

HurdleJumpr: System Requirements Specification

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1 Introduction

1.1 Overall Description

HurdleJumpr tracks user inputs and behavioral patterns, and uses this data to determine whether or not the user is likely to have ADHD. This is determined by comparing the user response times and input patterns to those of people with and without ADHD. If the application can determine with a high level of confidence that the user is likely to have ADHD, a suggestion is made to the user to visit a medical professional.

This application is to be used by a number of people with and without ADHD so that we may test its detection algorithms.

1.2 Overview of Developer's Responsibilities

The developer is responsible for development and deployment of the HurdleJumpr application to Android systems. The developer is responsible for the maintenance of the the system with regards to new feature development and bug fixes.

2 General Description

2.1 Product Perspective

HurdleJumpr is a game that collects the user's response times and usage metrics. The information collected is stored in a local database, anonymized, and sent to a remote server for data processing. The data processing feeds information for calibration of a model that aims to predict the likelihood of a user having ADHD.

2.2 Product Functions Overview

1. Game Functionality: HurdleJumpr
2. User input tracking and data collection
3. Data processing to determine whether or not the user has ADHD
4. Result generation
5. Comparative analysis of user's data with average user data

2.3 User Characteristics

The users of this application are to be people with and without ADHD. A user survey is conducted at the start of this application such that the results can be calibrated based on the user's age and gender. Of users with ADHD, there is a distinction made between users that are medicated and unmedicated.

2.4 General Constraints

This project is to be completed to the extent that data has been collected by November 30, 2014. Once data has been collected, a model can be created from the information gathered and a test of the model can be conducted.

3 Functional Requirements

1. Introductory User Survey
2. Home Screen
3. Volume Control
4. Data Collection
5. Data Encryption
6. Game Functionality
7. Data transfer and processing
8. Result display

3.1 Introductory User Survey

The introductory user survey is displayed on first load of the program. It must be completed before the home screen is allowed to display. The introductory user survey establishes information to better understand the user's state: whether or not they have been diagnosed with ADHD (and if they have, whether or not they are currently taking medicine), their age, and their gender. This information is required so that the calculations regarding the likelihood of ADHD are accurate. In the case that the user does not complete the survey, their incomplete survey's state is saved, and will be loaded upon re-launch of the program.

3.2 Home Screen

The home screen must display two navigation options to the user: the option to begin the game and the option to enter the settings pane. In the case that the user does not select an option, the program will remain in the home-screen state.

3.3 Volume Control

Allows the user to toggle audio volume.

3.4 Data Collection

Collects the following usage metrics from the user:

1. Introductory User Survey
2. Reaction Time
3. Amount Played
4. Number of encounters
5. Average Session Length

Furthermore, error logs are collected in the event of an error. All data is logged in a local database and tagged with a unique identifier.

3.5 Data Encryption

The data is encrypted with an RSA encryption scheme because survey results and collected data may be sensitive.

3.6 Game Functionality

The game involves a single character sprite running rightwards, avoiding obstacles which appear at pseudo-random intervals.

3.7 Data Transfer and Processing

The data is transferred to a remote server where it is processed. The processing involves statistical normalization of the information, as well as comparison with our model. Once the data is transferred to the server, the model determines whether or not the user's individual data follows the same correlative trends as those users with ADHD.

3.8 Result Display

Two results must be displayed to the user:

1. The Game Score
2. Their likelihood of having ADHD

The game score is calculated as the result of the game, whereas their likelihood of having ADHD must be processed remotely and transferred back to the user.

4 Non-functional Requirements

- Easily understandable – the software should be easy to use and understand
- Entertaining – the game must be entertaining to the users so as to encourage usage
- Enhanceable – the system must allow for enhancement without major code rewrites or architectural changes; coupling must be limited
- Reusable – the components of the system should be reusable
- Stable – the system must be stable on all target versions of Android
- Good performance – the system should provide good performance on all targeted platforms
- Responsive – the system should respond to user actions immediately.
- Clean interface – the interface should be simple and clean so as to not confuse users.

5 External Interface Requirements

5.1 User Interfaces

The application will use the touchscreen interface of the mobile device it is installed on. The primary function will be tapping the screen to jump. Secondary functions include navigating the included survey and any menus it may be necessary to include.

5.2 Hardware Interfaces

Mobile device running a compatible version of the Android operating system or iOS.

5.3 Software Interfaces

Android OS versions, including version 4.0 and above. iOS versions, including version 7.0 and above.

6 Performance Description

6.1 Response Time

As this application is measuring user reaction time, the response time will need to be as minimal as possible to allow more precise measurements. Human reaction time has a limit of about 180 milliseconds. Our application should have a response time less than 100 milliseconds to be effective.

6.2 Processing Time

This follows the same constraints as above. Processing of user input needs to be near instantaneous. Data that is collected may be transmitted to the database for storage when convenient, for example between games, such that it does not affect the processing of the application.

