系统设计与分析

Intelligent Fitness Manager

——Your excellent personal fitness coach

Team name

TechFit Innovators

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1. Project Descriptions

1.1. Project Backgrounds

President Xi Jinping has pointed out that without good health for all, there can be no well-off society in all respects. With the increase in people's health awareness, the demand for scientific fitness is also increasing. Keep Fit—— Intelligent Fitness Manager aims to provide fitness courses for most fitness enthusiasts to meet users' needs for personalized fitness guidance, scientific diet advice, action norms, and fitness equipment.

1.2. Main Goals

- Through this project, we will master the basic system analysis principles and design methods, and develop the ability to analyze and specify system requirements, so as to understand how to systematically decompose complex problems and formulate solutions.
- The project aims to simplify the user's fitness process through an integrated solution that integrates diet plans, exercise plans, and equipment management. The goal of the project is to allow users to achieve their fitness goals in a smarter and more effective way and to drive the trend towards exercise for all.

1.3. Main Functionality and Characteristics

1.3.1. **Functions Overviews**

- **Fitness tutorial (administrators & users)**

Tutorials distributed by the administrator, our goal is to create a comprehensive fitness tutorial that includes the basics of various types of exercise, proper posture, and training plans. This is to ensure that users can choose the right training program for their needs and effectively improve their fitness results.

- **Fitness platform management (administrators)**

Administrators can manage user accounts and are also responsible for uploading and maintaining content in the Fitness Tutorials, Diet and Equipment modules to ensure that the information is accurate and current.

- **Fitness punch plan (users)**

Users can pick out what they are interested in from the fitness tutorials, and once the user selects and starts a tutorial, the system will automatically track its progress and clock in once the tutorial is completed. They can also get feedback and advice generated by the system to help them optimize their fitness program.

- **Fitness movement specification (users)**

This is an intelligent feature of our platform, the system detects the user's exercise posture in real-time, which can avoid exercise injury and improve the effect of exercise.

- **Fitness diet advice (users)**

Our AI system recommends appropriate diet plans based on the user's fitness tutorial. Users can also upload photos of their own diets, which AI systems will process using advanced image analysis technology to provide dietary nutrition analysis and advice.

- **Fitness equipment recommendation (users)**

Based on the user's fitness tutorial selection, the system will provide personalized fitness equipment recommendations, related procurement links and detailed equipment use guidance and maintenance recommendations.

1.3.2. Characteristics Overviews

- **Object-Oriented Programming Utilization**

The application of OOP ensures the efficiency and effectiveness of the project structure and improves the organization and maintainability of the system by dividing and clarifying their interactions, making the code more modular and reusable.

- **User-Friendly interaction interface**

We use a simple interface design to avoid complex navigation and redundant elements, enabling users to quickly find the required functions and information. And the operation process should meet the user's habits and provide clear guidance and feedback.

- **External API interface**

Integrated GPT interface, which can interact with artificial intelligence. Users can perform various AI functions, such as chat, customized services, and consulting. This integration greatly improves the level of intelligence of the project.

- **Personalized customization and incentives**

The system provides customized fitness programs, food recommendations and equipment recommendations based on the user's fitness tutorials to ensure that users get the most personalized service. The system has multiple incentives, such as a user completing a tutorial for virtual encouragement.

1.4. Intended Users and Key Usability Goals

- **Fitness Users**

The program is mainly aimed at fitness users. Their role is to follow a fitness tutorial, implement a corresponding diet plan, and maintain a dietary record. Users can also use the system-embedded exercise specification detection and smart device question-answering function to do more standard fitness.

- **Administrator**

Administrators are responsible for managing the system. Their roles include managing user accounts, publishing fitness tutorials, and managing the diet and equipment modules to ensure that users are provided with quality tutorials, healthy diet plans, and a comprehensive introduction to the use of equipment.

1.5. Analysis of Existing Similar Products

- **高校体育**

This application provides the ability to track motor activity, with its minimal function to verify the actual presence of the activity. However, it only supports both limited and fixed types of exercise. Moreover, it does not provide guidance on diet and equipment.

- **Keep**

The Keep fitness app is designed to enhance users' workout experience. It provides training programs tailored to individual goals, and each program includes professional video coaching. The app also allows users to track their exercise data, allowing them to effectively monitor progress. In addition, community interactions and regular challenges keep Keep into a social fitness tool.

1.6. Novelty and Enhancements

- **Intelligent Movement Specification Detection**

The system can monitor users' movements with a camera to see if they meet the standards. It provides immediate feedback to help users correct their posture and reduces the risk of associated injuries.

- **Intelligent Equipment Q&A System**

The system integrates an intelligent question-and-answer function that allows the user to interact with the system. It provides accurate, real-time responses to enhance the user experience.

- **Integrated Management**

The system offers a one-stop service for users including fitness tutorials, movement detection, and accompanying diet plans, helping users to exercise and eat scientifically and reasonably.

- **Cross-Platform Deployment**

This enables the system to operate seamlessly across multiple platforms, including desktop and mobile web. This approach ensures users can access the system through various devices with a consistent and responsive experience.

