ÇANKAYA UNIVERSITY FACULTY OF ENGINEERING COMPUTER ENGINEERING DEPARTMENT

Project Report

CENG 408

Innovative System Design and Development I I

201920
Learn Easy Read Easy

Elif Solmaz
201511053

Kenan Özütemiz
201511046

Büşra Karausta
201511037

Advisor: *Dr. Instructor Gül TOKDEMİR*

İçindekiler

1. Introduction

Our game is an educational game for children that will help the education of children in need of special attention. These special children have problems in learning the basic concepts, so a series of mobile games will be designed to provide them with the basic reading knowledge they can understand. The small games included in the content of the game will enable children to learn the basic knowledge they need to learn in a playful reality and with fun. The game will be designed in singleplayer mode. Parental control will be added as it is a children's game. At the end of this game, the children will be able to complete their education and get the information taught. If the child cannot complete the learning on the game pieces, that is, as a percentage of success, the child must repeat the level. Since the game will be controlled by the parents, game tracking is provided. The control of this doctrine will be reported so that the parent can follow it with the evaluation of each small game.

1.1 Company Background

What is Otsimo and When did Otsimo come to life?

Otsimo It is aimed to provide support and development to children with autism completely in education. Until now they developed more than 50 games with educators and families and created a free open source AAC communication tool for nonverbal children in different languages. Otsimo was developed in 2016 for children with autism.

How did the idea come about?

Otsimo is a project and organization that has emerged as a result of a computer engineer brother who has an autistic brother who wants to help his brother. Although his brother couldn't read it, he noticed that he had spent too much time on smart devices. He bought a tablet computer but there is no educational practice for his brother with autism. Together with a close friend, they decided to make educational applications and laid the first foundations of Otsimo.

1.2 Motivation

We are a group of senior students in computer engineering department who are interested gaming. We aimed to combine the fields of education and gaming in this project. We have chosen the game engine Unity 3D which all of the members of the group are already familiar to develop our project. Aside from scripting, our project includes visual arts. It is our team members who will provide the necessary environment and 3d models for visual arts. 3ds Max is used for 3d modeling and environment.

1.3 Problem Statement

The education of special children requires extra attention for every family. Both at school and at home, it is necessary to complete their shortcomings by considering their situation. Having different learning speeds than their peers, these children can also interpret everything around them differently. What they need to learn before and after school is not only at school but also at home with their families. This is the main goal of our practice. We designed this application to enable children to continue their education at home and leave it to the parents' control. We made our practice play to contribute to children's learning speed. Especially because visuality has a very effective power on children, we aimed to reinforce what they learn with games.

1.4 Related Work

İÇİMDEKİ HAZİNE :

Upon our research, we found the project "İçimdeki Hazine". This project is a project produced and sold by OTSİMO which we have received support from in the final project. İçimdeki Hazine Project is a project implemented under the auspices of the Ministry of National Education under the umbrella of Non-Barriers for the development of children with autism spectrum disorder. This project is an internationally certified and awardwinning educational game application developed under the supervision of child psychologists and trainers to provide digital support to the education of children with autism spectrum disorder, down syndrome and learning difficulties.

The project has two branches;

- Education classes in schools where children with autism are educated
- İçimdeki Hazine mobile app

Education classes in schools for children with autism: In schools where students in need of special education under the Ministry of National Education are educated; architectural hardware and various educational materials are provided in line with the needs of the students. Various materials take place in the classrooms to be used in the education programs prepared considering the individual characteristics of the students. With the diversity of educational materials, development areas are included in the education-training process. Training materials; It is prepared in a variety of ways to develop receptive and expressive language, self-care, big-small muscle, social, physical and cognitive skills. Although the areas of development in individual education programs vary between students, the use of materials may vary. Tablets are provided to students and teachers in order to use students' interest in technology for teaching purposes. It is ensured that physical conditions are designed in accordance with the architectural equipment arrangements for students with autism. In addition to lighting, insulation, room temperature regulations, the absence of sharp corners, opening the windows from above and having plugs with covers are also made to ensure the safety of the educational environment. So far, education classes have been established in 11 schools in Istanbul, Izmir, Usak, Ankara, Karabuk, Nevsehir, Osmaniye, Kilis, Corum and Tekirdag.

