2248-CSE-5335-002 WEB DATA MANAGEMENT

Team Members:-

- Akshay Daundkar- **1002149721**
- Arun Sabarish Krishnaswamy Ganesan- **1002234442**
- Pallavi Chowdary Gogineni-**102221774**
- Kevin Gomez- **1000873983**
- Sanket Rajendrakumar More-**1001952737**

Report on AI-Powered Fitness Tracker- FitXpert AI

Project Overview

The AI-Powered Fitness Tracker is designed to help users monitor their fitness progress, track workouts, set goals, and receive AI-based recommendations for workouts and nutrition. The system integrates AI insights for predictive analytics, personalized fitness plans, and automated progress tracking.

Member 1:- Akshay Daundkar – 1002149721

Module 1: User Registration , Management & Authentication

The User Management & Authentication module ensures users can register, log in, and manage their fitness profile while keeping their data secure. The system is designed to safeguard personal details such as height, weight, and fitness level, allowing users to track their fitness journey in a structured way. During registration, users will provide basic details like name, email, age, gender, and fitness level to personalize their experience. The authentication system guarantees secure access using encrypted passwords and token-based login sessions. Users can also update their profiles as their fitness goals evolve. The registration process is designed to be user-friendly and secure. It collects essential details that help personalize workout recommendations. Users will also be able to modify their profiles after registration to adjust fitness goals as they progress. To ensure data accuracy, I will implement real-time form validation that checks for missing or inconsistent information before submission a strong authentication system is crucial to protect user data. I will be implementing bcrypt encryption to hash passwords before storing them in the database. This makes it extremely difficult for unauthorized parties to access credentials. Additionally, I will use salting techniques with bcrypt, which involves adding a random value to passwords before hashing, preventing attackers from using precomputed hash tables (rainbow tables) to break passwords.For managing login sessions, I will implement JWT-based authentication. This ensures users receive secure access tokens upon login, reducing the risk of unauthorized access while maintaining a seamless user experience.

Key Features:

- **User Registration** with **Name, Email, Password, Age, Gender, Height, Weight**
- **Secure Password Encryption** using **bcrypt**
- **JWT-based Authentication** for secure login sessions
- **Role-based Access Control** for personalized fitness tracking
- **Profile Management** (Updating weight, height, fitness level, goals)
- **Seamless Integration with Wearable Devices** for personalized recommendations (Optional)

Implementation Approach:-

1. **Framework:**
   - The frontend is developed using React.js, ensuring an intuitive and smooth user experience.
   - The backend is built with Node.js and Express.js, handling user authentication and data management securely.
   - MongoDB is used for storing user profiles, offering scalability and flexibility.

2. **Dry Principles:-**
   - I will ensure reusable UI components (e.g., form fields, validation logic) are implemented to maintain code consistency and easy maintenance.
   - The authentication logic will be modularized, allowing it to be efficiently reused across registration, login, and profile management.
   -
3. **Password Encryption**:
   - Passwords will be hashed using bcrypt, ensuring that stored passwords are difficult to decrypt.
   - Salting techniques will be applied to prevent brute-force attacks and make passwords even more secure.
   -
4. **Fitness profile customization:**
   - Users can modify weight, height, and fitness level as they progress.
   - AI-powered recommendations will adjust based on updated user profiles to ensure workouts remain relevant.
   -
5. **Mobile Friendly & Responsive design:**
   - The registration and authentication pages will be designed to work flawlessly on desktops, tablets, and smartphones.
   - UI elements will be optimized for smartwatches and fitness wearables to ensure accessibility across different devices

Api Endpoints (Designed)

Feature	Endpoint URL
User Registration	/api/users/register
User Login	/api/users/login
Get User Profile	/api/users/profile/:id
Update User Profile	/api/users/profile/update
Delete User Account	/api/users/delete/:id

