# Project Report on SELF-GYM APPLICATION

In Partial Fulfillment of requirements for the degree

of

**BACHELOR OF TECHNOLOGY** 

IN

COMPUTER SCIENCE AND ENGINEERING

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# SHRI VAISHNAV VIDYAPEETH VISHWAVIDYALAYA, INDORE SHRI VAISHNAV INSTITUTE OF INFORMATION TECHNOLOGY

#### DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

#### **DECLARATION**

We here declare that work which is being presented in the project entitled "Self-Gym Application" in partial fulfillment of degree of Bachelor of Technology in Computer Science & Engineering is an authentic record of our work carried out under the supervision and guidance of Dr. Anand Rajavat Director SVIIT & HOD of Computer Science & Engineering and Mr. Sachin Chirgaiya Asst. Professor of Computer Science & Engineering. The matter embodied in this project has not been submitted for the award of any other degree.

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# SHRI VAISHNAV VIDYAPEETH VISHWAVIDYALAYA, INDORE SHRI VAISHNAV INSTITUTE OF INFORMATION TECHNOLOGY

#### DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

#### **PROJECT APPROVAL SHEEET**

Following team has done the appropriate work related to the "Self-Gym Application" in partial fulfillment for the award of Bachelor of Technology in Computer Science & Engineering of "SHRI VAISHNAV INSTITUTE OF INFORMATION TECHNOLOGY" and is being submitted to SHRI VAISHNAV VIDYAPEETH VISHWAVIDYALAYA, INDORE.

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# SHRI VAISHNAV VIDYAPEETH VISHWAVIDYALAYA, INDORE SHRI VAISHNAV INSTITUTE OF INFORMATION TECHNOLOGY

#### DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

#### **CERTIFICATE**

This is to certify that Ms. Mansi Jaiswal, Mr. Priyanshu Parashar, Mr. Samaditya Jatar and Mr. Samarth Bhole working in a team have satisfactorily completed the project entitled "Self-Gym Application" under the guidance of Dr. Anand Rajavat and Mr. Sachin Chirgaiya in the partial fulfillment of the degree of Bachelor of Technology in Computer Science & Engineering awarded by SHRI VAISHNAV INSTITUTE OF INFORMATION TECHNOLOGY affiliated to SHRI VAISHNAV VIDYAPEETH VISHWAVIDYALAYA, INDORE during the academic year July 2022- December 2022.

Prof. Sachin Chirgaiya
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Dr. Anand Rajavat
Director & Head,
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#### **ACKNOWLEDGEMENT**

We are grateful to a number of persons for their advice and support during the time of complete our project work. First and foremost, our thanks go to **Dr. Anand Rajavat** Head of the Department of Computer Science & Engineering and **Mr. Sachin Chirgaiya** the mentor of our project for providing us valuable support and necessary help whenever required and also helping us explore new technologies by the help of their technical expertise. His direction, supervision and constructive criticism were indeed the source of inspiration for us.

We would also like to express our sincere gratitude towards our Director **Dr. Anand Rajavat** for providing us valuable support.

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We forward our sincere thanks to all **teaching and non-teaching staff** of Computer Science & Engineering department, SVVV Indore for providing necessary information and their kind co-operation.

We would like to thanks our parents and family members, our classmates and our friends for their motivation and their valuable suggestion during the project. Last, but not the least, we thank all those people, who have helped us directly or indirectly in accomplishing this work. It has been a privilege to study at SHRI VAISHNAV VIDYAPEETH VISHWAVIDYALAYA, INDORE.

#### **ABSTRACT**

During the covid-19 outbreak and the following lockdown protocols, it took a direct hit on the gyms and fitness of the people. We experienced this problem and could not find any viable solutions for the same except some which were superfluous so,

it engendered to an intuitive solution that shall help people who want to continue their fitness journey in their homes with minimal equipment and under supervision from their own virtual SELF GYM APPLICATION.

Due to the Covid-19 outbreak gyms were closed and people who preferred home gyms lacked supervision of the trainer or watcher in order is necessary to keep people motivated.

Our system will keep an eye on the trainee to motivate them further and count their work and record their progress in our system, which will ultimately help them analyze their health with the help of our system. Also, the users will be provided with a chat bot which will address their health-related queries.

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#### **CHAPTER 1**

#### 1.1 INTRODUCTION

To overcome the limitations of fitness trackers we designed a better system with a better accuracy of number of reps of biceps, sit-ups, jumps, crunches, etc. We track this different exercise with the help of logics which we developed using media pipe's pose classifier and individual logic which we developed for each of these exercises and hence predict better results. And also a health and dietary tracking system for individual users. A chat bot system is also there which is created using newspaper and NLTK, to address user's queries

#### 1.2 PROBLEM STATEMENT

During the covid-19 outbreak and the following lockdown protocols, it took a direct hit on the gyms and fitness of the people. We experienced this problem and could not find any viable solutions for the same except some which were really superfluous so, it engendered to an intuitive solution which shall help people who want to continue their fitness journey at their homes with minimal equipment and under supervision from your own virtual SELF GYM APPLICATION.