Mobile Application: The aim of this course is to teach basic information such as letters, numbers, colors, animals and objects to children with learning difficulties and focus problems through selection, matching, sorting, drawing and voice games developed by Applied Behavior Analysis (ABA) technique. The application, which can be downloaded to the tablet and phone, helps children with autism attend school. İçimdeki Hazine consists of two separate platforms dedicated to children and their families. The Children's section includes a variety of educational games that are opened in a specific order according to the age and educational status of the child with autism, as well as a Supportive and Alternative Communication System (AAC) for children with speech difficulties. The individually shaped

curriculum adapts to the mental development of children. The children's section has no distractions, including ads and purchase options. The family section is the platform where you can review the child's development reports and configure the education settings. Through the family platform, you can access articles about autism, down syndrome and other special needs and have full access to your child's education. Game Reference: https://otsimo.com/tr/icimdeki-hazine-hakkinda/

1.5 Solution Statement

Choosing games and trainings is our top priority. Our main problem is to educate children in such a way that they can adversely affect them or make no improvement. We thought that we had to get to know children especially in order to understand and attract their attention. Thus, with the help of OTSİMO, with whom we worked together, we learned from the psychologists what the children could pay attention to and what were the elements that would strengthen their education. In addition, we tried to take into account how much they would react to the trainings, in what order they should be, and their attention span. Another factor we need to pay attention to is to reinforce and measure the progress of children in these trainings. To do this, we will help parents to determine their level of children by sending statistical data to the parents. We know that each child is different and that individual progress develops independently of each child's discomfort. Therefore, our tests will be to pass on the development of children to parents. We will ensure that they monitor whether this development is sufficient for children. Another problem is that children can learn without isolating the outside world. Because unlike other children, the real concept around them is quite different. That's why the help of a psychologist is invaluable every step of the way. We will also use our company's data from these children as a professional aid in identifying games and trainings.

2. Literature Review

Abstract

Virtual education is modernized and popularized today. There are various educational mobile applications and games for everyone from adult to child. Nowadays, there are many mobile applications or games that are very useful, especially for children, which facilitate learning and development. There are so many applications for children, but not all children can learn and develop with the same games. For children with autism, learning is more difficult. For this reason, games for children with autism should be designed to be more sensitive, careful with their contents and without any negativity in their education. In this project, we have developed a mobile game in the education of children with autism without taking any psychological, psychological harm and considering the adequacy of learning skills.

Introduction

Autism Spectrum Disorder (ASD) is a pervasive developmental disorder which affects individuals with varying degrees of impairment. Currently, there has been ample research done in serious game for autism children. Although serious games are traditionally associated with software developments, developing them in the autism field involves studying the associated technology and paying attention to aspects related to interaction with the game. Serious Games for autism cover matters related to education, therapy for communication, psychomotor treatment and social behavior enhancement. The project will be aimed at individuals with autism themselves (who study) and people who work with them, such as psychologists, instructors, assistants and family members. The main goal of this app is to help and assist the Autistic children that would enhance their understanding and capabilities.

1. Autism and Education

The education of autistic children is not limited to school or individual therapies and is a twenty-four-hour process that must be continued in all aspects of life. Since autistic children have different characteristics, an Individualized Education Program (IEP) should be prepared for each child's education [1]. The most important factor to be considered in the education and treatment of autism is to ensure the participation of the family in education. It is important for the child's development that the family is included in the IEP, learning the methods used in education and using them when necessary. Another point to be considered is the intensive and continuous implementation of the training.