Member 2:- Arun Sabarish Krishnaswamy Ganesan – 1002234442

Module 2: Workout Management & Tracking

The Workout Management & Tracking module is responsible for logging workout sessions, tracking fitness progress, and providing users with detailed insights on their activities. This module ensures users can plan, execute, and monitor their workouts while receiving personalized feedback on their fitness journey. Users can choose workouts based on difficulty level, category, and calorie expenditure. Workout sessions will be recorded with details like duration, calories burned, and progress over time. Additionally, AI-driven insights will suggest workout optimizations based on user performance. This feature allows users to track their workouts in real-time. Users can choose from a predefined list of exercises or log custom workouts. Each session will store: Workout type (e.g., Cardio, Strength, Yoga) Duration of the workout Calories burned based on activity intensity Date & time of the session Wearable devices will be supported to automatically sync workout data, eliminating the need for manual input. AI-based trend analysis will help users identify improvements in performance over time. AI will analyse workout patterns and offer: Optimized workout recommendations based on activity levels , Calorie burn efficiency reports, Performance comparisons with past sessions Goal-based progress tracking (e.g., Weight loss, Muscle gain, Endurance training)

Key Features:

- **Workout Logging** – Users can record workouts including session duration, workout type, and calories burned.
- **Predefined Workout Library** – Stores different workout categories with difficulty levels and calorie burn rates.
- **Progress Tracking** – Logs steps walked, weight changes, BMI trends, and calorie expenditure over time.
- **AI-Powered Insights** – Provides personalized suggestions to improve workout efficiency.
- **Sync with Wearable Devices (Optional)** – Automatically logs workouts from smartwatches and fitness trackers.
- **Custom Workout Plans** – Users can create their own workout routines or choose from system-generated plans.

Implementation Approach:-

1 Framework:
- React.js will be used for the frontend, ensuring a clean UI for logging and viewing workouts.
- Node.js with Express.js will handle backend logic for storing and processing workout data.
- MongoDB will be the database of choice for scalability and efficient data retrieval.

2 Code Efficiency with DRY Principle:
- Reusable UI components for workout forms, tracking dashboards, and analytics.
- Modular backend services for logging workouts and AI-based insights.

3. Responsive & Mobile-Optimized Design:

- The workout tracking interface will be fully responsive for desktop, mobile, and wearable device support. The authentication logic will be modularized, allowing it to be efficiently reused across registration, login, and profile management.

Api Endpoints (Designed)

Feature	Endpoint URL
Log Workout Session	/api/workouts/log
Get Workout History	/api/workouts/history/:userId
Get Recommended Workouts	/api/workouts/recommendations/:userId
Update Workout Session	/api/workouts/update/:sessionId
Delete Workout Session	/api/workouts/delete/:sessionId

Member 3:- Pallavi Chowdary Gogineni-102221774

Module 3: AI-Powered Fitness Insights & Predictions

The AI-Powered Fitness Insights & Predictions module leverages machine learning and analytics to provide users with personalized fitness recommendations, performance tracking, and predictive analysis. This module helps users understand their progress, identify trends, and receive intelligent workout suggestions based on their performance. By analyzing workout history, progress tracking, and calorie burn patterns, AI algorithms will predict future fitness trends and suggest optimized workout routines. Users will also receive daily and weekly insights on their health metrics. This feature ensures users get valuable feedback on their fitness journey. AI models analyse workout data and provide insights into:
Workout effectiveness (Calories burned vs. time spent), Trends in weight loss or muscle gain
Projected improvements based on exercise consistency, Daily, weekly, and monthly fitness summaries
By recognizing patterns in workout habits, the system will provide real-time suggestions on how users can enhance their training efficiency.

Key Features:

- **AI-Generated Fitness Reports** – Provides data-driven insights on user progress.
- **Performance Analysis** – Tracks calories burned, workout intensity, and weight changes over time.
- **Personalized AI Recommendations** – Suggests improvements in workout routines based on trends.
- **Predictive Analysis** – Forecasts future fitness performance based on historical data.
- **Activity Trend Monitoring** – Compares user activity patterns with optimal fitness goals.
- **Adaptive Workout Modifications** – AI adjusts workout intensity and duration based on progress.

Implementation Approach:-

1. AI & Machine Learning Model:

- TensorFlow or PyTorch will be used to train predictive models based on workout history.
- AI will analyze user data trends to suggest better workout schedules.
- Natural Language Processing (NLP) may be used to provide chat-based AI fitness guidance.