#### 1.3 MODULES OF THE SYSTEM

#### 1.3.1 OpenCV

Used OpenCV as it is a great tool for image processing and performing computer vision tasks. It is an open-source library that can be used to perform tasks like face detection, objection tracking, landmark detection, and much more.

#### 1.3.3 MediaPipe

Used MediaPipe Pose classifier for obtaining landmarks and data points on the body and then analyzing them to track body movements.

#### **1.3.4 Pandas**

pandas is a software library written for the Python programming language for data manipulation and analysis. In particular, it offers data structures and operations for manipulating numerical tables and time series. It is free software released under the three clause BSD license

#### 1.3.5 Django

Django is a high-level Python web framework that enables rapid development of secure and maintainable websites. Built by experienced developers, Django takes care of much of the hassle of web development, so you can focus on writing your app without needing to reinvent the wheel. It is free and open source, has a thriving and active community, great documentation, and many options for free and paid-for support.

#### 1.4 OBJECTIVE

Provide convenient, NO-dependability and self-equipped home gym application with supervised, monitored training sessions, workout tracking and health management features.

#### 1.5 NEED FOR PROPER SYSTEM

Home gym was considerably the most favorable solution which is great but it has its own drawbacks like there is no way to track our workout so we came up with an solution which uses a machine learning model to recognize the joints in our body through which we can track the moment of a specific muscle which will eventually help us track our workout and also our system will include other functionality which will track your calorie intake we will use webscrapping to manage their diet.

#### **1.6 SCOPE**

Due to the Covid-19 outbreak gyms were closed and people who preferred home gym lacked supervision of the trainer and performing exercises in a wrong way and form/posture could result in injuries like shin splints, tennis elbow, wrist tendinitis and knee-cap injuries. Acute injuries are caused by the lack of a warm-up routine, incorrect technique or by use of substandard equipment, resulting in ankle sprains, or injuries to the knee ligament or shoulders.

#### **CHAPTER 2**

#### 2. LITERATURE SURVEY

#### 2.1 Existing System

There are several existing systems in place including big Gym's and workout centers. Removed the need to physically go to a gym and train under supervision of a personal trainer which requires you to pay hefty fees, and as per the recent events (during covid19) there were rising cause for not going to public place and still continue with healthy lifestyle which means doing work out regularly, and maintaining a perfect diet. We are also restricted by the gym schedule and timings which could be a very major issue in life of person trying to maintain a work-life balance.

#### 2.2 Proposed System

Home gym was considerably the most favorable solution which is great but it has its own drawbacks like there is no way to track our workout so we came up with an solution which uses a machine learning model to recognize the joints in our body through which we can track the moment of a specific muscle which will eventually help us track our workout and also our system will include other functionality which will track your calorie intake we will use webscrapping to manage their diet. To deal with user's health related queries a chat bot system is also included, which will search articles online with help of web scrapping to answer user's questions.

#### 2.3 Feasibility Study

Feasibility study is a step towards identification of the candidate system as a feasible product. First the studies often pre-suppose that when the feasibility document is being prepared, the analyst is in a position to evaluate solutions. Second, most studies tend to overlook the confusion inherent in system development, the constraints and the assumed attitudes. If the feasibility study is to serve as a decision document, it must answer three questions:

- Is there a new and better way to do a job that will benefit the user?
- What are the costs and saving of the alternatives?
- What is recommended?

#### 2.3.1 Technical Feasibility

As we are observing this day after day there is a surge in people getting on internet, which is helping us to provide this system all across the country and even across the world. As our application would be live up on internet which would allow our users to access it from anywhere and anytime.

#### 2.3.2 Economical Feasibility

Economic feasibility of this approach is quite in concordance with a low budget project. The method we use is really inexpensive as it does not require any special hardware. Since the application runs on most of the android devices, it does not require the end user to buy new hardware. The application only needs an android device on which it will be installed and an internet connection. Since no extra hardware is required, it make the application economically feasible for both client and the service provider. The financial and the economic questions during the preliminary investigation are verified to estimate the following:

• The cost to conduct a full system investigation.

- The cost of hardware and software for the class of application being considered.
- The benefits in the form of reduced cost.
- The proposed system will give the minute information, as a result the performance is improved which in turn may be expected to provide increased profits.

#### 2.3.3 Operational Feasibility

The proposed system will benefit anyone who is willing to adapt to a newer way of achieving a healthier life. Only people who are left behind in this system are the ones who are dogmatic to the traditional gyms.

#### 3. REQUIREMENTS ANALYSIS

#### 3.1 Method used for Requirement analysis

- **Group Interviews:** A group interview also has an advantage when there is a time constraint. More thoughts and discussion can be generated, as someone in the group may state or suggest an idea that may have been overlooked by others, which in turn can lead to a discussion or provide more information on a particular issue.
- Analyzing Existing Documents: Analyzing existing documents can prove to be a useful technique in requirement gathering, on its own as well using it to supplement other techniques. Reviewing the current process and documentation can help the analyst understand the business, or system, and its current situation. Existing documentation will provide the analyst the titles and names of stakeholders who are involved with the system.

