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AI Based Work Out Assistant

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Abstract: Virtual assistants have become an integral part of our daily lives, significantly influencing how we perform various activities. With the rising prominence of AI, we aim to explore this emerging field through our project, which focuses on AI-based workout assistants. Introducing Workout assistant, our application is designed to detect users' exercise poses, count repetitions for specified exercises, and provide personalized recommendations to enhance their form. By utilizing MediaPipe, the application accurately identifies a person's pose and analyzes the pose's geometry using both dataset information and real-time video. This analysis enables Workout assistant to precisely count repetitions for specific exercises and offer detailed guidance to users on improving their exercise technique. Our goal is to leverage AI technology to create a comprehensive virtual workout assistant that empowers users to track their progress, ensure proper form, and gain valuable insights for their fitness journey.

Keywords: AI, Virtual assistant, CNN, workout assistant, Pose estimation, Blazepose, OpenCV.

I. INTRODUCTION

Human beings possess a natural sensitivity towards various health issues, among which musculoskeletal disorders hold significant importance, necessitating prompt treatment. Each year, a considerable number of individuals experience musculoskeletal disorders due to accidents or the aging process. Yoga offers a valuable avenue for improving one's physical well-being. While exercise brings numerous benefits, engaging in it incorrectly can lead to detrimental consequences. Hence, proper guidance becomes essential for individuals performing activities on their own. With appropriate instruction, individuals can derive multiple advantages from their exercises while enhancing their overall health. Yoga poses contribute to the development of mindfulness, balance, and strength in both the mind and body. However, practicing yoga poses incorrectly can lead to severe complications such as strokes and nerve damage. Therefore, it is crucial to follow appropriate yoga postures that align with one's abilities and requirement. The proposed approach utilizes a PC camera to detect the user's pose during Yoga practice. Firstly, the system identifies the pose based on the user's body position. Next, it calculates the variance in specific body angles between the instructor's pose and the user's pose. If the difference exceeds a predefined threshold, the system suggests corrections for that particular portion of the pose. This feedback aims to assist users in achieving proper alignment and form during the practice.

II. LITERATURE SURVEY

Paper Name: Implementation of Machine Learning Technique for Identification of work out assistant Author:Yash Agrawal*, Yash Shah*, Abhishek Sharma Abstract :—In recent years, yoga has become part of life for many people across the world. Due to this there is the need of scientific analysis of y postures. It has been observed that pose detection techniques can be used to identify the postures and also to assist the people to perform yoga more accurately. Recognition of posture is a challenging task due to the lack availability of dataset and also to detect posture on real-time bases. To overcome this problem a large dataset has been created which contain at least 5500 images of ten different work out assistant and used a tf-pose estimation Algorithm which draws a skeleton of a human body on the real-time bases. Angles of the joints in the human body are extracted using the tf-pose skeleton and used them as a feature to implement various machine learning models. 80% of the dataset has been used for training purpose and 20% of the dataset has been used for testing. This dataset is tested on different Machine learning classification models and achieves an accuracy of 99.04% by using a Random Forest Classifier.[1]

Paper Name: Yoga-82: A New Dataset for Fine-grained Classification of Human Poses Author:Manisha Verma1 , Sudhakar Kumawat2 , Yuta Nakashima Abstract : : — Human pose estimation is a well-known problem in computer vision to locate joint positions. Existing datasets for learning of poses are observed to be not challenging enough in terms of pose diversity, object occlusion and view points. This makes the pose annotation process relatively simple and restricts the application of the models that have been trained on them. To handle more variety in human poses, we propose the concept of fine-grained hierarchical pose classification, in which we formulate the pose estimation as a classification

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task, and propose a dataset, Yoga82§, for large-scale work out assistant recognition with 82 classes. Yoga82 consists of complex poses where fine annotations may not be possible. To resolve this, we provide hierarchical labels for work out assistant based on the body configuration of the pose. The dataset contains a three-level hierarchy including body positions, variations in body positions, and the actual pose names. We present the classification accuracy of the state-of-the-art convolutional neural network architectures on Yoga82. We also present several hierarchical variants of DenseNet in order to utilize the hierarchical labels.[2]

Paper Name: RECOGNITION OF work out assistant USING EMG SIGNALS FROM LOWER LIMB MUSCLES Author :: Pradchaya Anantamek Description :—Exercise with yoga postures is very popular nowadays because yoga exercises can help to increase flexibility and muscle strength and improve the respiratory system. However, the correctness of the yoga postures is difficult to check, and thus practitioners may not be able to benefit from the exercises fully. This paper presents a yoga posture recognition system to verify the correctness of the lower muscle movements while practicing yoga. The study included ten subjects, five males and five females. Data were collected during five yoga postures. This paper focuses on the use of Electromyography signals for analyzing the motion of four lower-limb muscles of both legs. Recognition was performed with three machine learning algorithms. The results showed that the Random Forest Decision Tree algorithm has the highest accuracy in recognizing yoga postures in comparison with other algorithms and that the yoga posture recognition model is accurate at 87.43 percent. [3]