2. Backend & Data Processing:

- Node.js with Express.js for handling API requests.
- MongoDB for storing AI insights and recommendations.
- Python-based AI processing engine for fitness predictions.

3. UI Integration & Notifications:

- The dashboard will display fitness insights in an easy-to-read visual format.
- Push notifications will remind users about suggested workouts and activity trends.

4. Adaptive Learning System:

- The AI system will continuously update its recommendations as users log more workouts.
- Predictive algorithms will refine suggestions based on real-time fitness tracking.

Api Endpoints (Designed)

Feature	Endpoint URL
Get AI Insights	/api/ai/insights/:userId
Get Activity Predictions	/api/ai/predictions/:userId
Generate AI Report	/api/ai/report/:userId
Update AI Training Data	/api/ai/update/:userId
Delete AI Insights	/api/ai/delete/:userId

Member 4:- Kevin Gomez- 1000873983

Module 4 : Personalized Nutrition & AI Meal Recommendations

The Personalized Nutrition & AI Meal Recommendations module ensures that users receive tailored dietary suggestions based on their fitness level, workout intensity, and fitness goals. By tracking daily meal intake, calories, macronutrients (protein, fats, carbs), and AI-driven analysis, users will get personalized meal plans that align with their workouts.

Key Features:

- **Meal Tracking** – Users log their daily meals and nutritional intake.
- **AI-Based Nutrition Recommendations** – AI suggests customized meal plans.
- **Calorie & Macronutrient Breakdown** – Provides detailed insights into food consumption.
- **Integration with Fitness Goals** – Adjusts meal recommendations based on weight loss or muscle gain objectives.

Implementation Approach:

1 AI-driven meal planning using historical meal data and fitness goals.
MongoDB stores meal logs, AI recommendations, and user dietary preferences.
Simple and intuitive UI to track daily food intake and suggested meals.

Api Endpoints (Designed)

Feature	Endpoint URL	Method
Log Meal Entry	/api/nutrition/log	POST
Get Meal History	/api/nutrition/history/:userId	GET
Get AI-Recommended Meal	/api/nutrition/recommendations/:userId	GET

Member 5:- Sanket Rajendrakumar More-1001952737
Module 5 : Smart Fitness Plans & Goal Tracking

The Smart Fitness Plans & Goal Tracking module helps users set and monitor fitness goals, whether it is weight loss, muscle building, or endurance training. AI-driven insights adjust plans dynamically based on progress and performance.

Key Features:

- **Goal Setting** – Users define their fitness objectives.
- **AI-Optimized Fitness Plans** – Personalized workout & diet plans.
- **Progress Tracking** – Logs steps, calories burned, and goal progress.
- **Goal Adjustments** – AI modifies plans as users progress.