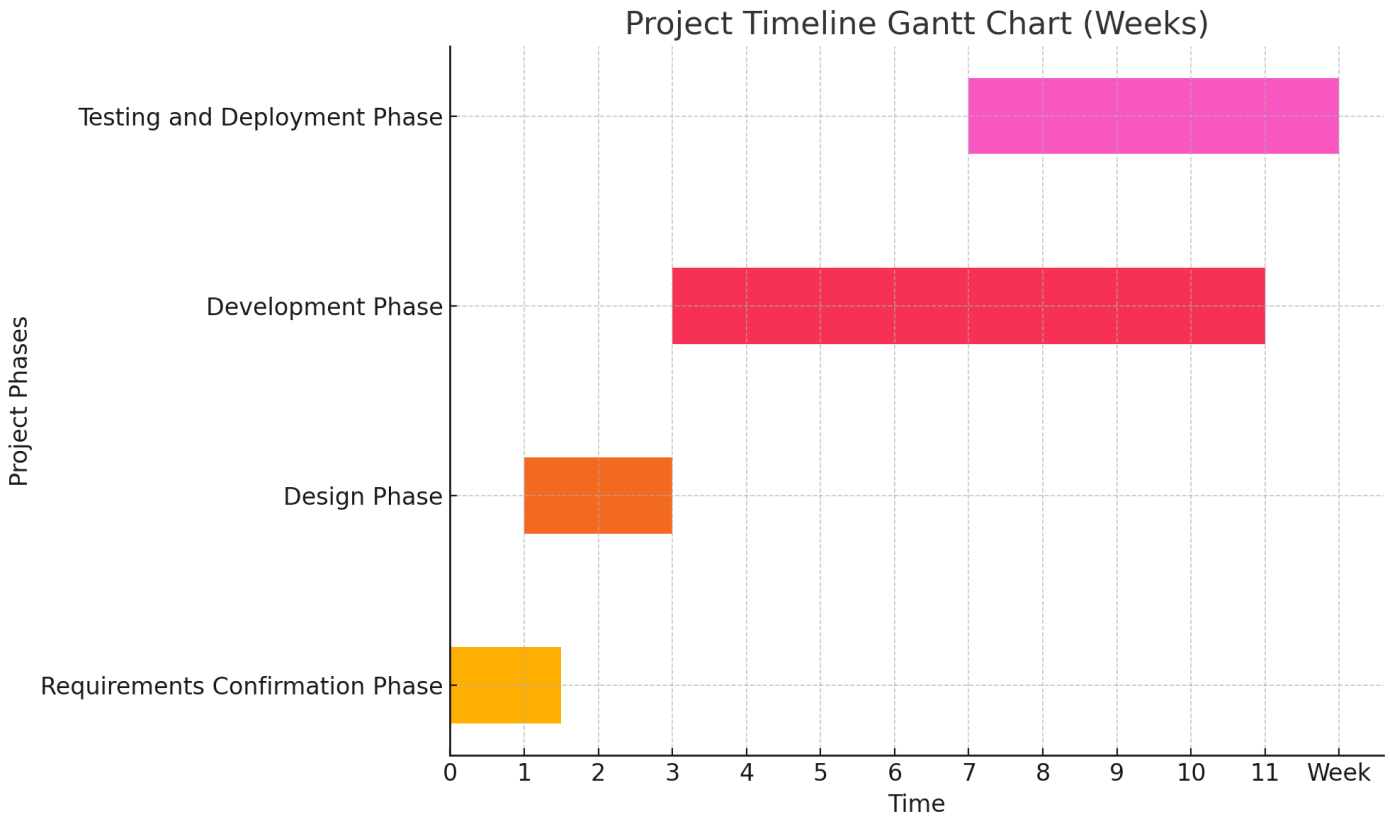
1.7. Team organization and Preliminary planning

1.7.1. Team Organization

- **Project Manager (Weicheng Zheng)**: Responsible for project management and coordination to ensure that the team completes the project goals and plans on time.
- **Front-End Developers (Lixin Ma, Juekai Lin)**: Use Vue CLI and React Native to develop a cross-platform, user-friendly, and visually appealing front-end interface.

- **Back-End Developers (Junhao Yang, Weicheng Zheng)**: Develop back-end functions using C# and manage large-scale data storage with Oracle database and Alibaba Cloud OSS.
- **Tester (Junhao Yang)**: Writing test cases, and conducting functional and performance testing.

1.7.2. Preliminary Planning



1.8. Engineering Process and Methodologies

- **Requirements Analysis**
  - We use **user stories** and **use case diagrams** to collect and analyze system requirements. By communicating with users and stakeholders, we identified the core features of the system.
  - Using **UML modeling** tools, we create use case diagrams to detail how users interact with the system, ensuring the completeness and traceability of functional requirements.
- **System Design**
  - We adopt **Object-Oriented Design** to modularize the system. Through UML tools, we clarify the system's core objects, their attributes and methods, and the interactions between objects.
  - The **front-end and back-end separation** architecture ensures that the front-end and back-end can be developed and deployed independently. Data is exchanged efficiently through **AJAX** and **JSON**.