Paper Name: Synthesizing Images of Humans in Unseen Poses Author: : Guha Balakrishnan, Amy Zhao Description :—We address the computational problem of novel human pose synthesis. Given an image of a person and a desired pose, we produce a depiction of that person in that pose, retaining the appearance of both the person and background. We present a modular generative neural network that synthesizes unseen poses using training pairs of images and poses taken from human action videos. Our network separates a scene into different body part and background layers, moves body parts to new locations and refines their appearances, and composites the new foreground with a hole-filled background. These subtasks, implemented with separate modules, are trained jointly using only a single target image as a supervised label. We use an adversarial discriminator to force our network to synthesize realistic details conditioned on pose. We demonstrate image synthesis results on three action classes: golf, yoga/workouts and tennis, and show that our method produces accurate results within action classes as well as across action classes. Given a sequence of desired poses, we also produce coherent videos of actions. [4]

Paper Name: Novel IoT-Based Privacy-Preserving Yoga Posture Recognition System Using Low-Resolution Infrared Sensors and Deep Learning Author: Munkhjargal Gochoo , Tan-Hsu Tan. Abstract :In recent years, the number of yoga practitioners has been drastically increased and there are more men and older people practice yoga than ever before. Internet of Things (IoT)- based yoga training system is needed for those who want to practice yoga at home. Some studies have proposed RGB/Kinect camera-based or wearable device-based yoga posture recognition methods with a high accuracy; however, the former has a privacy issue and the latter is impractical in the long-term application. Thus, this paper proposes an IoT-based privacy-preserving yoga posture recognition system employing a deep convolutional neural network (DCNN) and a low-resolution infrared sensorbased wireless sensor network (WSN). The WSN has three nodes (x, y, and z-axes) where each integrates 8×8 pixels' thermal sensor module and a Wi-Fi module for connecting the deep learning server. We invited 18 volunteers to perform 26 yoga postures for two sessions each lasted for 20 s. First, recorded sessions are saved as .csv files, then preprocessed and converted to grayscale posture images. Totally, 93 200 posture images are employed for the validation of the proposed DCNN models. The tenfold cross validation results revealed that F1-scores of the models trained with xyz (all 3-axes) and y (only y-axis) posture images were 0.9989 and 0.9854, respectively. An average latency for a single posture image classification on the server was 107 ms. Thus, we conclude that the proposed IoT-based yoga posture recognition system has a great potential in the privacy-preserving yoga training system. [5]

Paper Name: Implementation of Computer Vision in Detecting Human Pose Author :Ian Gregory Abstract:—Developing strong core muscles are important for children. Children with strong core muscles allow them to do any kinds of activities that mostly involve physical movement. The work tested on an education organisation that aims to strengthen core muscles by providing yoga-like poses. There are certified trainers that will coach the students along the way. However, mistakes could be made during the coaching because of different trainer's justification and whether the coaching processes were done correctly. Therefore, a solution is proposed to develop a computerized pose detector package which allows the trainers to improve the coaching with the students. The result is promising where the standardized pose could be implemented and compared to observed students' poses, however it is found that due to the uniqueness of the poses, it generates several unidentified results. [6]

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Paper Name: Yoga Posture Recognition By Detecting Human Joint Points In Real Time Using Microsoft Kinect Author:Muhammad Usama Islam , Hasan Mahmud Abstract:——Musculoskeletal disorder is increasing in humans due to accidents or aging which is a great concern for future world. Physical exercises can reduce this disorder. Yoga is a great medium of physical exercise. For doing yoga a trainer is important who can monitor the perfectness of different yoga poses. In this paper, we have proposed a system which can monitor human body parts movement and monitor the accuracy of different work out assistant which aids the user to practice yoga. We have used Microsoft Kinect to detect different joint points of human body in real time and from those joint points we calculate various angles to measure the accuracy of a certain work out assistant for a user. Our proposed system can successfully recognize different work out assistant in real time. [7]

Paper Name :A Proposal of work out assistant Assessment Method Using Pose Detection for Self Learning Author :Maybel Chan Thar1 , Khine Zar Ne Winn1 , Nobuo Funabiki Abstract:—Nowadays, Yoga is popular around the world. A lot of people are participating in it by themselves through watching TV/videos or teaching each other. However, it is not easy for novice people to find the incorrect parts of their work out assistant by themselves. In this paper, we propose a work out assistant assessment method using pose detection to help the self-learning of Yoga. The system first detects a work out assistant using multi parts detection only with PC camera. Then, it calculates the difference of the specified body angles between the pose of an instructor and that of a user. Then, it calculates the difference of the specified body angles between the pose of an instructor and that of a user, and suggests the correction if larger than the given threshold. The total angle difference values are calculated averagely and defined as performance class level in Table 1. For evaluations, we applied the proposal to three persons with three work out assistant of basic and easy work out assistant for beginners and confirmed that it found the incorrect parts of each pose.[8]