- An autism-specific program developed for children with autism, -Fits the individual characteristics and needs of the child and the child has the skills appropriate to the level of development, not just the age,
- Having clear set goals from the beginning,
- Evaluating the results and achieving the target
- To be able to adapt the objectives to the requirements periodically, to be flexible and renewing the program
- Being structured, arranging both the skills to be taught and the place to be taught.
- To be systematic, to teach by following the skill steps
- It is very important to complete with the integration processes in which they are together with their peers.

1.a Special Education In Autism

It is the education provided for autistic children to acquire the necessary and age-appropriate self-care, mental, social and communication skills in order to be fully independent or at least dependent. Speech and language therapies within the special education program aim to provide children with autistic characteristics to improve their speaking and language skills, to improve and improve their relationships. Occupational therapy is applied to improve self-care skills of children with autism, balance and coordination, hand and eye coordination, coarse and fine motor skills [2].

2. Psychology and Sociology in Autism

Autism is a complex neurodevelopmental disorder encompassing severe abnormalities in reciprocal social interaction, verbal and nonverbal communication, accompanied by restricted and repetitive behaviours and interests. These behavioural symptoms are present in very early childhood, before the age of 36 months. There is much variability in the disorder in terms of intellectual functioning, language ability, and severity of behavioural symptoms. A large proportion of children with autism (between 50 and 70 per cent) have additional learning disabilities (i.e. an IQ lower than 70), while such disabilities are absent in the remaining children, who are often described as 'high-functioning'. For some children, language is limited or absent altogether. For others, speech can be fluent, but even so, their use of language to communicate in social contexts (e.g. conversations) is odd, awkward, and often one-sided. Autism is defined as one of the neurodevelopmental disabilities which continue for life and affect social development, communication and behaviors of the individuals in a negative sense. In addition, it was seen that the first reaction of the parents' children to get autism was also the intense sadness. Parents have expressed concern about the future of their children, depending on the strength of their children's self-expression. It has been determined that the society has negative attitudes towards autistic children and that parents would like to see the society to be more moderate towards autistic children. [2]

Social skills consist of behaviors of an individual in order to fulfill their social responsibilities. Social skills are learned behaviors. Children are not able to acquire social skills or exhibit their existing skills sufficiently for various reasons. Children with autism who are generally inadequate in social skills compared to their peers; they are faced with various problems in social relations, school life, academic studies and emotional - behavioral areas due to problems such as gathering and maintaining attention, excessive mobility, agility, not being able to distinguish the stimuli around them, reading communicative clues such as gestures, facial expressions and limitation of communication skills. Many social skills deficiencies observed in these children (failure to comply with the rules, waiting for their order, not listening, finishing the activity, not being able to focus their attention, not following the instructions, etc.) are perceived as problem behavior by teachers and other people around. In order to improve the quality of life of children with autism, social skills education programs in education should be prepared. Teaching social skills to children with autism;

- Facilitates their learning of academic skills (such as working independently, following guidelines, using leisure time),
- Improving friend / teacher relationships by increasing the level of social acceptance

- Social cohesion (sharing, fulfilling responsibilities, obeying rules) behaviors are increasing,
- Develops self-control skills (such as controlling anger / anger, impulse control, obeying rules, time management, problem solving, accepting criticism, expressing emotions). [3]

3. Educational Affect of Serious Mobile Games on Special Children

An American psychiatrist, Leo Kanner (1943) described Autism as a condition that resulting from a brain disorder that takes place during the first 2 and a half years of childhood. Nowadays, mobile devices are prevalent in our lives. Their numerous potentials make them educational friendly. [4]

The Serious Games have been designed so that, besides their pure entertainment value, they convey relevant ideas or messages about various aspects not related to the gaming industry. A Serious Game is associated with the education and learning of new concepts and skills, but can also works as training and simulation of various activities of real life. In other words, a serious game should have an evident connection between the real and virtual world, and a purpose beyond the scope of just playing a video game. [7]

More specifically, previous studies have reported that educational computer games can enhance the learning interest of children, and also increase their learning motivation. The diagnosis and the assessment of learning disabilities is often determined when children begin to exhibit academic difficulties in school, and the average age when children receive learning disabilities assessments is 9years. Since mostly of the students in West City Central School is 15 below students is focusing more on the game rather than the traditional methods. Young children with disabilities often have difficulties developing emergent literacy skills as phonological awareness, alphabetic principles, comprehension, concepts about print, and vocabulary development. [5] Due to these reasons, this study aims to improve quality of life of individuals with autism and enhance autonomy as much as possible through the use of the latest technologies in mobile devices such as smartphones and tablets, implementing Serious Games.