6.3 Memory Constraints

Memory constraints will be minimal due to the nature of the application. However, this should be verified as the application is intended to be used on mobile devices which have severe constraints to both processing and memory.

6.4 Security & Privacy

Because of the sensitive nature of some of the data collected the application must be secure and must not store any data locally. One possible exception is the circumstance when there are multiple users on the same device. In this case an anonymous identifier will be generated locally to differentiate between users. Data must be transmitted to a secure database from memory and never stored on disk.

6.5 Storage Requirements

A secure database must be present for receiving data transmitted by the application. The database must be capable of handling transmissions from multiple users at once. There must also be sufficient space. At a minimum we would expect 50-100 users, and depending on the popularity of the application, as many as a few hundred.

7 Design Constraints

7.1 Standards Compliance

Must be Android Compliant, as defined by the Android Compatibility Definition Document Must also be iOS Compliant, as defined by the Apple App Store Guidelines.

7.2 Hardware Limitations

This application is only targeted at iOS devices running iOS version 7.0 or higher and Android devices running version 4.0 or higher. The device must have networking capability.

8 Validation Criteria

8.1 Documentation

The software for both the client side mobile application must be fully documented and clearly readable. The documentation should adequately describe what is occurring within the code in a clear and concise manner. The code should also be as loosely coupled as possible to allow desirable changes to be easily made to the code and to also reduce the possibility of errors cropping up when a developer wants to make changes to the code base. This is important especially on the server side as the algorithm for determining the possibility of ADHD may be constantly changing and refined over time as more and more data becomes available and new patterns in the data are picked up on that may help diagnose a user with ADHD.

8.2 Testing

The mobile application must be able to be run on a variety of Android operating systems. Ideally, the application will run on all Android versions greater than or equal to Android 4.0 (Android Jelly Bean) as well as all iOS devices of version 7.0 or greater. The application should pass all tests we develop using NUnit to test the application for possible errors on the mobile application side along with server passing all stress tests performed on it. If these tests are passed and the user can successfully upload their data and get results back (if enough data is available), then the mobile application will pass its acceptance criteria as a prototype for an application with the potential for helping to diagnose users with ADHD.

9 Other Requirements

Appendices

A Information Gathering

Interviewee Dr. Tony Morelli

Position Professor of Computer Science

Affiliation Central Michigan University

Interviewer Jonathan Kissinger

Date Thursday, 9/18/2014

Start Time 2:00pm

End Time 2:30pm

Q. We're considering using Unity for our game engine, but we would need access to Unity Pro to run native android code. Does the school grant access to that software and is it appropriate for our needs?

A. Yes, the school has Unity Pro on the lab computers in PE 400. It may also be available on the Virtual Machines accessible remotely. However, Unity may be a bit more than what you need. You're aware of the project I recently did with interface testing and Unity and it worked well for that but it's really up to you.

Q. In your research you used ISO standards, are there any applicable to reaction time and our project?

More than likely, check out ISO 9241 it contains most standards like that. It's primarily aimed at interfaces but there are lots of other standards contained within it.

Q. We need to file an IRB application to have anonymous surveys and data collection right?

Yes, the best thing to do is give them a call. They'll tell you which form to fill out and send in. I had to fill out 3 different forms last time because I kept filling out the wrong one. You'll need a professor to sponsor the project, which I will be glad to do if Dr. Lee doesn't wish to.

Q. Is it possible to save the interviewing step and submit a prototype for publication?

Yes, that would be called a work in progress and it's something that's not uncommon. They get accepted for publication just like regular papers.