Paper name:Recognition of work out assistant through an interactive system with Kinect based on confidence value Author:Edwin W. Trejo l , Peijiang Yuan Abstract: Nowadays, the recognition of poses is a field of investigation that takes incredible significance for oneself preparing in different sports. Kinect offers a lowcost solution for the recognition of work out assistant due to body tracking and depth sensor. In this research, we propose an interactive system for perceiving a few postures for learning Yoga that will be characterized by a level of trouble and coordinated with command voices to envision the guidelines and pictures about the stances to be execution. Likewise, posture correction instructions will be displayed for the user in real time made by an expert yoga trainer. Besides, the recognition algorithm is based on Adaboost algorithm in order to get a robust database for detecting 6 Asana work out assistant All data were obtained and analyzed according to the confidence which showed a maximum average value of 92%.[9]

III. SOFTWARE REQUIREMENT SPECIFICATION

Technologies and tools used in Policy system project are as follows Technology used:

Software Requirement

- RAM : 8 GBTools
- Processor : Intel i5 Processor
- IDE : Spyder
- Coding Language : Python Version 3.8
- Operating System : Windows 10(64 Bit)

Hardware Requirement

- Speed : 1.1 GHz
- Hard Disk : 40 GB
- Key Board : Standard Windows Keyboard
- Monitor : LCD/LED

IV. EXTERNAL INTERFACE REQUIREMENT

A. USER INTERFACES

The usability of the application interface will be prioritized , with a functional and minimalist design. Users may easily navigate because every choice will be given in a menu-based fashion. To improve the interface's usability, the desktop app will be used to set up the page layout and apply simple styling.

B. HARDWARE INTERFACES

It will be necessary to have a webserver so that the students and mess administrator can connect to it and communicate. All of the data entries are stored in a database on the servers. The Server must be connected to the college's local network through a fast 1 Gigabit Ethernet connection.

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C. SOFTWARE INTERFACES

The database of clients that connect to the server over JDBC is stored using MySQL.

D. COMMUNICATION INTERFACES

The program's whole feature set is accessible offline. To download the application, update it, and (optionally) receive some target images for your personal profile, all you need is an internet connection. Our project is Android-based, which allows us to connect users online via a request and response form.

We will use for that HTTP protocol. Internet Protocol An application protocol for distributed, collaborative, and hypermedia information systems is the Hypertext Transfer Protocol. The World Wide Web's data communication is built on HTTP. Hypertext is structured text that connects text-containing nodes with logical linkages (hyperlinks).

V. FUNCTIONAL REQUIREMENT

A. SYSTEM FEATURE 1

- Feature point extraction: Feature points of each Dataset parameters gets detected.
- Feature correspondence matching: Matching of selected feature points across various parameters.
- Point estimation: Position estimation and vision system orientation during navigation.

B. SYSTEM FEATURE 1

- In system we have used Linear Regression algorithm of Machine Learning.

VI. NON -FUNCTIONAL REQUIREMENTS

A. PERFORMANCE REQUIREMENTS

- The performance of the functions and every module must be well. The overall performance of the software will enable the users to work decently. Performance of encryption of data should be fast. Performance of the providing virtual environment should be fast Safety Requirement.
- The application is designed in modules where errors can be detected and steadily. This makes it easier to install and update new functionality if required.

B. SAFETY REQUIREMENTS

- The application is designed in modules where errors can be detected and fixed easily. This makes it easier to install and update new functionality if required.

C. SECURITY REQUIREMENTS

- This specification must be sufficiently specific such that the design and implementation can achieve the necessary safety integrity and enable a functional safety evaluation.

D. SOFTWARE QUALITY ATTRIBUTES

Our software has many quality attribute that are given below:-

- Adaptability: This software is adaptable by all users.
- Availability: This software is freely available to all users. The availability of the software is easy for everyone.
- Maintainability: After the deployment of the project if any error occurs then it can be easily maintained by the software developer.
- Reliability: The performance of the software is better which will increase the reliability of the Software.
- User Friendliness: Since, the software is a GUI application; the output generated is much user friendly in its behavior.
- Integrity: Integrity refers to the extent to which access to software or data by unauthorized persons can be controlled.
- Security: Users are authenticated using many security phases so reliable security is provided.
- Testability: The software will be tested considering all the aspects.

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VII. SYSTEM REQUIREMENTS

A. DATABASE REQUIREMENTS

➢ DBSqlite3 : The Database Requirements involves the use of a lot of information, some which will be needed several times and the most appropriate form of storage of this data is in a database. This will allow data to be saved from input to the Database Requirements and retrieved to be used by the Database Requirements. As an important aspect of this project is use of Time Control System. In this section several databases are reviewed for their suitability to this project.