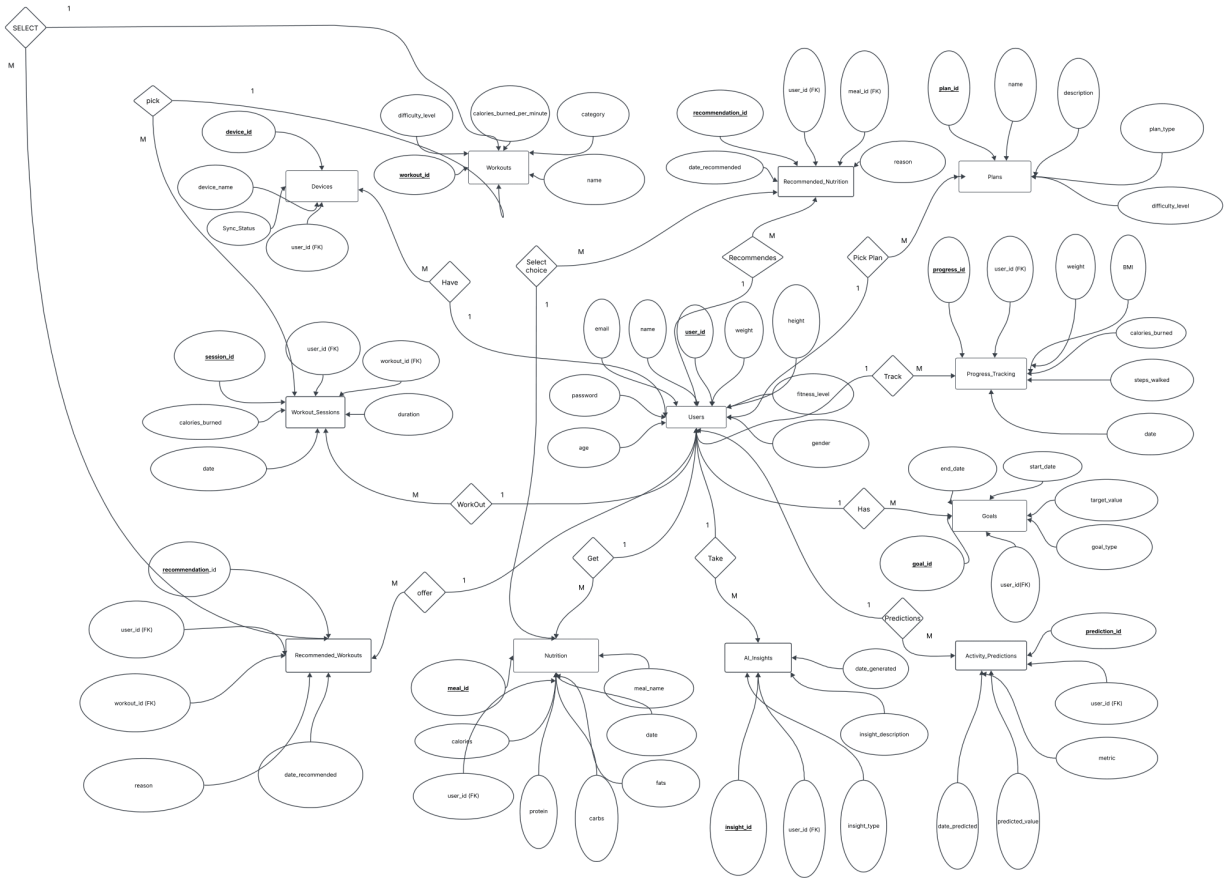
Implementation Approach:

- User-defined goals stored in MongoDB for tracking progress.
- AI dynamically updates workout and diet plans based on progress.
- Mobile-friendly UI for setting and modifying fitness goals.

Api Endpoints (Designed)

Feature	Endpoint URL
Set New Fitness Goal	/api/goals/set
Get User Goals	/api/goals/:userId
Update Goal Progress	/api/goals/update/:goalId

ER Diagram for FitXpertAI



Key Entities & Relationships:

- **Users Table** – Stores user credentials, fitness level, and demographics.
- **Workout Sessions Table** – Tracks exercise sessions, duration, and calories burned.
- **Progress Tracking Table** – Logs steps, BMI, and calorie expenditure.
- **Nutrition Table** – Stores meal intake, calories, and macronutrient breakdown.
- **AI Insights Table** – Provides AI-based fitness recommendations.
- **Activity Predictions Table** – Uses AI models to predict user progress.
- **Recommended Workouts & Nutrition Tables** – Offers AI-powered recommendations.

Relationships & Cardinality for AI-Powered Fitness Tracker

One-to-One Relationships (1:1)

1 Users & Devices

- A user may or may not have a connected device (smartwatch, fitness tracker).
- Each device is uniquely linked to one user.

2 Users & Goals

- A user may have only one active fitness goal at a time.
- Each fitness goal belongs to a specific user.

3 Users & AI Insights

- A user can receive AI-generated insights, but each insight entry belongs to a specific user.

One-to-Many Relationships (1:M)

1 Users & Workout Sessions

- A user can log multiple workout sessions.
- Each workout session belongs to only one user.

2 Users & Progress Tracking

- A user's progress is logged multiple times (daily, weekly, monthly).
- Each progress tracking record is linked to a single user.

3 Users & Nutrition Logs

- A user can log multiple meals in a day.
- Each nutrition entry belongs to one user.

4 Users & Recommended Workouts

- A user can receive multiple AI-recommended workouts.