Nowadays, people with disabilities specifically persons with difficulties in social and emotional aspects spend and enhance their implications through playing mobile game applications that were in line in the augmentation of their impairments. Through thorough study and analysis of the existing studies presented by many authors about children with autism, the researchers created a mobile game application wherein students with autism can learn and have fun guided by their guardian. The features of this game application have a scoring system for focus monitoring, eyecatching graphics, simple level of exercises, video tutorial and background music that coincide with the current educational teachings. [6]

3. SRS

1. Introduction

Autism Spectrum Disorder (ASD) is a pervasive developmental disorder which affects individuals with varying degrees of impairment. Currently, there has been ample research done in serious game for autism children. Although serious games are traditionally associated with software developments, developing them in the autism field involves studying the associated technology and paying attention to aspects related to interaction with the game. Serious Games for autism cover matters related to education, therapy for communication, psychomotor treatment and social behavior enhancement. The project will be aimed at individuals with autism themselves (who study) and people who work with them, such as psychologists, instructors, assistants and family members. The main goal of this app is to help and assist the Autistic children that would enhance their understanding and capabilities.

1.1 Purpose

The aim of the project is to make this basic information permanent for children with autism disability who have learning difficulties and who need basic information.This basic information is divided into 3 main groups. These groups consist of alphabet information, basic number information, and basic color information. Our project aims to give these information by considering the psychological status and learning speed of special children. It is aimed to reach a successful point by carrying out joint studies with professional people who closely observe the special situations of children with autism and conduct academic studies on this subject. This document includes detailed of software functionalities. Moreover, explains how children with autism disability interact and learn with the educational games.

1.2 Scope of Project

In the beginning of the project, we aimed to support the education of children with autism. We were aware of the fact that children with autism have difficulties in understanding and learning, unlike children in formal education.

In order to complete this shortage, we wanted to create an easy-to-reach area to help preschool children with autism having fun while learning.

We have benefited from concrete and abstract concepts that will help special children learn by getting help from experts and articles examining psychological, educational and social relationships. If we need to explain briefly these concepts, we took advantage of visuals, sounds and colors that will not break the bounds with reality considering the speed of

learning. We created game objects by identifying their learning levels. We have developed this game environment for simple, effective and lasting learning.

When creating game objects in the game environment, we aim to use simple structures of simple colors and shapes that will not distort the perception of reality. We decided that we should use bright and vivid colors that would attract children's interest in color selection and we aimed to pay attention to these characteristics in the use of color. As a result of our research on the use of sound and music, we aimed to disrupt their concentration and benefit from the motivating sound and music that does not scare children. In creating the play, we decided that we should create a parental entrance that will follow the progress of children with autism. We determined the features that should be under parental control. These features include the daily playing time of the child, the number of trials, and which games he plays. These daily statistics will be arranged to show the last 1 week to the parents. This arrangement will allow the parent to actively monitor the child's development.
If necessary, the parent will inform the child which games fail and which child should seek help. There will be training of the 3 main skills in the game mode in which the child will enter and actively use. Alphabetical skill games will allow the child to learn each letter in one game. Teaching each letter in alphabetical order using the object associated with that letter or the live characters that are not far from reality will provide a significant acceleration in the child's development. In addition to the alphabet training, basic number counting skills will also be gamified. Before the games, the instructor will practice counting and then be expected to complete multiple choice games to entertain and test what he has learned. If the expected repetition does not complete the game, the parents will be informed at the panel.