B. SOFTWARE REQUIREMENTS

➢ RAM : 8 GB
➢ Processor : Intel i5 Processor
➢ IDE : Spyder
➢ Coding Language : Python Version 3.8
➢ Operating System : Windows 10(64 Bit)

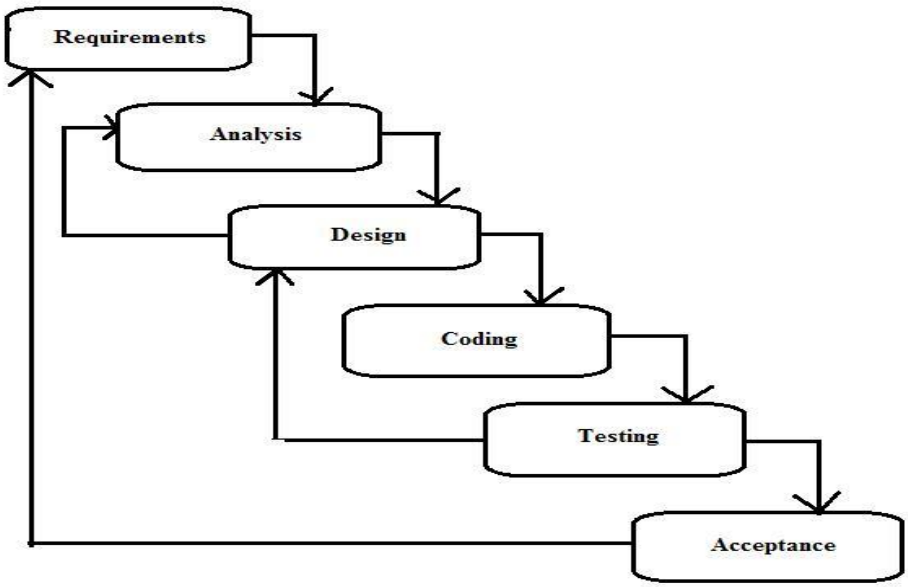
C. HARDWARE REQUIREMENTS

➢ Speed : 1.1 GHz
➢ Hard Disk : 40 GB
➢ Key Board : Standard Windows Keyboard
➢ Mouse : Two or Three Button Mouse
➢ Monitor : LCD/LED

VIII. ANALYSIS MODELS : SDLC MODEL TO BE APPLIED

Software Development Life Cycle Models are referred to as SDLC models. In this post, we examine some of the most popular SDLC approaches, such as Agile. Each software development life cycle model begins with an analysis in which the technologies employed in the project and the team load are specified. Software Development Life Cycle models, or SDLC models, are one of the fundamental ideas in the software development process.

The SDLC is a continuous process that begins when the decision to start the project is made and ends when it is completely removed from exploitation. No single SDLC model exists. They are split up into major groupings, each with specific characteristics and drawbacks.



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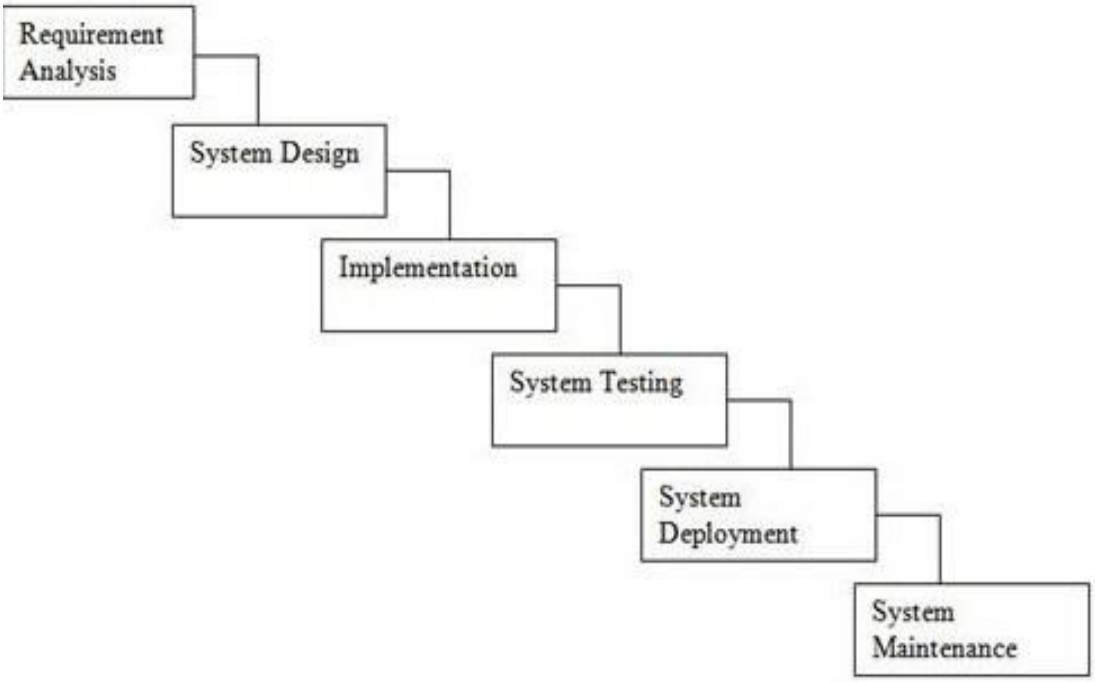

