Software Requirements Specification

Gaming App Using Pose Detection

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Group 10

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1.Introduction

Physiotherapy is a necessity for empowering the overall health of autistic and cerebral palsy children. We are proposing an immersive technology-based approach for improving the lower limb and fine motor activities with cognitive skills. The Physiotherapy Guide App is designed to be a comprehensive mobile guide for users who require lower limb physiotherapy, providing them with lower limb-oriented games and feedback to help them achieve their health goals. This can help patients to achieve better rehabilitation outcomes, reduce the risk of further injury, and improve overall mobility and functionality of the lower limbs.

1.1 Document Purpose

The purpose of this document is to provide a detailed description of the requirements for the development of an app that utilizes pose detection of lower limb. It gives a detailed description of specific features included in the games. It detects lower limb movements like the number of squats, foot movements etc to play different games specified in this document

1.2 Document Conventions

This document is based upon:
● IEEE 830-1998 - IEEE Recommended Practice for Software Requirements Specifications
● IEEE 830-1984 - IEEE Guide for Software Requirements Specifications

1.3 Intended Audience and Reading Suggestions

Intended audience includes college professors, developers, industry experts, and other stakeholders who may be involved in the development or evaluation of the system Review the overall design and system description, then focus on specific requirements and any diagrams or visual aids that can help clarify system behavior. Note any areas of interest or concern that could impact involvement or use of the system.

1.4 Product Scope

The app is intended for use by individuals who require lower limb physiotherapy, including those recovering from injury or surgery, those with chronic conditions, and those who wish to maintain their overall health and fitness. The app is designed to be user-friendly, responsive, and secure, and is optimized to run smoothly on both iOS and Android devices.

1.5 Stakeholders

1. Autistic and cerebral palsy children: These users require physiotherapy to improve their motor skills and physical abilities. The app should be designed to cater to their specific needs and provide customized exercises and activities.
2. People who require lower limb physiotherapy: This group includes individuals recovering from injuries, surgeries, or illnesses that affect their lower body. The app should provide exercises to improve mobility, strength, and balance.
3. Doctors: Physicians who prescribe physiotherapy to their patients will be able to monitor their progress through the app. They will be able to adjust the treatment plan based on the app's reports and feedback.
4. Healthcare institutions: Hospitals, clinics, and rehabilitation centers can use the app to offer physiotherapy services to their patients. They can also use the app to manage patient records and treatment plans.
5. Investors: Investors interested in the healthcare sector may invest in the development of the app. They will be looking for a product that has a significant impact on patient outcomes and has the potential for commercial success.

1.6 References

ML Kit for Pose Detection- https://developers.google.com/ml-kit/vision/pose-detection/android#java
Squats Detector with OpenCV- https://towardsdatascience.com/squats-detector-with-opencv-and-tensorflow-ce934f19aeb9
Human Deep Squat Detection- https://ieeexplore.ieee.org/document/9902631
Java Game Development- https://www.gamedesigning.org/learn/java/

2.General Description

2.1 Product Perspective

The app will be a standalone application for Android and iOS platforms. The app contains three games namely flappy bird, dino run and quiz app. Each game utilizes different lower limb motions of different joints. The quiz app works by counting the number of squats done and selecting the corresponding option with the number. Flappy bird detects the vertical motion of feet of the user to administer the game. Dino run is a runner game where the avatar jumps when an obstacle approaches. The app is implemented using the ML Kit framework for pose detection of lower limb activities.

2.2 Product Features

The app will include the following features:

- User registration and login
- Option to select required game
- Option to select difficulty levels in each game.
- Quiz questions on various topic
- Pose detection to verify the correct answer based on lower limb activity and number of squats
- Option to reset the quiz
- Option to play flappy bird
- Option to play dino run
- Score recording and display
- Option to share scores on social media
- Option to view high scores
- Option for doctors to check the scores of their patients

2.3 User Classes and Characteristics

Different users are identified based on the review process of the document. It is listed as follows:

1. Customers

a. Physiotherapy institutions: The solution can be used in physiotherapy institutions to facilitate communication of improvement health between doctors and patients with physical impairments.

b. Non-profit organizations: Non-profit organizations that serve the disabled community can use the solution to enhance accessibility for their clients.

2. End Users

a. Physically Impaired Users: These are the primary users of the application who have physical impairments and face challenges in motion of the lower limb. They may have varying degrees of visual impairments and may require different levels of assistance from the application.

b. Regular Users: These are users who do not have physical impairments but may still benefit from the application's game based exercising techniques. They can use the application to improve their physique by playing fun games.

2.4 Operating Environment

The app will require an Android or iOS device with a camera. The application will require sufficient battery power to ensure uninterrupted operation.

2.5 Design and Implementation Constraints

- The application is designed to work on both iOS and Android devices.
- The Android API level should be above 21.
- The device must have a good camera
- The application must comply with the General Data Protection Regulation (GDPR)
- The application must be developed using Android Studio
- The user interface should be simple and easy to understand, with readable text and smooth transitions.
- The application should be space-efficient and use a readable and maintainable code.
- The variables should be named using camel case, and the class names should start with a capital letter.
- The application should follow proper exception handling mechanisms

- The front-end should be developed using Dart programming language

2.6 User Documentation

A user guide will be distributed to customers and developers as soft-copy in pdf format.
The end users (target) would be provided a tutorial video available in the Google Play Store while installing the app.

