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Software Requirements Specification Document

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1. Introduction

1.1 Purpose

The purpose of this SRS document is to standardize the development process of Reboot corporation's "ASD Education Application" interactive electronic software (the application is used to train the interactive skills of children with autism.). It mainly describes the functional requirements and non-functional requirements of the "ASD Education Application" system, as well as the functions and goals to be achieved by the system. This document provides basic ideas for system analysts, programmers, testers, etc., and clarifies the development direction. Improve development efficiency and reduce development risks and costs.

1.2 Scope

The main purpose of developing the software "Reboot Story-Teller" is to train the interactive skills of children with autism. The product will collect a large number of stories for graded teaching according to different ASD situations (level). By being accompanied and operated by the guardian, the software combines with the environment to generate a short story to improve the understanding and interactive ability of children with autism. In the software development process, the characteristics of the city and the collected data should be combined to realize the flexibility of the formulation of the software content. The e-learning system of ASD children can better stimulate their interest and potential. The software should be funded by Wenzhou Autism Center.

1.3 References

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1.4 Overview

The first section of the SRS shows the introduction section, and the second part shows the general factors that affect the product and its requirements (design requirements, development software introduction, etc.). The third section contains all the detailed descriptions of output and input. Developers should comply with all requirements in the software development process. The fourth section provides the communication channel between the software development team and the customer. The SRS document was signed and approved by the CEO of Reboot corporation. Finally, supporting information is provided, including table of contents, index, appendix, etc.

2. The Overall Description

2.1.1 System Interfaces

1.Text-to-Speech API. This API basically will be helpful for the system to plug in the voice sites that will be suitable for the story telling. By using this API our system can be used to synthesize a speech according to the environmental factors as well as the location of the user.

2. User-Location API This API will help the system to spontaneously sense the location of the user. This API basically will help the APP to load the real time location data to the AI module where the data will be further processed for the recommendation system.
3. Weather API. This weather API will help us to sense the weather condition of the user's current location. By using this weather API, the system will process that data, and then load to the recommendation system.
4. API for voice database. This API will allow the user to upload their own stories as well as own pictures so that the system will have an API for the extension of its story database.
5. Camera API. This API basically will help the user to use their camera to scan real time objects. This will be helpful for the basic function of the system for AR.
6. Vuforia Engine API. It is an API for C++ and Java, by using Unity Engine for the basic core of the AR functionalities. By using Vuforia, our system can be built with a stable system also to fulfil the basic function of the system.

2.1.2 Interfaces

1. Interfaces for the user to use their camera. As this app is basically use for user to use their camera to scan real-time objects, this interface will be associated with the camera of users' phones.
2. Story Databases Interface. This interface will be used as a store. When users click on this interface, they can see the stalled stories as well as the story text. This will help the parent decide which kind of story will be useful.

3. Voice speaker Interface. After the object is already scanned, the user will see this interface, as well as hear the voice of the system.

4. Output Interface. This interface will be used to output the text of the story in the background of the screen. The size of the output of the sentence should be as simple as possible. AS autism students will not understand the too complex sentences.

5. Presentation Interface. After the user scans the object the AR will process and then activate the presentation Interface, this will allow the screen to synthesize some pictures according to the object type. Also, according to the real-time information of the user, the color and the content of the AR picture shown will be different.

2.1.3 Hardware Interfaces

The hardware for this APP will be android phone, the lowest android version for this app will be 6.8. This App will also allow Ethernet, USB, Monitor.

2.1.4 Software Interfaces

1. SQLyog. This will be the database of this story-teller APP. This SQLyog provide visualization interface for the user to update the database. The system is designed and developed through Mysql 8.0 for a better memory arrangement, also the data collection

2. Vuforia 1.6. Vuforia will be used as the interface for the AR core, Vuforia is developed based on Unity Engine with a plugin for the development of AR projects.

3. Unity Engine 2021. Unity Engine will be the platform for this App development with C++.

2.1.5 Communication Interfaces

The system will have a consistently uploading functionalities, by using TCP-IP protocol, also the system may connect to some TV for the video print out, this will be based on BLE protocol. The app also allow the wireless connection through wifi and Cellular Local Area Network

2.1.6 Memory Constraints

This app is developed based on AR core, which needs a relatively high use of the memory, also the upload function will cause the system to increase the process in the system. The RAM of

4GB will be the least and we recommend an RAM of 8GB. To ensure the basic function of the system. The limitation of the app is 3GB.