Fig. 1 Project Plan

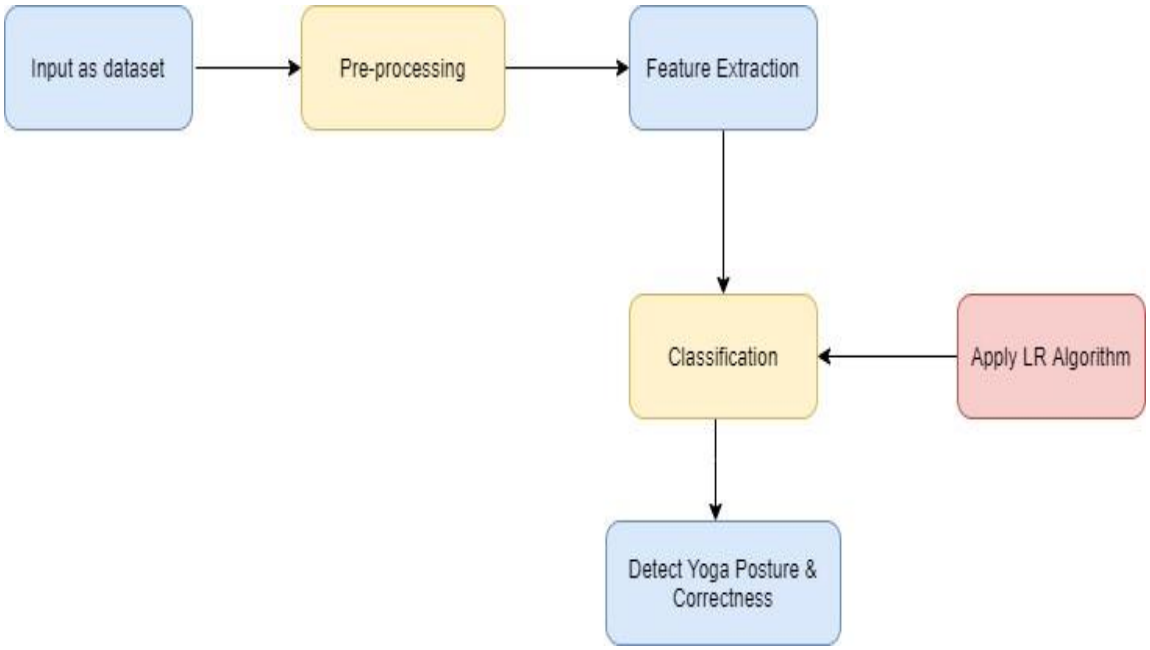

Fig. 2 System Architecture

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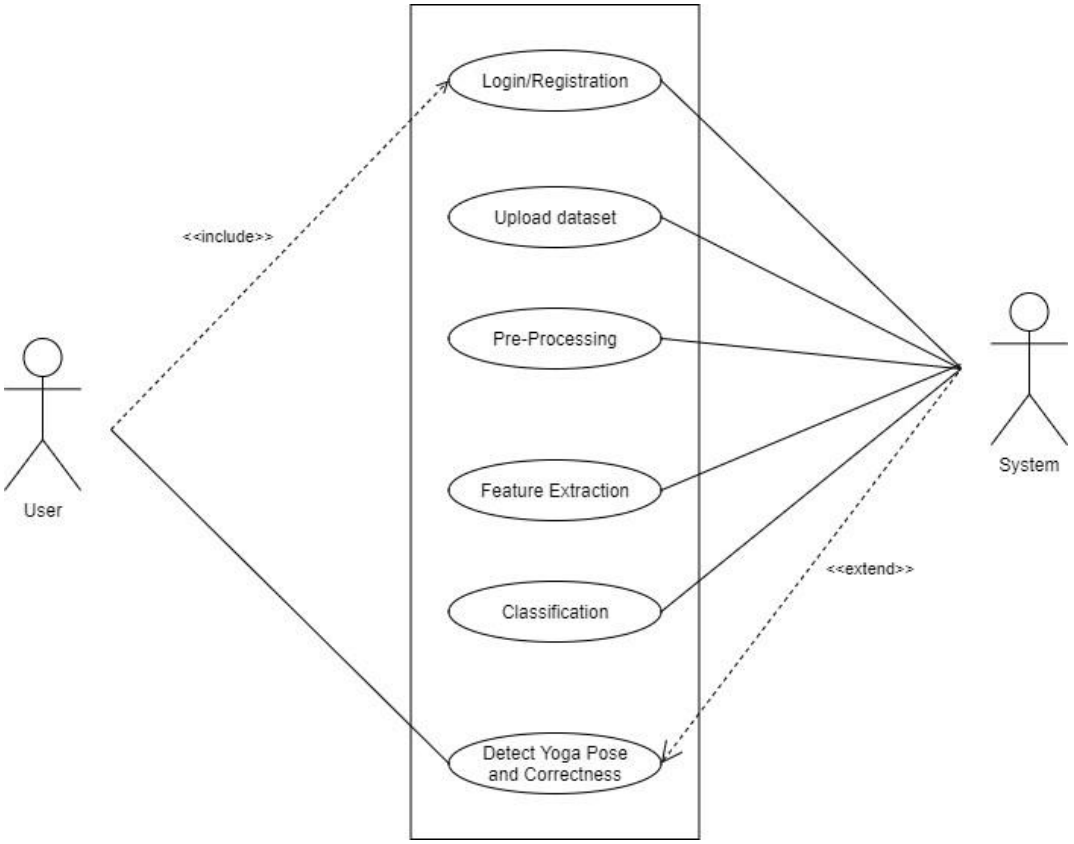
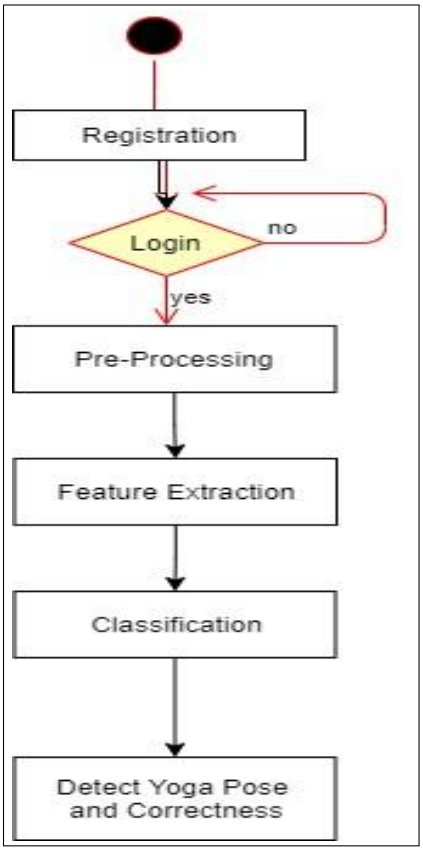