This method gives what are the stakeholders of the software.

• User Observation: User observation should be planned to ensure that all elements are constant surrounding the observation. This will assist in uncertainty, and the consultant can focus on the user and assist in knowing what to look for. The analyst will not be distracted and record, or note, irrelevant issues. The more useful information gathered, the less time it will take to the analyst to dissect and evaluate afterwards. Timing of the observation can also prove relevant when planning. In this method we observe the user i.e., what type of user uses this module and what the user can use this data. In this method we examine what data we should show to the user, which data is important to the user

#### 3.2 Data Requirements

The following are the data requirements needed:

- User basic Information
- User contact information
- User health information
- User workout information
- User timings and schedule of using the application
- User food intake information

#### 3.3 Functional Requirements

The main functional requirement for the system is to able to track the workout of any person using OpenCV and a media pipe and keep track of that workout for any individual user

- Member Dashboard
- · calories calculator
- Workout Tracker
- Mobile Responsive
- Social authentication
- Unique, recognizable design

#### 3.4 Non-Functional Requirements

- The system should be portable
- The system should take care of security
- It is required that system should be easy to Maintain
- Reliability is a important part of a system to maintain its integrity
- Scalability is necessity for system for future opportunities
- Performance is a need for any system
- Reusability of the is necessary of an organization
- Flexibility is a key aspect to which hold importance to it

#### 3.5 System Specifications

- Modern Operating System:
- Windows 7 or 10
- Mac OS X 10.11 or higher, 64-bit
- Linux: RHEL 6/7, 64-bit (almost all libraries also work in Ubuntu)
- x86 64-bit CPU (Intel / AMD architecture)

#### 3.5.1 Hardware Specification

- 4 GB RAM
- 5 GB free disk space
- Optical Sensor Resolution 3 MP
- Min Focal Length 30

#### 3.5.2 Software Specification

- Django-backend
- Google auth API
- Bootstrap CDN
- ML-classifier, Media pipe, OpenCV
- Beautiful Soup

#### **CHAPTER 4**

#### 4. DESIGN

#### 4.1 Software Requirements Specification

#### 4.1.1 Glossary

To engage in this task, it was needed to load ourselves with computer tools that could perform image processing and, in this way, allow us to rapidly test different imaging algorithms. Open-Source Computer Vision (OpenCV) is an open-source computer vision library that runs in Linux, Windows and Mac OS X, with active development on interfaces for Python, Ruby, MATLAB and other languages. OpenCV was designed for computational efficiency and with strong emphasis on real time applications. It is written in optimized C and C++ and can take advantage of multicore processors. Further automatic optimization on Intel architectures through Intel's Integrated Performance Primitives (IPP) libraries, which consist of low-level optimized routines in many different algorithmic areas. One of the OpenCV's goals is to provide a simple-to-use computer vision infrastructure that helps people building vision applications quickly. The OpenCV library contains functions that span many areas in vision, including factory product inspection, medical imaging, security, user interface, camera calibration, stereo vision and robotics. Since computer vision and machine learning often go hand-in-hand, OpenCV also contains a full, general-purpose Machine Learning Library.

#### **Class**

A class defines an software object's interface and implementation. It specifies the object's internal representation and defines the operations that the object can be instructed to perform. The prototype for an object in an object-oriented language; analogous to a derived type in a procedural language. A class may also be considered to be a set of objects which share a common structure and behavior. The structure of a class is determined by the variables which

represent the state of an object of that class and the behavior is given by a set of methods associated with the class.

A grouping of data having similar characteristics. A class definition defines instance and class variables and methods, as well as specifying the interfaces the class implements and the immediate superclass of the class.

#### Client

A computer system or process that requests a service of another computer system or process (a server). For example, a workstation requesting the contents of a file from a file server is a client of the file server. In the client-server model for communications, the client is a process that remotely accesses resources of a compute server, such as compute power and large memory capacity.

#### **Client-Server**

A common form of distributed system in which software is split between server tasks and client tasks. A client sends requests to a server, according to some protocol, asking for information or action, and the server responds. There may be either one centralized server or several distributed ones. This model allows clients and servers to be placed independently on nodes in a network, possibly on different hardware and operating systems appropriate to their function, e.g., fast server/cheap client.

#### **Database**

One or more large structured sets of persistent data, usually associated with software to update and query the data. A simple database might be a single file containing many records, each of which contains the same set of fields where each field is a certain fixed width. Loosely, any aggregation of data; a file consisting of a number of records (or tables), each of which is constructed of fields (columns) of a particular type, together with a collection of operations that facilitate searching, sorting, recombining, or similar activities.

