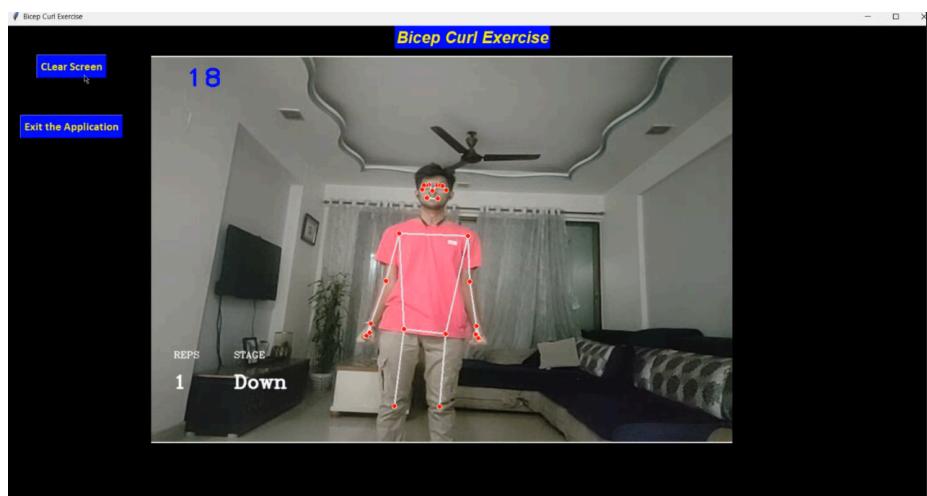


Fig 5.1.8 Bicep Curl Output

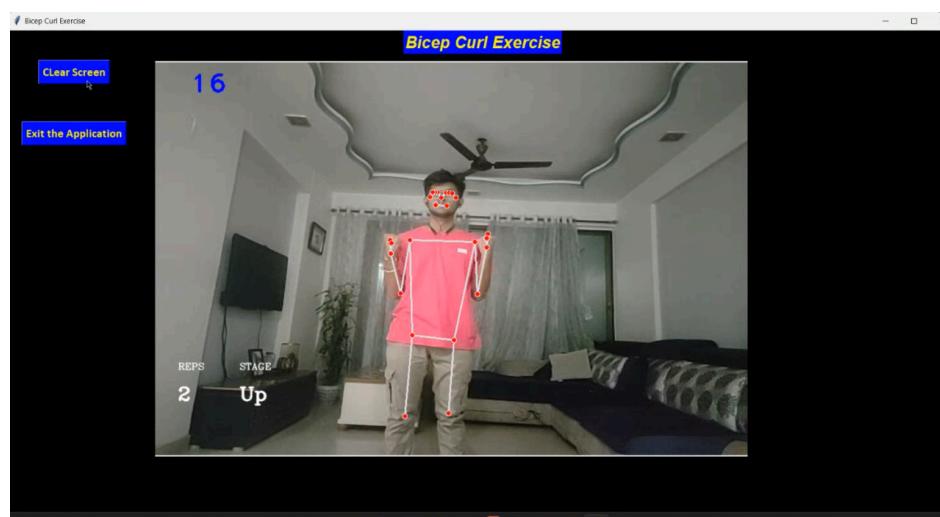


Fig 5.1.8 Bicep Curl Output

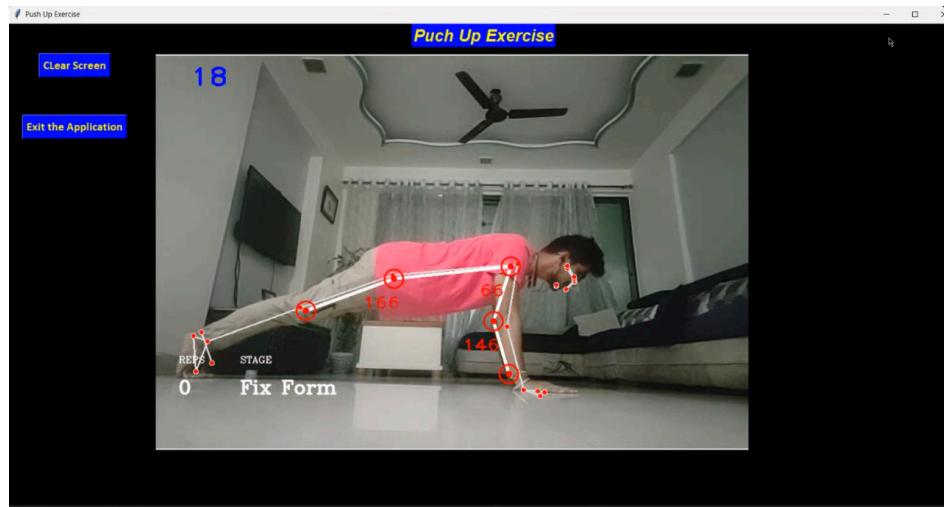


Fig 5.1.9 Pushup Output



Fig 5.1.9 Pushup Output

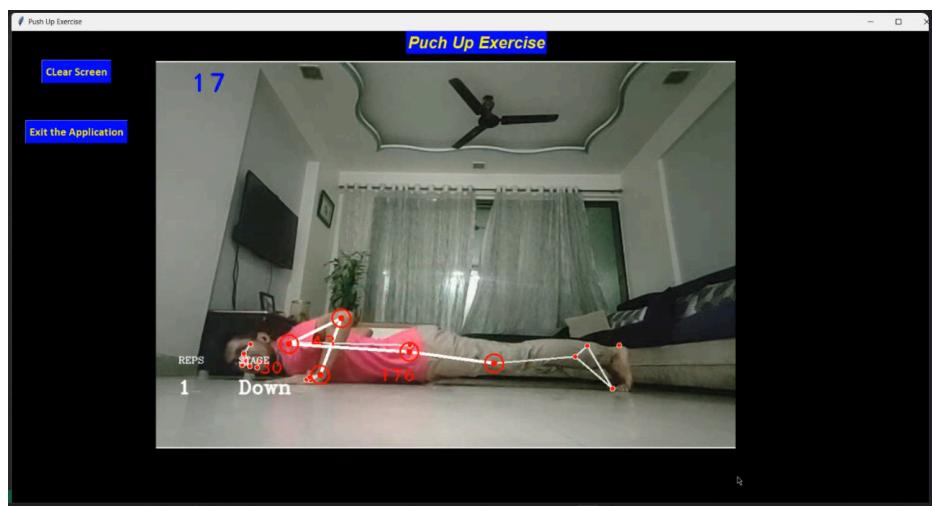


Fig 5.1.9 Pushup Output

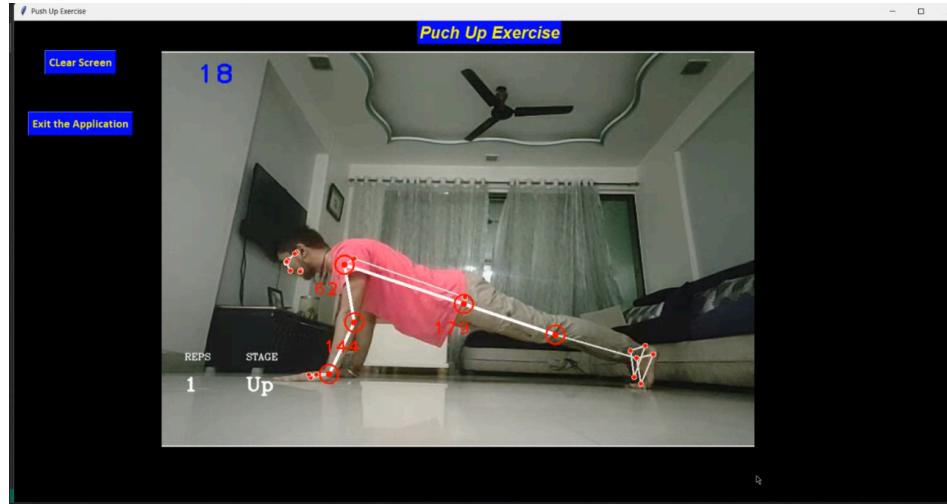


Fig 5.1.9 Pushup Output

The techniques employed in our analysis span a spectrum of advanced methodologies tailored to address specific challenges and objectives within our framework. For cart abandonment prediction, we leverage the robust capabilities of Random Forest, a powerful ensemble learning technique. By harnessing customer churn prediction, we discern the likelihood of customer loyalty and optimizing service offerings. Through the integration of diverse feature variables such as gender, country, and sentiment, alongside target variables like products purchased in the last month, we employ Random Forest Classifier to ascertain churn probabilities for individual customers, thereby enabling strategic decision-making and proactive retention strategies.

In the realm of customer segmentation, K-Means emerges as a pivotal tool for partitioning our customer base into distinct clusters, facilitating targeted marketing strategies and personalized experiences. Utilizing the iterative process of centroid initialization, data point assignment, and centroid recalibration, K-Means efficiently identifies homogeneous groups within our dataset. By iteratively optimizing cluster assignments until convergence, we unveil actionable insights into customer behavior and preferences, empowering informed decision-making and resource allocation.

One prominent application of MoveNet within our project is in the domain of gesture recognition and hand tracking. By harnessing MoveNet pre-trained models and modular graph-based architecture, we have developed a sophisticated system capable of accurately detecting and tracking hand movements in real-time. This functionality enables intuitive and natural interaction with our application, allowing users to perform gestures and commands with ease.

Collectively, these techniques represent a convergence of cutting-edge methodologies and domain-specific expertise, equipping our analysis with the tools necessary to extract actionable insights, drive informed decision-making, and unlock new avenues for innovation and growth in our domain.

Chapter 6

Conclusion and Future Scope

6.1 Conclusion

In this report, the study of different domain techniques is presented. The different techniques such as Customer Segmentation, Cart Abandonment and Workout monitoring are explained with examples. The comparative study of various techniques mentioned above is presented in this report. The performance measures like precision and recall are described in this report. The different standard datasets or variable inputs are defined that may be used in experiment for this domain system. The two datasets identified for experiments are Customers and Exercises. The applications of this domain are identified and presented in this report.

6.2 Future Scope

Implementation plan for future scope will be to improve the system (website) which will include all the features as discussed earlier like Workout monitoring, E-commerce website on which customer segment and cart abandonment analysis.

Various exercises of workout detections can be added, accordingly segmentation of customers can be done so that the website will get the clear idea that the customers should be divided on the basis of certain parameters.

Recommendation system can also be improved by providing recommendations in real time into the website so that every user can get the recommendation to reach their desired goals and to improve their fitness levels.

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