Fig. 3 Use Case Diagram



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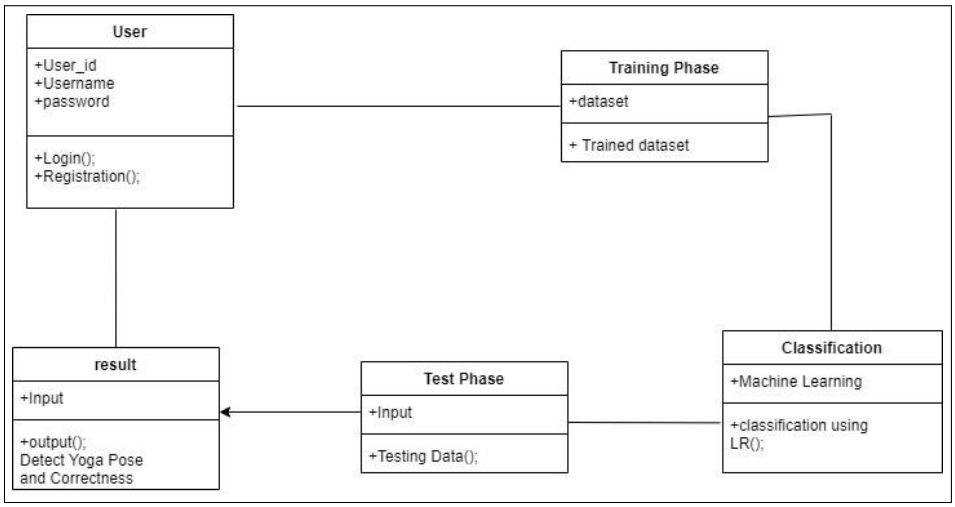

Fig. 5 Class Diagram

IX. OTHER SPECIFICATION

A. ADVANTAGES

- Easy to handle
- Improve Best accuracy.
- Increase the knowledge about work out assistant
- to bring harmony to both body and mind with the help of asana, meditation andvarious other breathing techniques It bring peace to the mind. Due to increase of stress in the modern lifestyle, yoga has become popular throughout the world

B. LIMITATIONS

- If the training not get successful or get interrupt because of any reason then system can not work proper.
- If the accuracy of training less then system can not work properly.

C. APPLICATIONS

- Used to detect work out assistant Correctness.
- Most people prefer self-learning but it is hard for them to find incorrect parts of their work out assistant by themselves.

