**PROJECT SYNOPSIS ON**

**“REPLIFIT”**

**(An AI-powered fitness tracking system that provides real-time posture correction and rep counting using computer vision and machine learning.)**

**Submitted To:**

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**ABSTRACT**

*RepliFit is an AI-powered fitness tracking system designed to enhance workout efficiency by providing real-time posture correction and rep counting. Utilizing computer vision and machine learning, it employs pose estimation techniques to analyze exercise movements, offering live feedback to optimize performance and reduce injury risks. Unlike wearable devices, RepliFit operates through a webcam, making it accessible for gym-goers, home workout enthusiasts, physiotherapy patients, and sports professionals.*

*The system integrates OpenCV, MediaPipe, and machine learning models such as Random Forest and SVM to classify exercise postures with high accuracy.*

*A user-friendly graphical interface, built with CustomTkinter, displays real-time statistics, rep counts, and error notifications while supporting dark mode for an engaging experience. With applications ranging from fitness training and rehabilitation to virtual coaching and sports performance analysis, RepliFit is a versatile and innovative solution for tracking and impr*

***CHAPTER 1:***

***INTRODUCTION:***

* 1. ***INTRODUCTION***

RepliFit is an advanced AI-driven fitness tracking system that integrates the use of computer vision and machine learning algorithms to track and study exercise postures in real time. Using pose estimation techniques, this app tracks movement, allows for live feedback on posture accuracy, counts reps, and helps users optimize their workouts while minimizing the risk of injury.

RepliFit is not a wearable device. It can work using a webcam with the aid of AI algorithms. Gym-loving people, those working out at home, physiotherapy patients, and sports professionals would greatly benefit from accurately tracking movement. In this project, MediaPipe, OpenCV, NumPy, Pandas, and a machine learning model are used to classify the exercise postures with high accuracy.

There will also be a graphical interface made with CustomTkinter to graphically monitor progress. It will be an interactive system providing real-time feedback and dark mode support to be an engaging, effective fitness program.

* 1. ***PURPOSE:***

The primary purpose of RepliFit is to enhance fitness training, rehabilitation, and sports

performance through AI-driven real-time posture correction and rep counting. By leveraging computer vision and machine learning, RepliFit aims to:

1. Improve Exercise Accuracy – Ensure users maintain proper posture during workouts, reducing the risk of injuries.
2. Provide Real-Time Feedback – Offer instant posture correction and rep counting to enhance workout efficiency.
3. Facilitate Home Workouts & Virtual Training – Serve as a virtual trainer for individuals exercising at home, helping them track progress without needing a personal coach.
4. Support Physical Therapy & Rehabilitation – Assist patients and therapists by monitoring recovery exercises remotely and ensuring correct movement execution.
5. Enhance Sports Performance – Aid athletes and coaches in analyzing body movements, improving form, and refining techniques in sports like weightlifting, yoga, and martial arts.

RepliFit is designed to be an accessible, AI-powered fitness tool that optimizes training experiences across various user groups without requiring wearable devices.

* 1. **SCOPE**

RepliFit is designed to revolutionize fitness tracking through AI-driven real-time posture correction and rep counting. Its scope extends across various domains:

1. Fitness Training – Supports gym-goers and home workout enthusiasts in maintaining proper form, minimizing injury risks, and improving exercise efficiency.
2. Physical Therapy & Rehabilitation – Assists physiotherapy patients by monitoring recovery exercises and enabling remote supervision by healthcare professionals.
3. Home Workouts & Virtual Training – Functions as a virtual trainer, providing real-time feedback to individuals exercising at home, helping them track progress effectively.
4. Sports Performance Enhancement – Helps athletes refine their movements in weightlifting, yoga, and martial arts, improving overall posture and technique.
5. Technology Integration – Utilizes computer vision, machine learning, and an interactive GUI to deliver an engaging and efficient fitness experience without requiring wearable

devices.

With its broad applicability, RepliFit aims to make AI-powered fitness tracking accessible to a diverse user base, ensuring accurate movement analysis and optimized workouts.