2.1.7 Operations

The application will not occupy the memory of the background resources. When the user's resources are not occupied for a long time, the system will automatically enter sleep mode in order to reduce the resource consumption of the system. In addition, the system will set up disaster tolerance programs to avoid the harm caused by network crashes. Users will be protected to the greatest extent by the security of their data. It should be that all users' data will be protected under the state of signing a confidentiality agreement.

2.2 Product Functions

The ASD education application would focus on assisting teachers and parents in teaching the autistic child the usage of the daily necessities. Due to the particularity or the features of autism spectrum disorders, the application has to be easy to understand and operation with personalization ability. The application should also have differences in content based on the study ability of the ASD child.

2.2.1 Function 1: Content select

This function is aiming at providing suitable learning material for ASD kids with different study abilities. This part would be set at the opening stage (booting stage) of the application and select by the supervisors rather than kids. The selecting interface would contain 4 levels with examples for parents or teachers to select and increase the difficulty.

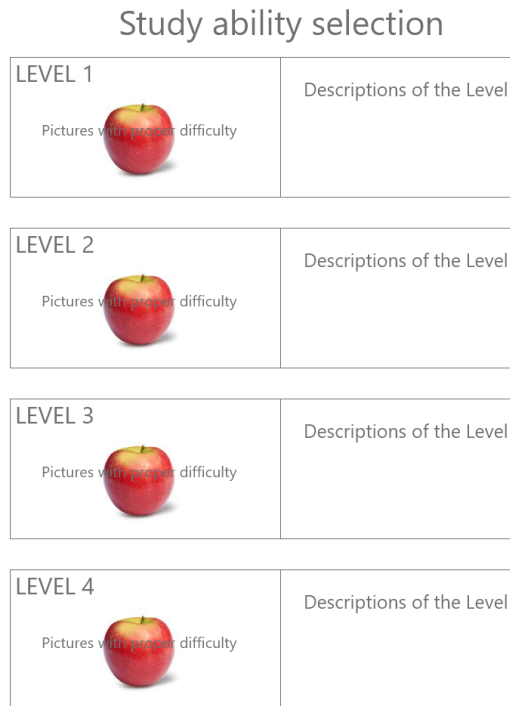


Figure 1: The prototype scene of the difficulty selection

2.2.2 Function 2: Voice Personalization

This function would personalize the output voice of the application based on the CNN deep learning to classify and recognize the input audio gained from the parents. This feature is aiming to increase the understandability and recognizability of the story by using ASD kids parents of voices.

2.2.3 Function 3: Storytelling

This would be the core function of the application with would display the pictures, audio, and text if necessary to the kids with different levels. This function would also be allowed to repeat the story.

2.2.4 Real-time weather Animation

This function would display the current weather in the user's location in the level 4(High learning requirement) story as an AR animation.

2.2.5 Object recognition

This function would allow the application to recognize the target object which has been loaded into the database and open a story.

2.2.6 Story Level Suggestion

This function would collect the ASD kid's voice (This application would suggest kids repeat the story followed the storytelling) and based on the Machine Learning classification to get the standard feature of the audio (chiefly frequency, harmonic structure, and intensity) based on the 10 first-time data. This step is to find the average emotional swings of the kids (which would only output as positive & negative emotion). Starting from the 11th audio data, the application would automatically classify the audio data into these two sets (negative & positive). Based on the set the application would suggest the more suitable level of the story.

2.3 User Characteristics

This application is developed to assist parents and teachers, whose education level, experience, and technical expertise are uncertain, in teaching ASD kids. So, simplicity and human-centered design would be implemented. However, the simplicity and human-centered design would be different between supervisors and ASD kids. The supervisor would be mental health adult which means that they have the ability to operate the application. Teachers may have more experience in operating software for ASD education and have specific knowledge in ASD education. However, parents would not have such an experience. The most important users of this application are the ASD kids. ASD is a pervasive developmental disorder having issues with social communication, interests, coordination, attention, and health. People with autism are very sensitive and cannot afford a minor change in their surrounding environment.