X. RESULTS

A. Login Page

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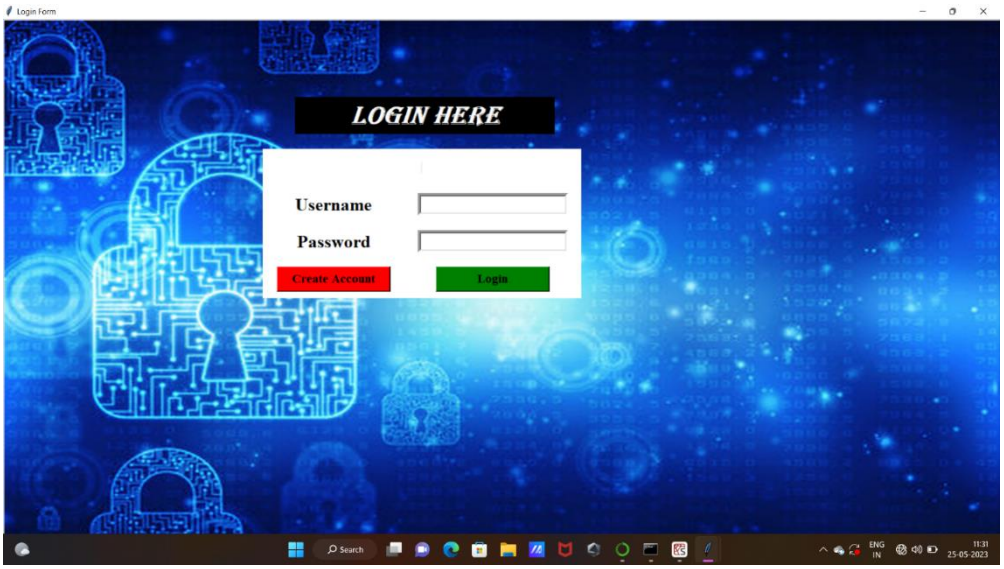
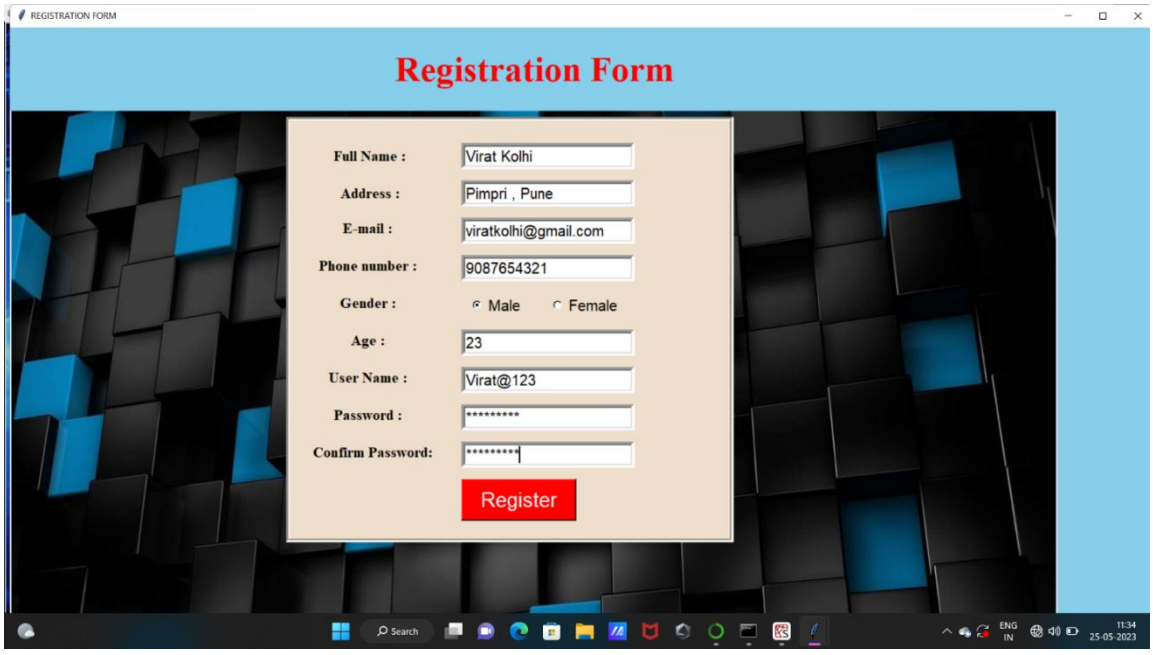