#### **Database Management System**

A suite of programs which typically manage large structured sets of persistent data, offering ad hoc query facilities to many users. A database management system is a complex set of software programs that controls the organization, storage and retrieval of data (fields, records and files) in a database. It also controls the security and integrity of the database. The DBMS accepts requests for data from the application program and instructs the operating system to transfer the appropriate data. When a DBMS is used, information systems can be changed much more easily as the organization's information requirements change. New categories of data can be added to the database without disruption to the existing system. A software system facilitating the creation and maintenance of a data base and the execution of programs using the data base.

#### **Data Flow Diagram (DFD)**

A graphical notation used to describe how data flows between processes in a system.

An important tool of most structured analysis techniques.

#### **Object**

A run-time entity that packages both data and the procedures that operate on that data. In object-oriented programming, a unique instance of a data structure defined according to the template provided by its class. Each object has its own values for the variables belonging to its class and can respond to the messages (methods) defined by its class.

#### **Software Life-Cycle**

The software life-cycle consists of requirements analysis, design, construction, testing (validation) and maintenance. The development process tends to run iteratively through these phases rather than linearly; several models (spiral, waterfall etc.) have been proposed to describe this process. Other processes associated with a software product are: quality assurance, marketing, sales and support.

#### **Uniform Resource Locator (URL)**

A draft standard for specifying an object on the Internet, such as a file or newsgroup. URLs are used extensively on the World-Wide Web. They are used in HTML documents to specify the target of a hyperlink.

#### User Interface (UI)

The aspects of a computer system or program which can be seen (or heard or otherwise perceived) by the human user, and the commands and mechanisms the user uses to control its operation and input data. A graphical user interface emphasizes the use of pictures for output and a pointing device such as a mouse for input and control whereas a command line interface requires the user to type textual commands and input at a keyboard and produces a single stream of text as output.

#### 4.1.2 Supplementary Specifications

#### **4.1.2.1 Purpose**

Defining and describing the functions and specifications of the Home Workout is the primary goal of this Software Requirements Specification (SRS).

This Software Requirements Specification illustrates, in clear terms, the system's primary uses and required functionality as specified by our customer.

#### 4.1.2.2 Definitions, acronyms, and abbreviations

	A user interface element that allows a User to click and inform the system to take an action
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Checkbox	A user interface element that allows a User to inform the system that he/she selected a particular item
CRUD	Create, Retrieve, Update, Delete
Customer	A person that is a user of the system but has created an account
Member	A person that is a customer of the system and has requested to be sent
	promotions
Session	The time which a User is actively using the system
SRS	Software Requirements Specification
User	The person who operate the software product.

## 4.1.3 Use Case Model

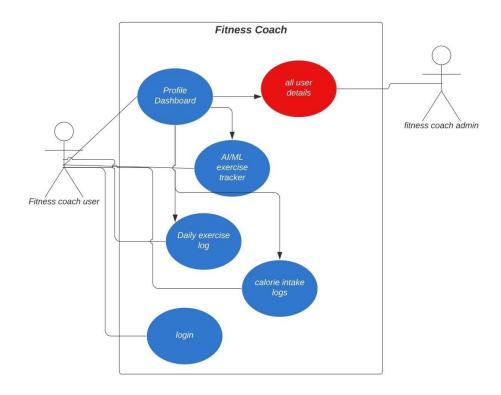


Fig-1 Use Case Diagram

# 4.2 Conceptual level class diagram

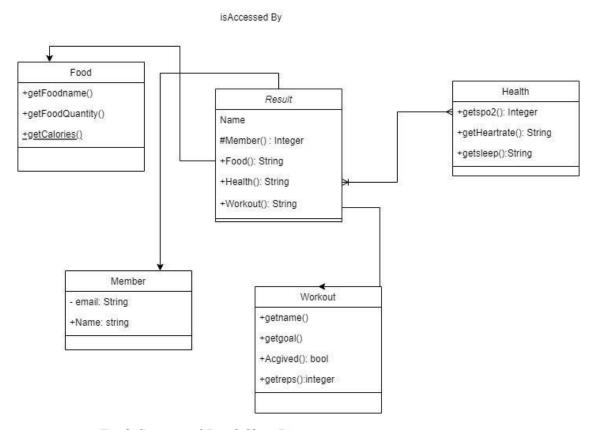


Fig-2 Conceptual Level Class Diagram

# 4.3 Conceptual level activity diagram

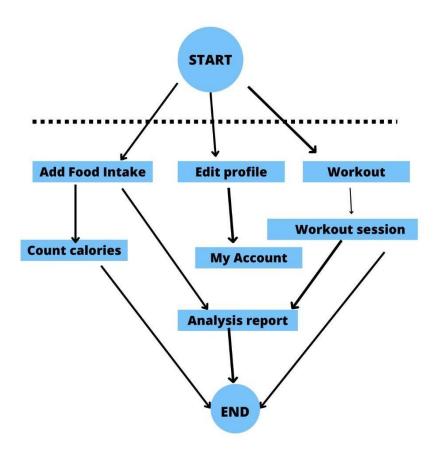


Fig-3 Conceptual level Activity Diagram

# 4.4 Data flow Diagram (Level 0,1)

#### DFD LEVEL 0



Fig-4 Data Flow Diagram (Level 0)