2.4 Constraints

1. Safety and security considerations: This would be the most important constraint of the application. The application should not cause harm or negative impact to the ASD kids. Every function and story needs to be suitable for the different learning ability ASD kids.
2. Interface to other applications: The application needs to have the priority to access the camera and albums of the device.
3. Regulatory policies: The development procedure would follow the ACM/IEEE-CS Software Engineering Code[Don Gotterbarn et al 1997]

2.5 Assumptions and Dependencies

1. Political factors. Political factors may influence the requirements of a system. Managers may demand specific system requirements because these will allow them to increase their influence in the organization.
2. The economic and business factors. The analysis of the economic and business environment takes place is dynamic. It inevitably changes during the analysis process. The importance of particular requirements may change. New requirements may emerge from new stakeholders who were not originally consulted.
3. Operating system factors. The operating system to the ASD Education Application is Android, which means it won't work on iOS system. If, in fact, the operating system were not available, the SRS would then have to change accordingly.

2.6 Apportioning of Requirements

1. The narrative of the story is narrated in the Wenzhou dialect, which is convenient for the local elderly who raise autistic children to understand the story.
2. Functions that support emotional intelligence (such as understanding different facial expressions and understanding social cues from video/audio clips).
3. Customisation (the ability to customize images, sounds, and music).

3. Specific Requirements

3.1 External interfaces

- Name of item: Vuforia Fusion
- Description of purpose: We use Vuforia Fusion API to solve the problem of fragmentation in AR-enabling technologies, including cameras, sensors, chipsets, and software frameworks such as ARKit and ARCore. It senses the capabilities of the underlying device and fuses them with Vuforia Engine features, allowing developers to rely on a single Vuforia Engine API for an optimal AR experience. Vuforia Fusion brings advanced Vuforia Engine features to devices that support ARKit and ARCore, in addition to other Android and iOS device models.
- Source of input or destination of output : Unity Engine
- Valid range, accuracy and/or tolerance : Available on each platform
- Relationships to other inputs/outputs Screen formats/organization: Core API

3.2 Functions

1. Sequence of operation

The system shall spontaneously check the real-time information of the user, then the output will be delivered to the AI module.

The system shall check the input of the camera input, this will be processed as picture information that will be suitable for AR core. Then the system will extract the feature of the picture and then recognize the picture patterns. The output signal will be transposed to the representation module. The system then shall integrate the picture data and the real-time information in the AI module for the representation module.

The system should then analyze and present the information about the picture and the test, the system shall also select the text in the database for the text-to-speech generator to read the story.

2. Exception

1. If the system input of the picture is not found in the database, the system will adapt and then load an information text to the user “the object is not found”, then release the button “upload” for uploading additional objects.

2. If the Internet connection is down, the system will generate the text that “No Internet”, then systematically open the phone Internet configuration page for the user.

3. If the story input by the user has some unrecognizable picture, the user will be informed that “Invalid Story”, then ask the user to upload the picture again.

4. If the AR or AI core falls, the system will record the data and reboot for updating the system configuration.

3.3 Performance Requirements

3.3.1 Static requirements:

- 1) This application requires one android or IOS platform device.
- 2) The number of simultaneous users is no more than 3. 1 ASD child and 1 to 2 teachers or parents.
- 3) The number of story displays is 1 and no more than 2 mins.

3.3.2 Dynamic requirements:

- 1) The response time per operation would not exceed 1 second.