We have identified the points that we need to pay attention to when designing the part where we will teach children the colors and the game part where we will test what children learn. We found that we need to teach colors in a fun way for children, and we set colors as basic colors. We aimed to design color games in the following order; in the part where we teach colors, we will match each color to an object in the real world, and these colors will provide a more specific match in the child's head, and the colors will be taught over and over again with a tiny animation. After the training, in the part where we test what the child has learned, multiplechoice questions will be asked to the children as in the numbers section and voice repetitions will be made, in this way both the education of the child will be reinforced and the level of the colors taught will be tested.

1.3 Glossary

Terminology	***Description***
Unity 3D	Unity is a cross-platform game engine developed by Unity Technologies, primarily used to develop video games and simulations for computers, consoles and mobile devices.
Autism	Autism is a congenital neurobiological disorder that is accepted to be caused by the different structure or functioning of the brain and nervous system. [1]
Singleplayer	A game mode in which only one player plays the game.
Frame Per Second	The number of complete scans of the display screen that occur each second.
Parental Control System Interface	It is a parent mode where the child's development is monitored and some permissions are granted.
Child Learning Interface	It is the mode in which the child has a play environment in which he sees, receives education and tests what he has learned.

1.4 Overview of Document

There are three main sections to this document. The first part, “Introduction", generally describes the main purpose, scope and glossary of this project. The second part, “Overall Description”, shows the system environment, materials used and usage status diagrams and functional requirements. In the third section, "Requirements Specification” contains a more detailed description of Portability, Performance, Usability, Adaptability, Security Requirements, Extensibility, and Efficiency.

2. Overall Description

2.1 Product Perspective

LERE: Learn Easy Read Easy is an educational game project for children to help educate children in need of special attention. These special children have problems in learning the basic concepts, so a series of mobile games will be designed to provide them with the basic reading information they can understand, and teach counting numbers and colors. The small games included in the game will help children learn the basic alphabets, numbers and colors they need to learn, in a fun reality. The game will be designed in singleplayer mode and parental control will be added as the game will be prepared for children. At the end of this game, when the children complete their education and successfully complete the games, the project objective will be achieved. If the child cannot complete his / her learning on the pieces of play, that is, if the percentage of success is not at the required level, the child must repeat the game until the required level is reached. In such cases, status monitoring is provided by the parent as the game will be controlled by the parents. On the parental control side, it will be designed as a platform where the parent can monitor the development of his or her child on each small playground.

2.1.1 Development Methodology

Our methodology that contributes to the development process we will use during the project is Agile methodology. During the development of Agile methodology, it will contribute to us to make additions according to needs and to go through a flexible process. This methodology is a sprint that is a period of time allocated for a particular phase of a project. Sprints are considered to be complete when the time period expires. There may be disagreements among the members of the team as to whether or not the development is satisfactory; however, there will be no more work on that particular phase of the project. The remaining phases of the project will continue to develop within their respective time frames. During the development period, agile methodology has 3 main roles. The Product Owner oversees all the business conditions of the project to ensure the right product is built and in the right order. The Scrum Master is the team’s coach; they help the teamwork together effectively. And the team works together to determine the best approach to achieve the product goals that are outlined by the product owner. We have daily stand-up meetings which are also called Daily Scrum meetings. The Scrum sessions are held daily by the team so

they can share pertinent information. These meetings are designed to keep all team members equally informed and updated on the status of the project. There are three levels of Agile development planning: release, iteration, and task. In the beginning stages, project developers and customers meet to discuss the primary user stories that are needed for the software. When Agile programming is done properly, organizations can continually find ways to increase the value to their customers. [3]

We use a project management application to support this methodology and to ensure the management of the project. Thus, we can assign everyone their jobs, we can learn about the course of business. Trello will help us during working on this project for whole time.