#### • DFD LEVEL 1

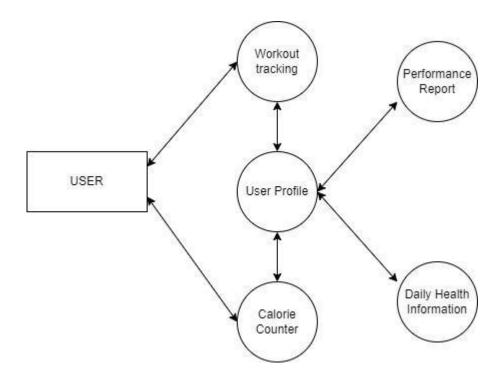


Fig-5 Data Flow Diagram (Level-1)

# 4.5 Database Design (ER-Diagram)

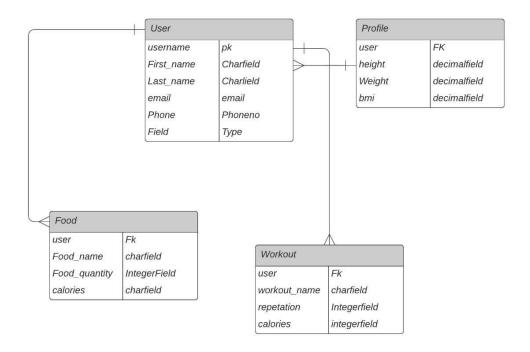


Fig-6 ER Diagram

#### **CHAPTER 5**

# **5.1 Detailed Class Diagram**

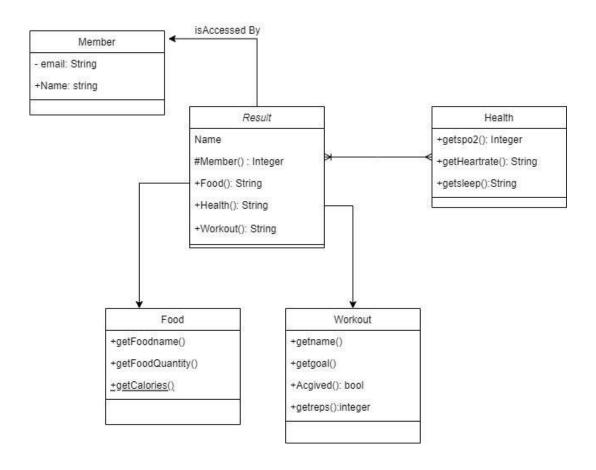


Fig-7 Detailed Class Diagram

#### **5.2 Interaction Diagram**

Interaction diagrams are used to represent how one or more objects in the system connect and communicate with each other. Interaction diagrams focus on the dynamic behavior of a system. An interaction diagram provides us the context of an interaction between one or more lifelines in the system.