3.4 Logical Database Requirements

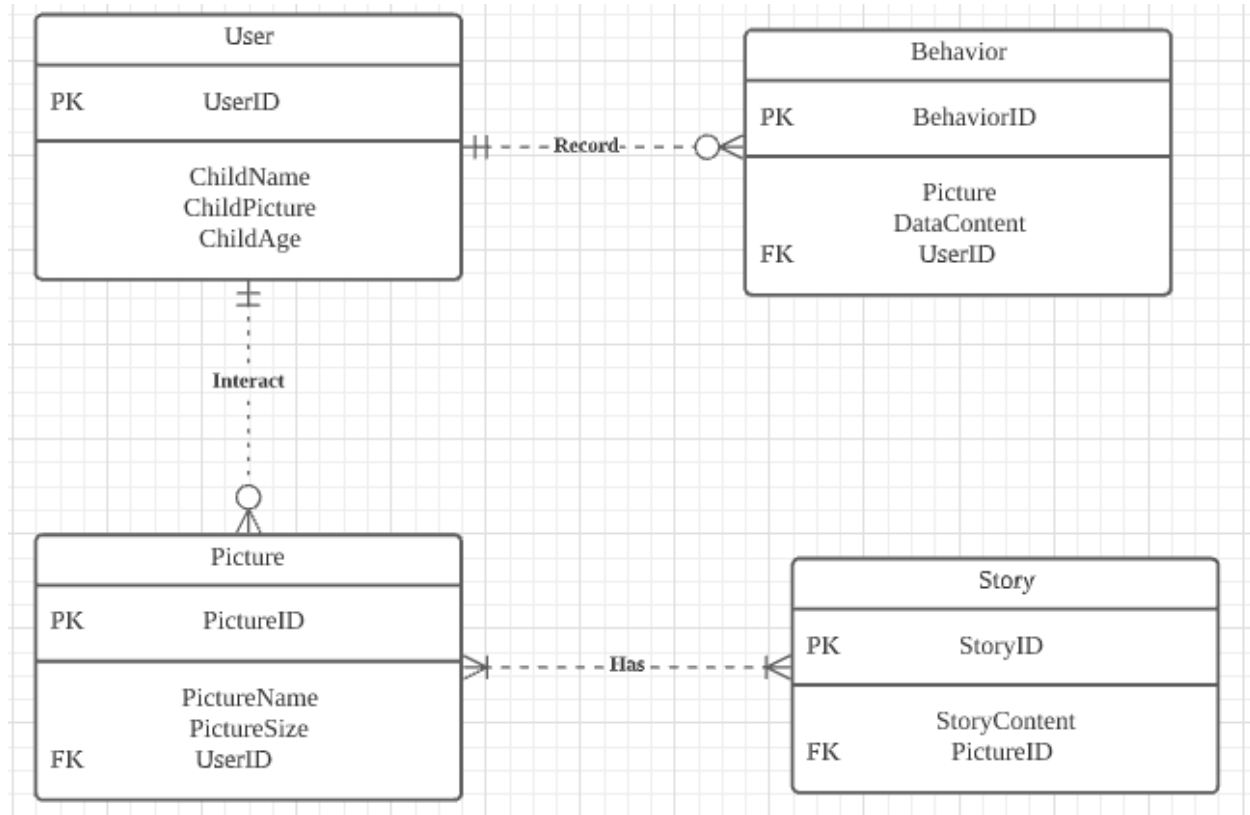


Figure 2: The chart of the logical database requirement

3.5 Design Constraints

Our company will remain the data integrity, if the user not accept the cookies collection or data collection of the App needs, the user may not be informed to use this App. Also, the user's privacy will also be protected, the company will minimize data collection and retention, and secure all the data that have been kept.

3.5.1 Standards Compliance

An addition of more stories requirement to augment the database must be recorded in a trace file with Newstory value.

3.6 Software System Attributes

3.6.1 Reliability

1) Feature testing: Each function should be tested at least once and executed properly.

2) Regression testing: When new updates are implemented, the application should contain no bugs.

3) Load Testing: The application should operate at least one story before break down. After rebooting, the application should still work.

3.6.2 Availability

1) The system would save the story database each time after adding or deleting stories.

2) The system should allow users to restart and recovery the default stories in the database.

3.6.3 Security

1)Vulnerability Scanning: The application should pass the testing of the automated software.

2)Security Scanning: The application should be identified the weakness in network security and system security.

3)Risk Assessment: The application should pass the examination of the ASD institution.

3.6.4 Maintainability

- 1) Verify the development standard of the application
- 2) Verify the input, processing, and output of the application has been executed properly
- 3) Verify the algorithm is optimized
- 4) Verify whether the application would be executed properly in android and IOS platform.

3.7 Organizing the Specific Requirements

3.7.1 System Mode

The ASD education application only has one mode. Children must be accompanied by parents using software.

3.7.2 User Class

Teacher

Parent

Child

3.7.3 Objects

User

Teaching example

3.7.4 Feature

Users teach with different image of objects with the same name.