2.2 User Characteristic

2.2.1 Participants

2.2.1.1. The participant must be a special child with autism.

2.2.1.2. The participant should not have hand or eye disability.

2.2.2 Admin

2.2.2.1. Admin should be the parent of the individual with Autism.

2.2.2.2. Admin must read and understand English language due to simulation language is English.

2.2.2.3. Admin should know how to use the phone.

3. Requirements Specification

3.1 External Interface Requirements

3.1.1. User interfaces

The user interface will be worked on Android or IOS.

3.1.2. Hardware interfaces

Devices must be smartphones and must include speakers and touchpad. There must be sufficient storage space for the application.

3.1.3. Software interfaces

Since this game is developed for smartphones, iOS and Android are the most important software needed for this game to work. Unity is used to create user interfaces and create in-game animations.

3.1.4. Communications interfaces

There are no external communications interface requirements.

3.1.5. Visual interfaces

Adobe Photoshop for 2-D images and 3ds Max for 3-D models will be used. Animation will be made with 2d visuals using a certain number of frames for animation.

3.2 Software Quality Attributes

3.2.1 Portability

- LERE is designed for the devices with IOS, Android version 4.1(Jelly Bean) and above, so LERE must work properly with the possible new versions of Android and IOS platforms.

3.2.2 Performance

- The game frame rate must be 30 frames per second.
- The game environment should start with the game selection screen and the game environment should be created when the game is selected.

3.2.3 Usability

- First of all the game should be easy, understandable and simple.
- The game should be easy to install, play and operate.
- When the participant fails, there should be feedback indicating how many times the participant failed in which game.
- The game consists of 3 categories.These are Letters, Numbers and Colors.
- Each letter, each color and each number consists of 1 game.

3.2.4 Adaptability

- Game interfaces will be divided into two; Child Learning Interface and Parental Control Interface. Since the percentage of progress of the child needs to be transferred from the Child Learning Interface to the Parental Control Interface between these two interfaces, this information will be updated in the Parental Control System Interface to adapt the information.

3.2.5 Safety Requirements

- The time spent by the child in the game should be limited to the child's eye and physiological health. This limitation will be provided through the Parental Control System Interface. The parent will unlock the games that the child should play every day from their interface and the child will only have access to those games.

3.2.6 Extensibility

- Since all games in the project are created independently of other games, changing any game will not affect other games. Games will be added, removable or changeable anywhere in the project. At the same time, new game categories can be added or the game category can be changed completely.

3.2.7 Efficiency

- The communication of each unit within the system is kept simple and the adequacy of performance is ensured. Each game will be played in a fixed frame. Thus, the performance of the project will be constant and high.

3.3 Performance Requirement

- In order for the games to be able to run efficiently, the device on which the game is played must meet certain requirements. The devices that meet the following requirements will be able to play games smoothly.

1. Operating System : Minimum Android 4.2 "Jelly Bean"
2. Processor : Intel Atom® Processor Z2520 1.2 GHz, or faster processor
3. Storage : Between 850 MB and 1.2 GB, depending on the language version
4. RAM : Minimum of 512 MB, 2 GB is recommended

3.4 Functional Requirements

- User Use Case Diagram

User Child

- 1: Categories -> Child can see all the categories that games consist of.
- 2: Letter -> See all games which type of letter.
- 3: Numbers -> See all games which type of numbers.
- 4: Colors -> See all games which type of colors.

User Parent

- 5: Options -> Parent control setting of games.
- 6: Statisticals -> Main screen of parent panel that shows some information about child progress on games.
- 7: Turn on/off Music -> Controling inner musics while game playing.
- 8: Turn on/off Voice -> Controling inner voice of educational and indicator voice while game playing.
- 9: Game Permission -> Controling amount of daily games which can be played by child.