* 1. **ADVANTAGES**
     + Real-Time Posture Correction – Provides instant feedback on exercise form, reducing the risk of injuries and improving workout effectiveness.
     + Accurate Rep Counting – Uses AI-powered pose estimation to track movements and count repetitions automatically.
     + No Need for Wearable Devices – Works with a simple webcam, eliminating the need for expensive fitness trackers or sensors.
     + User-Friendly Interface – CustomTkinter-based GUI with dark mode support enhances the user experience.
     + Versatility Across Applications – Suitable for gym users, home workout enthusiasts, physiotherapy patients, and sports professionals.
     + Remote Monitoring Capabilities – Enables physiotherapists and trainers to track progress and provide guidance from a distance.
     + AI-Powered Accuracy – Uses machine learning models such as Random Forest and SVM to ensure high precision in posture classification.
     + Customizable and Scalable – Can be adapted for different exercises, sports, and rehabilitation programs.
     + Data-Driven Insights – Tracks progress over time, helping users analyze their performance and set fitness goals.
     + Cost-Effective Solution – Eliminates the need for professional trainers for basic guidance, making fitness tracking more accessible.
  2. **LITERATURE SURVEY**

The development of RepliFit is based on advancements in computer vision, machine learning, and fitness tracking technologies. The literature survey examines various existing research and technologies related to AI-driven exercise monitoring systems.

1. Computer Vision in Fitness Tracking
   * Several studies have explored the use of computer vision for human pose

estimation, with frameworks such as MediaPipe and OpenPose being widely used for tracking body movements.

* + Research has shown that these technologies can accurately map human skeletal structures and detect movement patterns, making them ideal for fitness applications.

1. Machine Learning for Posture Classification
   * Machine learning models such as Random Forest, Support Vector Machines (SVM), and Neural Networks have been successfully implemented in fitness applications to classify exercise postures and detect incorrect movements.
   * Prior research indicates that training AI models on labeled datasets of human exercises can improve accuracy in identifying correct and incorrect postures.
2. Real-Time Feedback in Exercise Monitoring
   * Studies suggest that providing real-time feedback on posture and movement can significantly enhance workout effectiveness and reduce injury risks.
   * AI-driven fitness trainers have been explored in various applications, including virtual personal trainers and physiotherapy assistance systems, proving beneficial for individuals exercising without professional supervision.
3. Non-Wearable AI Fitness Solutions
   * Traditional fitness tracking methods rely on wearable devices such as smartwatches and fitness bands. However, research indicates that computer vision-based tracking systems can offer comparable or superior accuracy

without requiring any additional hardware.

* + The development of webcam-based fitness tracking solutions aligns with the growing trend of AI-powered, software-only fitness applications.

1. Applications in Rehabilitation and Sports Training
   * Several studies highlight the importance of AI in physical therapy and

rehabilitation, where computer vision is used to monitor patients’ recovery exercises.

* + Sports science research also explores AI-driven movement analysis to enhance

athlete performance in activities such as weightlifting, yoga, and martial arts.

**CHAPTER 2**

**SYSTEM AND SOFTWARE SPECIFICATION**

* 1. **HARDWARE REQUIREMENTS**

|  |  |
| --- | --- |
| Processor | Intel Core i5 |
| Computer system | Windows, Linux, macOS |
| Ram | 8GB |
| Storage type | 64-bit OS |
| Input device | Webcam ,Graphics card |

* 1. **SOFTWARE REQUIREMENTS**

|  |  |
| --- | --- |
| Operating system | Windows 10/11, Linux, or macOS |
| Programming language | Python 3.x |
| Deep Learning Framework | TensorFlow / keras |
| Computer Vision Library | OpenCV for image |
| Detection | Media pipe for pose |
| Additional Libraries | Numpy , Pandas |

* 1. **OBJECTIVES**

The primary objective of RepliFit is to enhance fitness training and rehabilitation by providing real-time posture correction and rep counting using computer vision and machine learning. The key objectives include:

* + - To develop an AI-driven fitness tracking system that can analyze exercise postures in real-time using pose estimation techniques.
    - To provide instant feedback on posture accuracy to help users optimize their workouts and reduce the risk of injury.
    - To eliminate the need for wearable devices by using a webcam-based tracking system, making fitness monitoring more accessible and cost-effective.
    - To implement machine learning models such as Random Forest and Support Vector Machine (SVM) for classifying correct and incorrect exercise postures with high

accuracy.

* + - To create an intuitive and interactive GUI using CustomTkinter, offering a user- friendly experience with real-time feedback and dark mode support.
    - To facilitate physical therapy and rehabilitation by monitoring recovery exercises and allowing remote observation by physiotherapists.
    - To support home workouts and virtual training by acting as an AI-powered virtual trainer that tracks progress and provides performance insights.
    - To enhance sports performance analysis by assisting athletes and coaches in refining their techniques in activities such as weightlifting, yoga, and martial arts.

To store and analyze workout data for tracking long-term fitness progress and helping users improve their exercise routines