3.7.5 Stimulus

The user selects an object.

3.7.6 Response

The user interface renders different photos of the object.

3.7.7 Functional Hierarchy

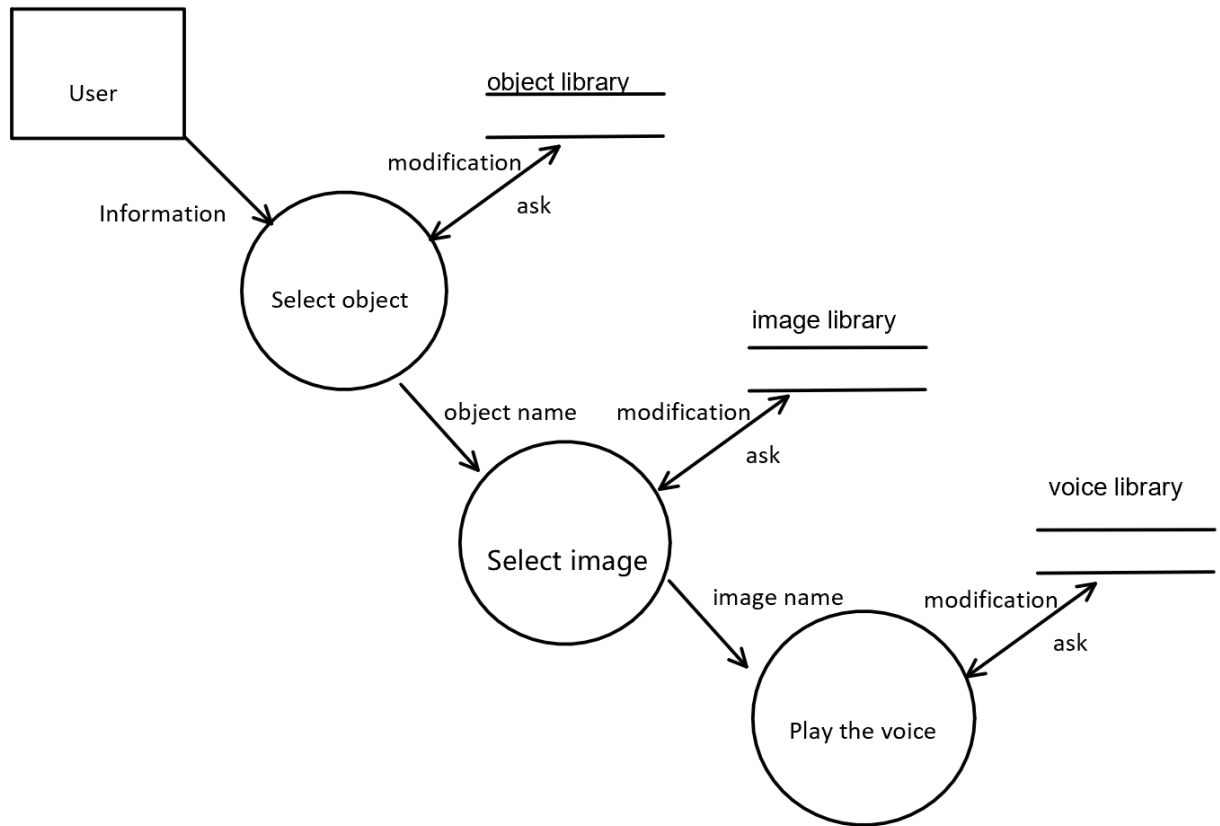


Figure 3: Function Hierarchy

3.8 Additional Comments

This project has great implications for ASD kids. According to the investigation, Wenzhou's autism center lacks an ICT application for autistic kids. They still train ASD students in traditional methods, and they will fund this application because the e-learning system for ASD children can better stimulate their interest and potential. In addition, such projects are closely watched by the Society for Autism Researchers, which could receive financial support in the future.

4. Change Management Process

We set up special mailboxes to receive customers' emails about their needs. The team set 4pm each day as a time to respond to customer needs. Meanwhile, at 4:30, the team will have a meeting to discuss how to deal with the change of customer needs.

5. Document Approvals

Approvers:

Time:

6. Supporting Information