B Functional Model

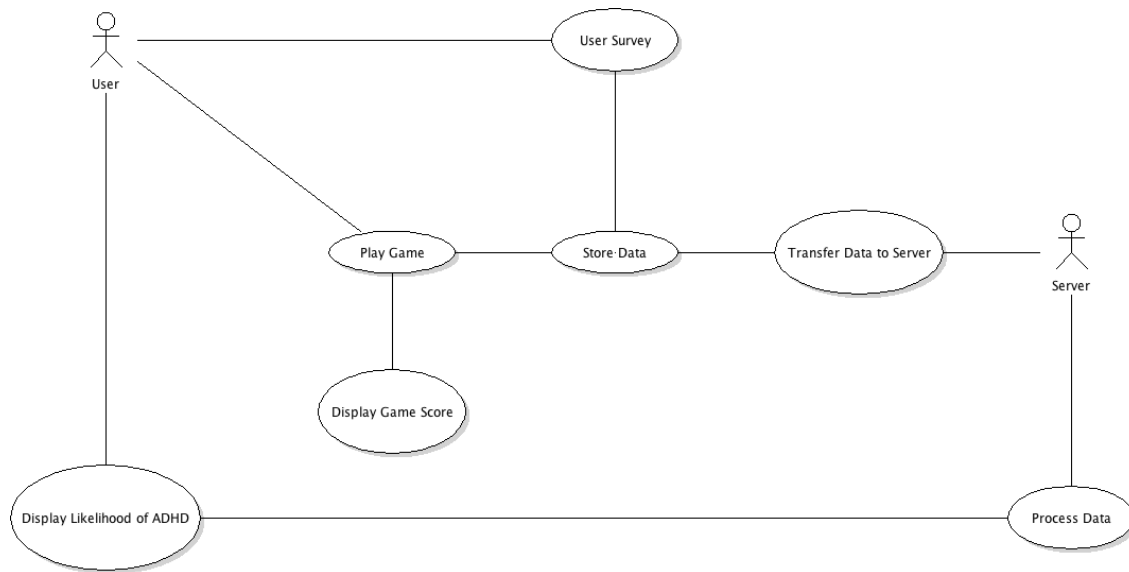


Fig. 1: Use Case Diagram involving user and server actions

C State Diagram

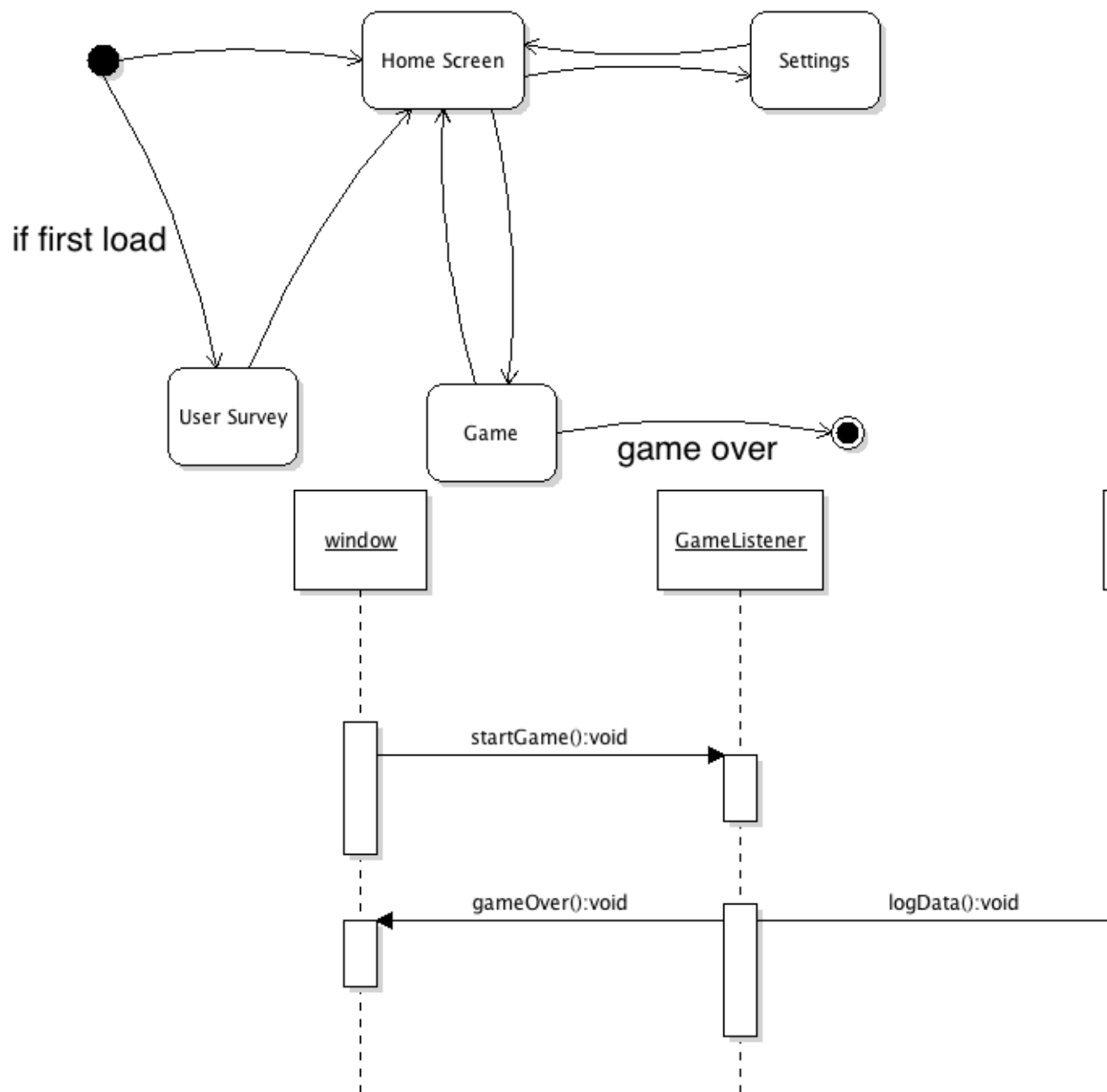


Fig. 2: State Diagram for HurdleJumpR

Fig. 3: Dynamic Model for HurdleJumpR