5 Users & Recommended Nutrition

- A user can receive multiple AI-recommended meal plans.
- Each recommended meal plan is personalized for a single user.

6 Users & Activity Predictions

- AI can generate multiple predictions for a user based on past fitness data.
- Each prediction belongs to one user.

7 Workout Sessions & Workouts

- A workout session is linked to a specific workout type (e.g., Running, Weightlifting).
- Each workout type can be performed in multiple sessions.

Many-to-Many Relationships (M:N)

1 Users & Workouts

- A user can perform multiple types of workouts.& Each workout type can be chosen by multiple users.

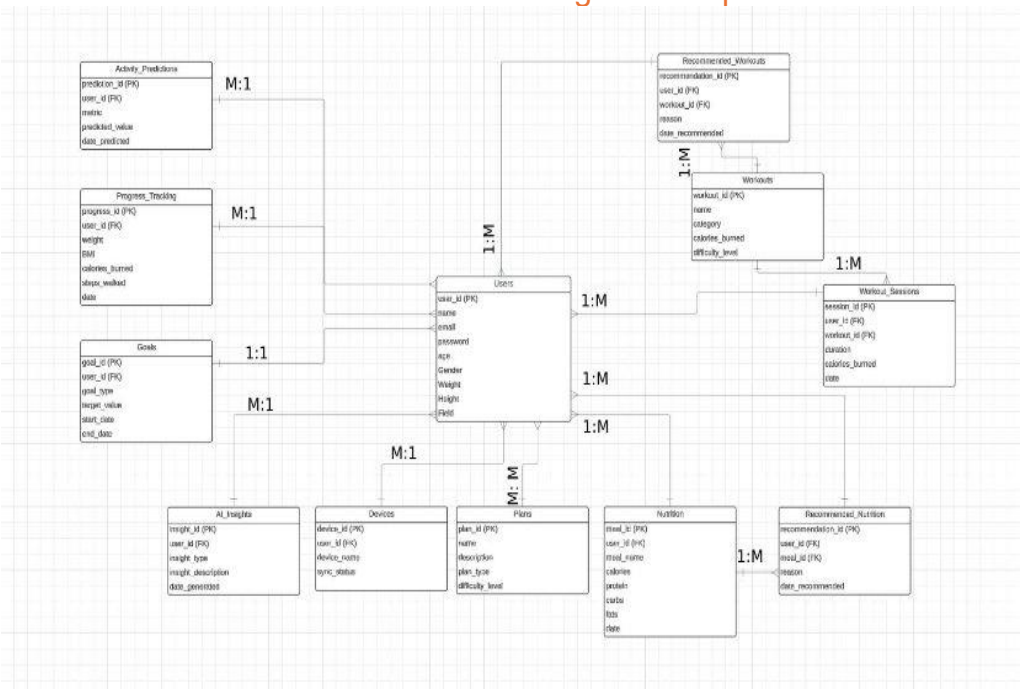
2 Users & Goals

- A user can set multiple long-term goals over time (e.g., weight loss, muscle gain).
- Each goal type can be selected by multiple users.

3 Users & Nutrition Recommendations

- AI can suggest multiple meal plans to a single user based on progress.
- The same meal recommendation can be used by multiple users.

Schema Design for FitXpertAI



Tables and Attributes

1. Users Table

- Stores user details including login credentials and fitness attributes.

Column	Data Type	Description
user_id	INT (PK)	Unique identifier for each user
name	VARCHAR	User's full name
email	VARCHAR	Email (Unique)
password	VARCHAR	Hashed password
gender	VARCHAR	Male/Female/Other
age	INT	User's age
height	FLOAT	Height in cm
weight	FLOAT	Weight in kg
fitness_level	VARCHAR	Beginner, Intermediate, Advanced

2. Workouts Table

- Stores different workout types, their calorie burns rates, and difficulty levels.

Column	Data Type	Description
workout_id	INT (PK)	Unique identifier for each workout
name	VARCHAR	Name of the workout
category	VARCHAR	Workout type (e.g., Strength, Cardi
calories_burned_per_minute	FLOAT	Estimated calorie burn per minute
difficulty_level	VARCHAR	Beginner, Intermediate, Advanced

3. Workout Sessions Table

- Logs user workout sessions, including duration and calories burned.