## **5.2.1 Sequence Diagram**

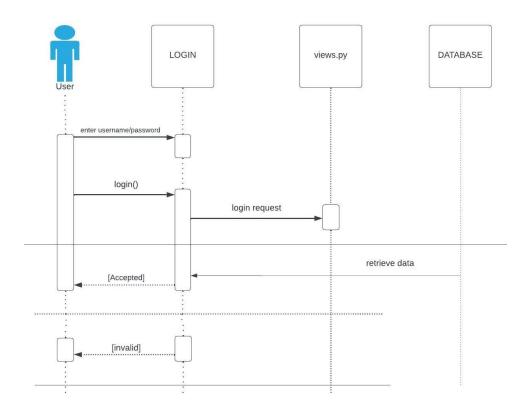


Fig-8 Sequence Diagram

# **5.2.2 Collaboration Diagram**

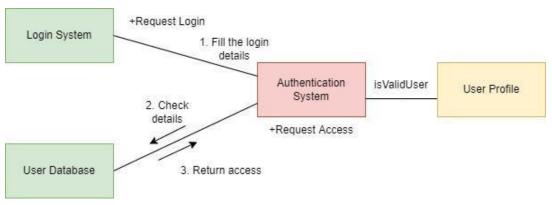


Fig-9 Collaboration Diagram

#### **5.3 State Diagram**

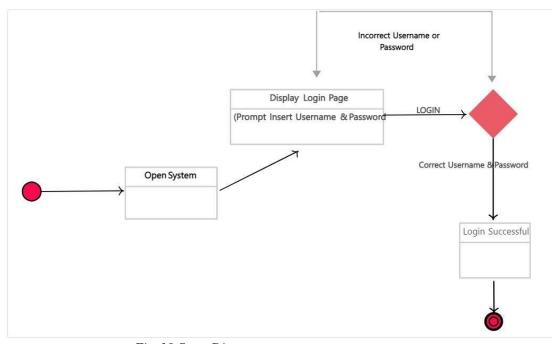


Fig-10 State Diagram

# **5.4 Activity Diagram**

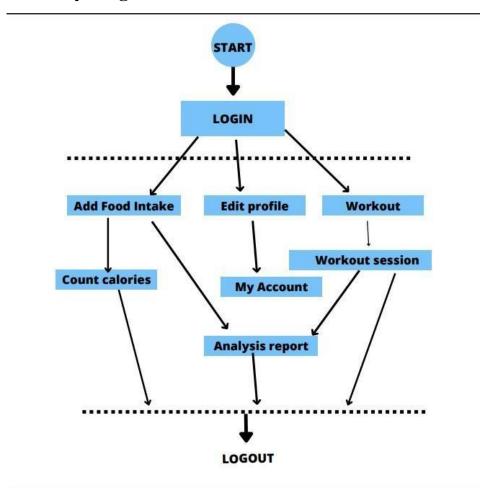


Fig-11 Activity Diagram

# 5.5 Object Diagram

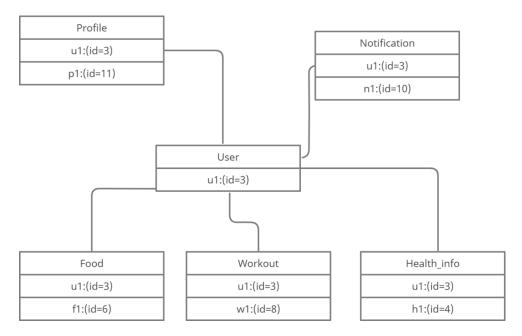


Figure 12 Object Diagram

# 5.6 Component Diagram

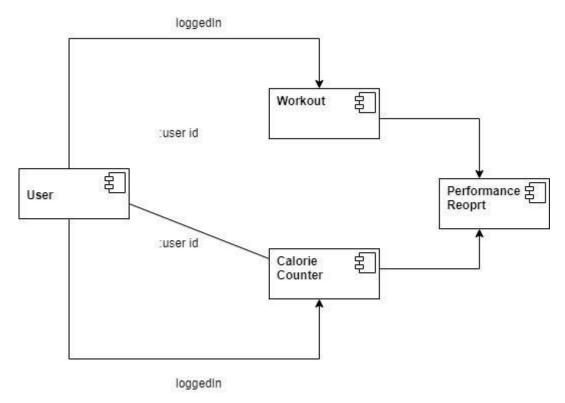


Fig-12 Component Diagram

# **5.6.1 Deployment Diagram**

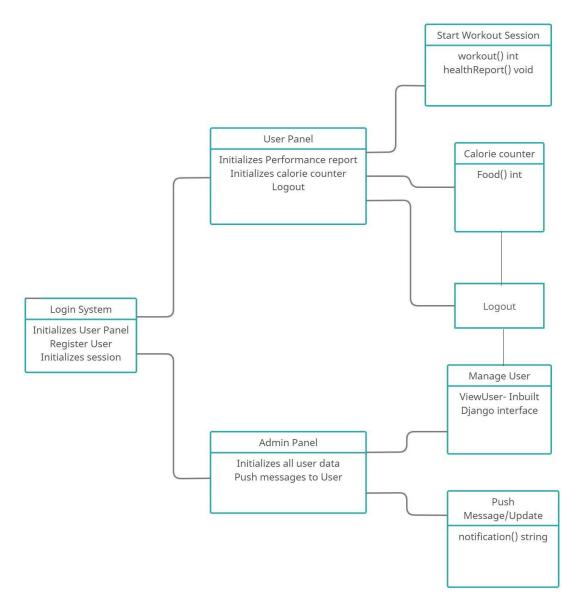


Fig-13 Deployment Diagram

# 5.7 Testing

#### 5.7.1 Testing Strategy Adopted

Testing Strategy Adopted is Proactive. Testing documentation involves the documentation of artefacts that should be developed before or during the testing of Software. Documentation for software testing helps in estimating the testing effort required, test coverage, requirement tracking/tracing, etc. This section describes some of the commonly used documented artefacts related to software testing. Testing allows you to ensure your application works the way you think it does, especially as your codebase changes over time. If you have good tests, you can refactor and rewrite code with confidence. Tests are also the most concrete form of documentation of expected behavior, since other developers can figure out how to use your code by reading the tests.

Various software-testing strategies have been proposed so far. All provide a template for testing. Things that are common and important in these strategies are: Testing begins at the module level and works "outward": tests which are carried out are done at the module level where major functionality is tested and then it works towards the integration of entire system.

Different testing techniques are appropriate at different point of time: Under different circumstances, different testing methodologies are to be used which will be the decisive factor for software robustness and scalability. The developer of the software conducts testing and if the project is big then there is a testing team: All programmers should test and verify that their results are according to the specification given to them while coding.

In cases where programs are big enough or collective effort is involved for coding, responsibilities for testing lies with the team as a whole.