- **Development Methodologies**
  - We chose **Agile Development** methodologies. The iterative nature of Agile development and quick feedback from users allows us to adjust system functionality and design promptly.
  - **Iterative Development**: We divide the entire project into several iterations, each containing requirements analysis, design, development, and testing.
- **Coding Standards**
  - We implement a **Code Review** process to ensure code quality and consistency. All developers must have their code reviewed before submission to ensure it meets the project's quality standards.
- **Testing Process**
  - We adopt **Test-Driven Development**, where test cases are written before implementing the corresponding code to ensure the reliability and functionality of the system.
- **Continuous Integration and Delivery**
  - We implement a **CI/CD process** to ensure that the code is automatically built, tested, and deployed after each submission. This allows us to quickly identify issues and improve the stability and efficiency of the project.

1.9. Team Collaboration Platforms

- **Communication tool**

  Use WeChat and Tencent meetings for instant messaging and video conference.

- **Project management**

  Use GitHub for project management and versioning.

- **File sharing and writing**

  File sharing and collaborative editing through Lark ensure real-time updates of documents.

1.10. Potential for Further Development

- **Advanced data analysis and forecasting**

  Using more advanced algorithms and data models to improve predictive power for more accurate health risk assessment and personalized exercise recommendations.

- **Augmented reality (AR) and virtual reality (VR) integration**

  Introduce AR and virtual reality technology into the platform to provide users with an immersive fitness experience. This includes virtual coaching, an immersive training environment, and real-time action correction.

- **Expansion of community and social functions**

Strengthen the interaction between users, and by building a community, users can share progress, engage in challenges, get encouragement from other users, and increase user engagement on the platform.

- **Cross-platform sharing and integration of health data**

Integrated interfaces with the healthcare system enable users to share their health data with physicians or health management professionals for more comprehensive health management advice.

1.11. Related Technologies

- **UML Modeling**
  - Use Case Diagrams: Used to visually represent the system's functionalities and user interactions.
  - Class Diagrams: Employed to model the system's core entities, their attributes, methods, and the relationships between them.
  - Sequence and Activity Diagrams: Leveraged to illustrate the dynamic aspects of the system, depicting logic flows, processes, and interactions between components.
- **Database Technology**
  - Oracle Database Management System: Utilized for the robust storage and management of structured data.
  - Entity-Relationship Model: The database schema is structured based on the ER model, capturing the relationships between data entities and laying the foundation for database normalization.
  - Aliyun OSS: Employed for the efficient storage and management of large-scale multimedia files, such as images and videos.
- **Front-end Development (Web and Mobile Applications)**
  - Vue CLI: Used for building the web front-end.
  - React Native: Utilized for mobile application development, enabling cross-platform compatibility (iOS and Android).
- **Front-end and Back-End Interaction**
  - Front-End and Back-End Separation Architecture: The system is designed with a clear separation of concerns, where the front-end and back-end operate independently.
  - AJAX and JSON: AJAX is employed for asynchronous data exchange between the front-end and back-end, while the JSON format is used for lightweight, human-readable data transmission.

1.12. Project Challenges

- Codesign of automated exercise and dietary plans is still relatively scarce in existing studies. Most existing systems or tools lack the ability to effectively integrate both to achieve overall optimization.
- The implementation of a motion recognition system based on artificial intelligence on edge devices is a cutting-edge technology application, which can realize efficient and real-time motion recognition.
- Reliable data collection is a core component of guiding user movement, which ensures personalized and effective exercise recommendations. However, the data sets available are still few or not realistic enough.

2. Professional Growth and Benefits of the Project

- **The Ability of Modular system architecture and scalability design**

We divided the system into independent modules, each module focusing on specific functions, enabling us to develop and test in parallel, and the subsequent function expansion and update are more flexible and convenient.

- **The Experience of Frontend and Backend Development**

We will learn modern front-end techniques and build a responsive, user-friendly interface. We also learned how to optimize front-end performance and improve page loading speed. We will learn to build efficient back-end services, especially using the ASP.NET framework to process user requests and manage API interfaces.

- **The Ability of API Development and Integration**

We will enhance our understanding of RESTful API and learn how to design, develop, and integrate third-party APIs, especially for fitness data, image recognition, and AI interfaces.

- **The Method of Project Management and Collaboration Tools**

With the use of tools like GitHub, we will improve our version control skills in multiplayer collaboration projects. At the same time, contact agile development to learn how to improve project delivery efficiency through rapid iteration, demand disassembly, and teamwork.

3. Project Related Resources

- **Qwen Large Model API: https://bailian.console.aliyun.com/**
- **Keep and Similar Software Reference: https://keep.com/**
- **Alibaba Cloud OSS: https://oss.console.aliyun.com/**
- **UML Modeling Tool - draw.io: https://www.drawio.com/**