B. Registration Page



C. Home Page

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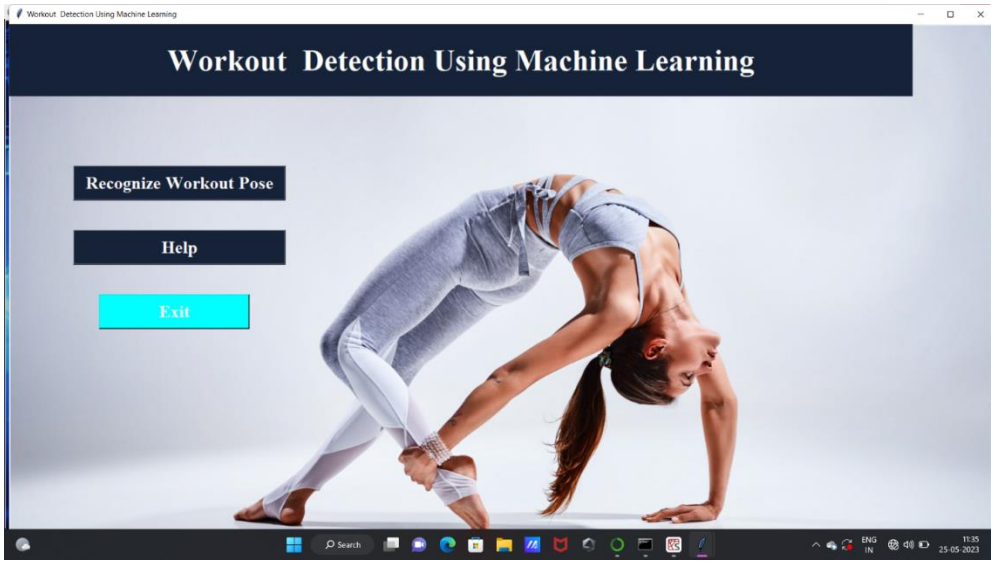
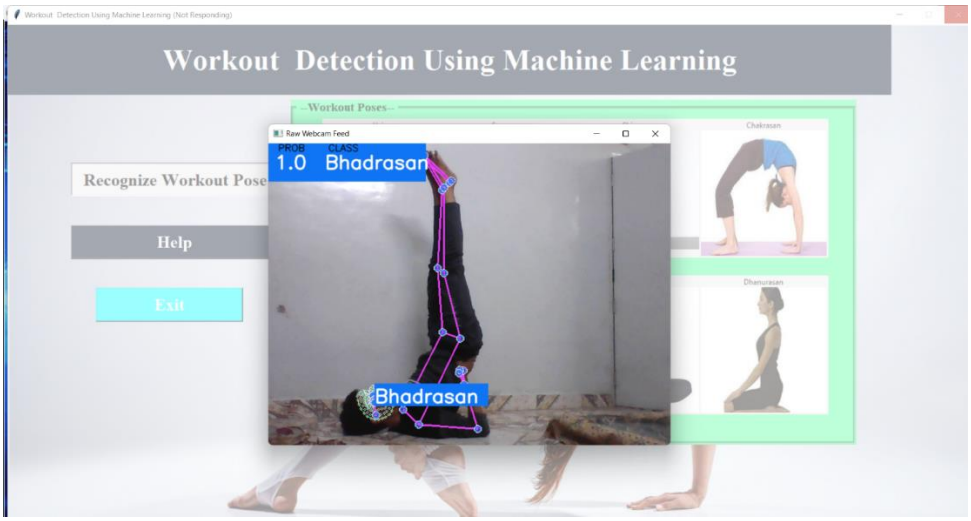
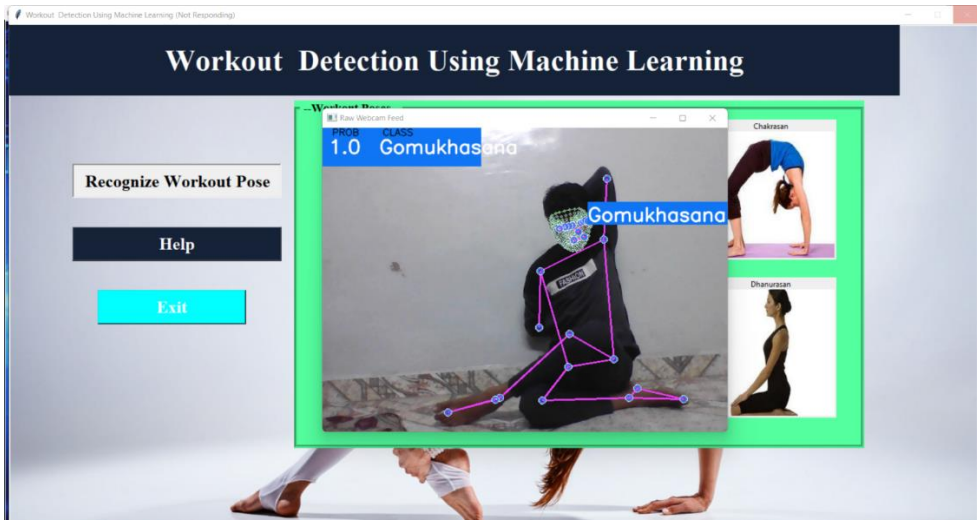


D. Result (Output)



E. Result 2



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XI. CONCLUSION

In our proposed system, we aim to introduce yoga posture recognition and correction capabilities. The system evaluates a learner's workout by following a series of steps:

Stance Detection: Using data from sensors or cameras, the system uses sophisticated algorithms to recognise and classify the user's yoga stance.

Angle Difference Measurement: It calculates the difference in body angles between the user's present stance and the instructor's reference pose. This comparison sheds light on the user's posture's alignment and appropriateness.

Error identification: The technology pinpoints the precise areas or elements of the pose where errors or discrepancies exist between the learner and the instructor by analysing the resulting angle differences.

Position Categorization: The system assigns the position to one of four levels based on the average angle difference determined.

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