A test approach is the test strategy implementation of a project, defines how testing would be carried out. Test approach has two techniques:

**Proactive:** An approach in which the test design process is initiated as early as possible in order to find and fix the defects before the build is created.

**Reactive:** An approach in which the testing is not started until after design and coding are completed.

There are many strategies that a project can adopt depending on the context and some of them are:

- Dynamic and heuristic approaches
- Consultative approaches
- Model-based approach that uses statistical information about failure rates.
- Approaches based on risk-based testing where the entire development takes place based on the risk
- Methodical approach, which is based on failures.
- Standard-compliant approach specified by industry-specific standards.

# **5.7.2. Testing Methods**

#### • Unit Testing:

Testing of an individual software component or module is termed as Unit Testing. It is typically done by the programmer and not by testers, as it requires detailed knowledge of the internal program design and code. It may also require developing test driver modules or test harnesses.

#### • System Testing:

Under System Testing technique, the entire system is tested as per the requirements. It is a Black-box type Testing that is based on overall requirement specifications and covers all the combined parts of a system.

### • White Box Testing:

It is also known as Glass box Testing. Internal software and code working should be known for performing this type of testing. Under these tests are based on the coverage of code statements, branches, paths, conditions, etc.

#### • Black Box Testing:

Black Box Testing, also known as Behavioral Testing, is a software testing method in which the structure/ design/ implementation of the item being tested is not known to the tester. These tests can be functional or non-functional, though usually functional.

## **CHAPTER 6**

### 6. CONCLUSION & FUTURE WORK

The primary aim of this project has been met. All the objectives that were set out have

completed and are giving positive results in the end. Although the application has some minor bugs which will be resolved shortly. The application is working efficiently and the core objective of the system, i.e.; to analyze and recognize human joints using post classifier (Media Pipe) and calculate each exercise movement with an algorithm to track workout along with extra functionalities like tracking food intake, daily health tracking. The project has been appreciated by all the users in the organization. It is easy to use, since it uses the GUI provided in the user dialog. User friendly screens are provided. The usage of software increases efficiency, decreases the effort. It helped a lot of users to complete their work from remote location by just using their laptop without physically going to the gym.

Use data obtained from website to train machine learning models of which genre of music promotes more exercises. Support more exercise tracking and recognition techniques along with pose correction. Use IOT-enabled devices to track and get health details and update it directly in the performance report.

#### 6.1. Limitations

Apart from being a reliable and useful approach there are some situations where the model shows some limiting factors. These limiting factors does not degrade the current model but it limits the extra approach that the model could have provided us with. These limiting factors are:

- There are some minor bugs in the application such as if there are more than two people in the frame then it is uncertain which data points are going to be recognized by the system, hence the system may generate incorrect output in some scenario.
- Also, sometimes the application may not display images which high resolutions since the size of Image View is fixed and it can hold image up to a certain limit only.

• The system may not work properly if the camera resolution is too low or if the data points are not clearly visible in the frame.

### **6.2 Future Enhancements**

- We are aiming to make it platform independent in further enhancements.
- Various workout routines can be added to make it more convenient for users, and users can have a proper workout routine and workout tracker on the same platform.

## **CHAPTER 7**

### 7.1 Reference Books

Django for Professionals

The Python Workbook

Python For Data Analysis

### 7.2 Other Documentations & Resources

Django documentation

Python documentation

Bootstrap documentation

Media Pipe documentation

#### 7.2.1. Documentation and Resources

Django Development: https://docs.djangoproject.com/en/4.0/

OpenCV: https://docs.opencv.org/4.x/

Django google authentication: https://django-allauth.readthedocs.io/en

UML Diagrams: https://app.creately.com/

Web Scrapping: https://towardsdatascience.com/

Django Development: https://www.youtube.com/c/DennisIvy

Django Development: https://stackoverflow.com/

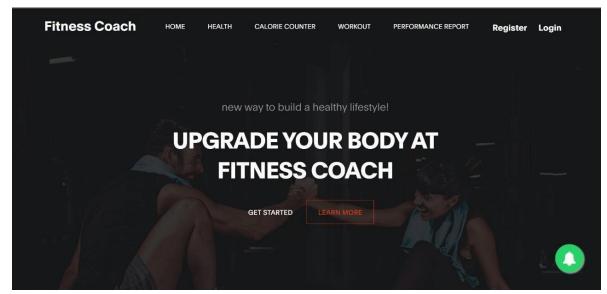
Media Pipe: https://google.github.io/mediapipe/

NLTK Documentation: https://www.nltk.org/

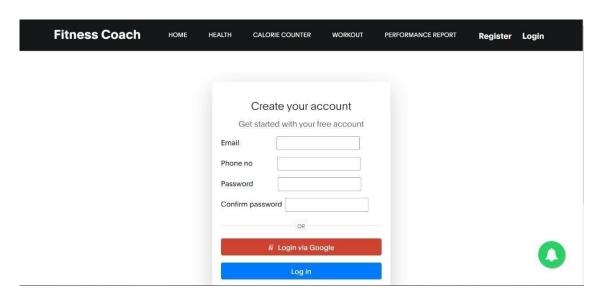
Newspaper for Scrapping: https://newspaper.readthedocs.io/en/latest/