2.7 Assumptions and Dependencies

The assumptions are:-
▪ The system meets all the hardware requirements
▪ The user has internet browsing capability and an internet connection
▪ The system should have more capacity and provide fast access to the database
▪ The games will be developed for both Android and iOS platforms, with similar gameplay and user interface across both platforms
▪ The games will be designed to be accessible and enjoyable for people with different levels of cognitive and physical abilities, without causing frustration or sensory overload

The dependencies are:-
▪ The specific hardware and software due to which the product will run
▪ The end users should have proper understanding of the product
▪ On the basis of listing requirements and specifications the project will develop and run
▪ The information of all users must be stored in a database that is accessible by the system
▪ The face-tracking technology may require customization or calibration to work effectively with the target users, which may require additional testing and development time.

3.Functional Requirements

3.1 User Interface

The user interface will be designed to be simple and easy to navigate. The home screen will include options to register or log in to the app. Once the user logs in, they will be taken to a screen where they need to select one of the three games. The quiz screen will include the quiz questions and a video feed of the user's lower limb activity. The options for the quiz questions will change based on the number of squats performed by the user. After each round of question, the user's score will be updated and displayed. The flappy bird gameplay involves controlling the vertical motion of the bird through a series of pipes without touching them. Dino run contains an avatar of a dinosaur. The gameplay involves running and jumping to avoid obstacles, such as rocks and other obstacles. The app contains a report page which contains the detailed report on the various games played and their high scores attained.

3.2 User Registration and Login

The app will allow users to register and create a new account or log in using their existing account. The registration process should include the following fields:

- Full Name
- Email Address
- Password (should contain a range of 8-15 characters)
- Confirm Password
- Age
- Medical condition

The app will use Firebase Authentication for user authentication.

3.3 Quiz Questions

The app will include multiple choice questions on various topics. The app will randomly select questions from a question bank and present

them to the user. The quiz should be presented in multiple-choice format with the following features:

- Each question should have four answer options.
- The correct answer should be identified through the number of squats performed by the user within the given time.
- The quiz should consist of at least 10 questions.
- The app should provide immediate feedback on the user's answer choice.
- The quiz should be timed, with a maximum time of 60 seconds per question.

3.4 Pose Detection

The app will display a video feed of the user's lower limb activity and use it to perform the corresponding action in the game. The app will use ML Kit framework to detect lower limb activity. The squats can be identified by calculating the knee angle. If the user performs 2 squats, the option selected for the quiz question will be 2. The ankle movement in the flappy bird can be identified using the angle differences in the ankle.

3.5 Score Recording and Display

The app will record the user's score and display it after each round of each game. At the end of the game, the user's final score will be displayed along with a message based on their score. The app will also store the user's high score and display it on the high score screen.

3.6)Use Case Model

1)Use Case Name: User Registration and Login

Summary: The user registration feature allows the actor of the software to use the application after registering themselves as a user. After the registration process, the actor can login to the application as a registered user.

Preconditions: Create an account

Triggers: Actors select the register user and sign in button.

Basic course of events (scenario):
Internal Precondition (1): The registration page is displayed.
Internal Precondition (2): The sign in page is displayed.

Actor	System	Screen
1.The actor selects to register		
	2. Full name, email, password, confirm password, age and medical condition is asked	
3.Actor completes fields and selects register		
	4. The application validates registration	

	of actor as a user.	
5.Actor selects sign in		
	6.Username and password	
7.Actor completes fields and selects sign in		
	8.The application validates actor as a registered user	

Internal Post Condition:

1.Actor confirmed as suitable user for the application after registration
2.Actor confirmed by the system as a registered user.
3.Customer can proceed to use the website.

Alternative Paths:

1.Actors proved unsuitable for registration

Internal Precondition: None

Actor	**System**	**Screen**
1.Actor confirmed unsuitable after assessing medical condition		

Internal Post Condition:

1.Customers can contact the helpline provided

2. Actors sign in as guest users.

Internal Precondition: None

Actor	System	Screen
1.Actor sign in as guest users		

Internal Post Condition:
1.Customers can proceed to select the difficulty level.

2)Use Case Name: Difficulty Level

Summary: The difficulty level feature allows the actor of the software to choose the difficulty level of the game.

Preconditions: Sign in page is displayed

Triggers: Actors select the difficulty level button

Basic course of events (scenario):
Internal Precondition: The actor is signed in using registered username and password.

Actor	Screen	System
	1.Difficulty level page is displayed	
2.Actor chooses from easy, medium and hard levels		
	3.The application validates the level of the game	

Internal Post Condition:
1.Customers can proceed to select the game

3)Use Case Name: Game Selection

Summary: The game selection feature allows the actor of the software to choose the required game.

Preconditions: Difficulty level selection page is displayed

Triggers: Actors select the game button.

Basic course of events (scenario):
Internal Precondition: None

Actor	System	Screen
	1.Game selection page is displayed	
2.Actor chooses the required game to play		
	3.The application validates the game	

Internal Post Condition:
1.Users can start playing the game

4.Non-Functional Requirements

4.1 Performance

The app should respond quickly to user input, with minimal lag or delay. The app should be optimized to run smoothly on both iOS and Android devices.

4.2 Usability

The app should have a user-friendly interface that is easy to navigate. The assessment results and exercise recommendations should be presented clearly, and the app should provide easy-to-follow instructions.

4.3 Security

The app should be designed with security in mind, with measures in place to protect user data.

4.4 Software Quality Attributes

- Capacity: The storage requirements of the app can be minimal since no information about
- the user is stored.
- Compatibility: Compatible with any version of the android which supports voice assistants.
- Response Time: Each page loads within 10-15 seconds and the output are expected to have the same response time.
- Reliability: Chances of failure or system crash is low compared to other heavy applications that require huge storage.
- Availability: The app will be always available to the user except times of maintenance. It will be made available in the Play Store for installation.
- Efficiency: The app is very efficient as the user can reach their goal within minimal time

4.Conclusion

This SRS document has outlined the requirements for the development of a physiotherapy guide app that uses pose detection of lower limb. The app will be developed using flutter and firebase.