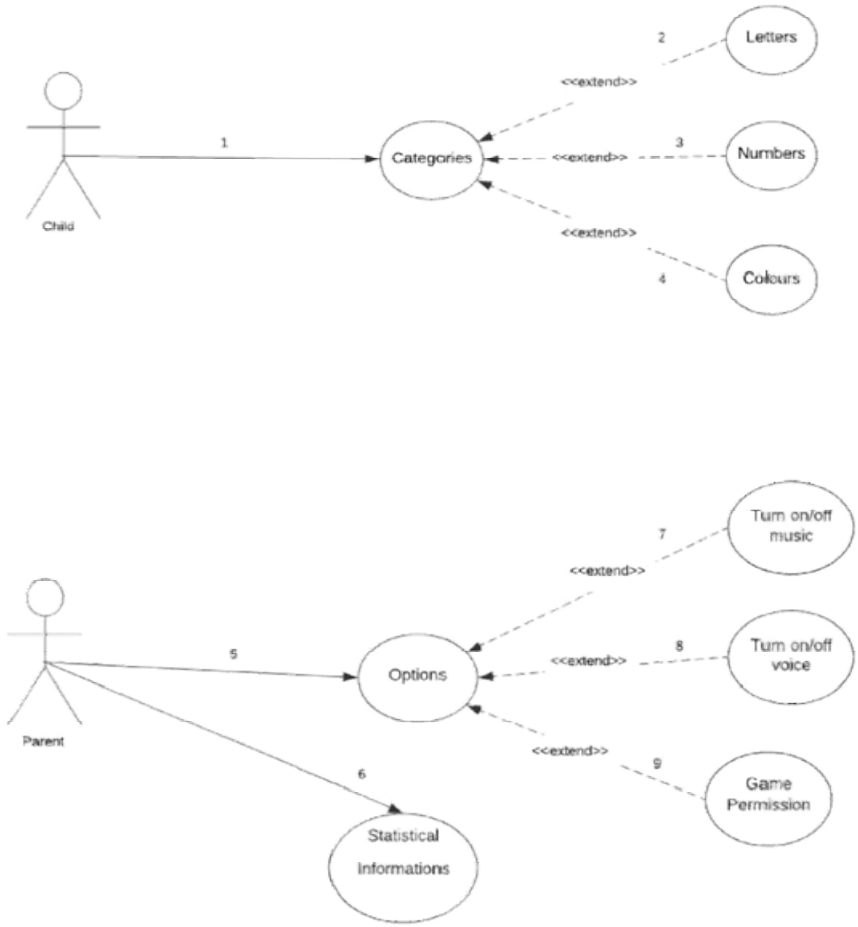

Figure-1 (Use Case Diagram)

4. SDD

1. INTRODUCTION

1.1 Purpose

The purpose of this Software Design Document is providing the details of project titled as "LERE: Basic Education for Children with Autism".

The target audience is Children with Autism. The game app is aimed at basic education for children. Letters, Numerals and Main colors are intended to teach.

The purpose of the project is to make this basic information permanent for children with autism disability who have learning difficulties and who need basic information. This basic information is divided into 3 main groups. These groups consist of alphabet information, basic number information, and basic color information. It also consists of 2 modes: child and parent. Parental mode has been added to keep parents informed of children's development. Our project aims to give these information by considering the psychological status and learning speed of special children. It is aimed to reach a successful point by carrying out joint studies with professional people who closely observe the special situations of children with autism and conduct academic studies on this subject. This document includes detailed of software functionalities. Moreover, explains how children with autism disability interact and learn with the educational games.

1.2 Scope

This document contains a complete description of the design of the LERE game project: LERE developed for the education of children with autism.

Unity3D is a game engine which is used by many game and simulation developers for it is practical. There are various programming languages that can be used within Unity3D such as C# and JavaScript. It is a powerful crossplatform and it is easy to extract to build of the project for Windows, Mac OS X, Linux, Android, and IOS. In Unity 3D, script codes are compiled to native code and it is most likely to get a fast iteration time. One of Unity's other gaming engines is that it allows developers to write program code at the time of game development. Most of the other game engines have separated graphics and code, while Unity and graphics work together. This working logic gives the developer flexibility and shortens the development time. In addition to all these advantages, games written in Unity 3D can be played easily on low and mid-level computers (lowest 1.6 GHz processor, 500 MB ram). Because of these facts, we have chosen Unity3D as our development environment.