Column	Data Type	Description
session_id	INT (PK)	Unique identifier for each session
user_id	INT (FK)	User performing the workout
workout_id	INT (FK)	Workout type
duration	INT	Duration in minutes
calories_burned	FLOAT	Total calories burned
date	TIMESTAMP	Date and time of session

4. Progress Tracking Table

- Stores user fitness progress over time, including weight changes and steps walked.

Column	Data Type	Description
progress_id	INT (PK)	Unique identifier for each progress entry
user_id	INT (FK)	User whose progress is recorded
weight	FLOAT	User's weight at that time
BMI	FLOAT	Calculated BMI
calories_burned	FLOAT	Total calories burned
steps_walked	INT	Steps taken
date	TIMESTAMP	Date of progress entry

5. Goals Table

- Stores user-defined fitness goals such as weight loss, muscle gain, etc.

Column	Data Type	Description
goal_id	INT (PK)	Unique identifier for the goal
user_id	INT (FK)	User setting the goal
goal_type	VARCHAR	Type of goal (e.g., Weight Loss, Muscle Gain)
target_value	FLOAT	Target weight, steps, or calories burned
start_date	TIMESTAMP	Goal start date
end_date	TIMESTAMP	Goal end date

6 Nutrition Table

- Stores user meal data, including calories and macronutrients.

Column	Data Type	Description
meal_id	INT (PK)	Unique identifier for the meal
user_id	INT (FK)	User logging the meal
meal_name	VARCHAR	Name of the meal
calories	FLOAT	Total calorie intake
protein	FLOAT	Protein content (g)
fats	FLOAT	Fat content (g)
carbs	FLOAT	Carbohydrate content (g)

7. AI Insights Table

- Stores AI-generated insights for users, based on fitness patterns.

Column	Data Type	Description
insight_id	INT (PK)	Unique identifier for the insight
user_id	INT (FK)	User receiving the insight
insight_type	VARCHAR	Type of insight (Workout, Nutrition, Progress)
insight_description	TEXT	AI generated analysis and recommendations
date_generated	TIMESTAMP	Date insight was created

8. Activity Predictions Table

- Stores AI-predicted future fitness trends based on past data.

Column	Data Type	Description
prediction_id	INT (PK)	Unique identifier for the prediction
user_id	INT (FK)	User for whom the prediction is generated
metric	VARCHAR	Predicted metric (Weight, Steps, Calories)
predicted_value	FLOAT	Expected value based on AI analysis
date_predicted	TIMESTAMP	Future date for prediction

9. Recommended Workouts Table

- Stores AI-recommended workouts for users based on performance.

Column	Data Type	Description
recommendation_id	INT (PK)	Unique identifier for the recommendation
user_id	INT (FK)	User receiving the workout suggestion
workout_id	INT (FK)	Suggested workout
reason	TEXT	AI-generated reason for recommendation
date_recommended	TIMESTAMP	Recommendation date

10. Plans Table

- Stores predefined workout plans for users to follow.

Column	Data Type	Description
plan_id	INT (PK)	Unique identifier for the plan
name	VARCHAR	Name of the plan
description	TEXT	Plan details
plan_type	VARCHAR	Type of plan (Beginner, Intermediate, Advanced)
difficulty_level	VARCHAR	Plan difficulty

Schema References & Relationships

Table	Referenced Table	Reference
users.user_id	devices.user_id	1:1
users.user_id	workout_sessions.user_id	1:M
users.user_id	progress_tracking.user_id	1:M
users.user_id	nutrition.user_id	1:M
users.user_id	ai_insights.user_id	1:1
users.user_id	activity_predictions.user_id	1:M
users.user_id	recommended_workouts.user_id	1:M
users.user_id	recommended_nutrition.user_id	1:M
workout_sessions.workout_id	workouts.workout_id	1:M
users.user_id	goals.user_id	1:M
goals.goal_id	progress_tracking.goal_id	1:M
recommended_workouts.workout_id	workouts.workout_id	M:1
recommended_nutrition.meal_id	nutrition.meal_id	M:1