Pandas in Python: https://newspaper.readthedocs.io/en/latest/

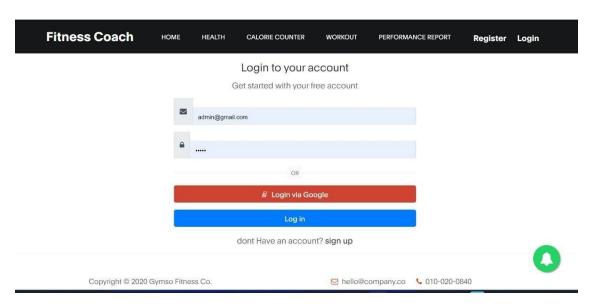
# 7.3 Snapshot (with description)



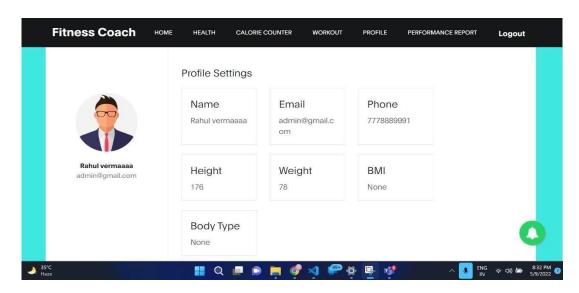
Homepage (Initial Screen)



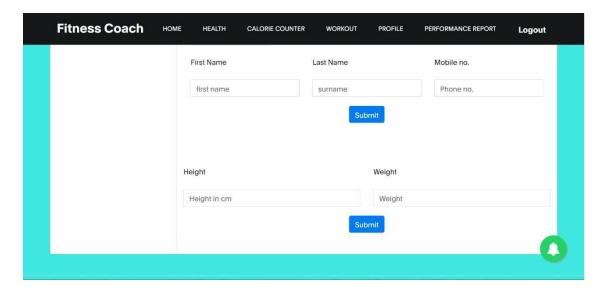
Register New User



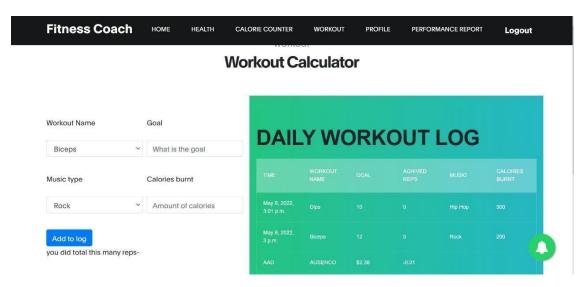
Login page



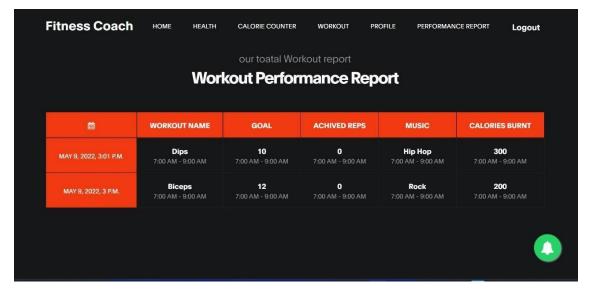
**User Dashboard** 



Update User Information



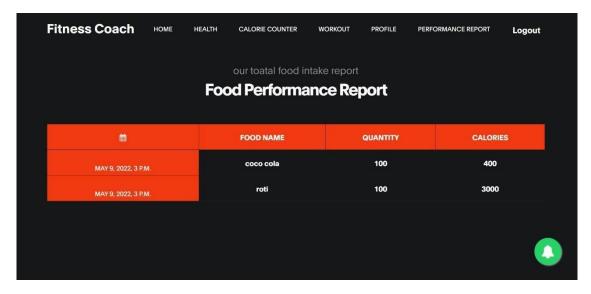
Start Workout Session



Workout Performance Report



Health Performance Report



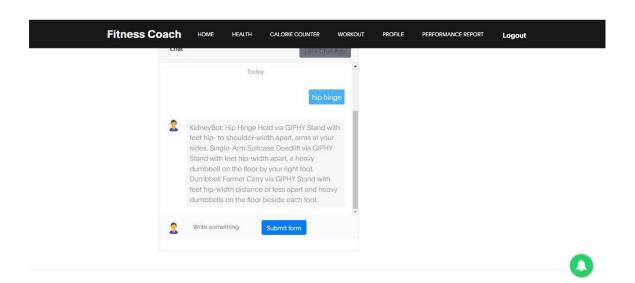
Food Report based on user diet



Working Application which measures bicep curls



Working Application which measures bicep curls



Chat bot for user's queries