Autism spectrum disorder is a complex neuro-developmental difference that is innate or occurs in the early years of life. Autism is thought to be caused by some nervous system problems that affect the structure or functioning of the brain. Autism, or autism spectrum disorder (ASD), refers to a broad range of conditions characterized by challenges with social skills, repetitive behaviors, speech and nonverbal communication. We know that there is not

one autism but many subtypes, most influenced by a combination of genetic and environmental factors. Because autism is a spectrum disorder, each person with autism has a distinct set of strengths and challenges. The ways in which people with autism learn, think and problem-solve can range from highly skilled to severely challenged. Some people with ASD may require significant support in their daily lives, while others may need less support and, in some cases, live entirely independently. Several factors may influence the development of autism, and it is often accompanied by sensory sensitivities and medical issues such as gastrointestinal (GI) disorders, seizures or sleep disorders, as well as mental health challenges such as anxiety, depression and attention issues. Indicators of autism usually appear by age 2 or 3. Some associated development delays can appear even earlier, and often, it can be diagnosed as early as 18 months. Research shows that early intervention leads to positive outcomes later in life for people with autism.[1]

Formerly known as a 3D studio and 3D studio Max, 3ds Max is a 3D professional modeling, animation and rendering application build for making 3D animations, models, interactive games, visual effects for the entertainment industry.

1.3 Glossary

Terminology	***Description***
Unity 3D	Unity is a cross-platform game engine developed by Unity Technologies, primarily used to develop video games and simulations for computers, consoles and mobile devices.
Autism	Autism is a congenital neurobiological disorder that is accepted to be caused by the different structure or functioning of the brain and nervous system. [1]
Singleplayer	A game mode in which only one player plays the game.
3ds Max	3ds Max is a computer graphics program for creating 3D models, animations, and digital images. [2]
Class Diagram	In software engineering, a class diagram in the Unified Modeling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects.[3]
Activity Diagram	Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency.[4]
GUI	The GUI(Graphical User Interface) is a form of user interface that allows users to interact with electronic devices through graphical icons and audio indicator such as primary notation, instead of text-based user interfaces, typed command labels or text navigation.[5]

1.4 Overview of Document

There are three main sections to this document. The first part, “Introduction", generally describes the main purpose, scope and glossary of this project. The second part, “Overall Description”, shows the system environment, materials used and usage status diagrams and functional requirements. In the third section, "Requirements Specification” contains a more detailed description of Portability, Performance, Usability, Adaptability, Security Requirements, Extensibility, and Efficiency.

1.5 Motivation

We are a group of senior students in computer engineering department who are interested gaming. We aimed to combine the fields of education and gaming in this project. We have chosen the game engine Unity 3D which all of the members of the group are already familiar to develop our project. Aside from scripting, our project includes visual arts. It is our team members who will provide the necessary environment and 3d models for visual arts. 3ds Max is used for 3d modeling and environment.

2. ARCHITECTURE DESIGN

2.1 Game Design Approach

For developing the project, we have planned to use Scrum which is an agile software development methodology. In scrum, main work is divided into sprints which should be completed within a certain period of time which could be 30 days on average(In addition, we met each weekends and merged our departments and carried out joint works on our project). Iteration length of every sprint must be equal, because scrum is an agile development methodology. Every Sprint includes tasks which has own story points and risk points. Development team should have a daily meeting every morning which should be maximum 15 minutes(We have made them via skype). Scrum has three main roles which are product owner, scrum master and development team. Product owner is the person who delivers the requirements, scrum master is the person who manages the development team. Development team is the group of developers who work on the project according to schedule. There are some advantages of Scrum. First advantage is that it is easier to cope with changes because of short sprints and constant feedback.

Another advantage is problems can be handled swiftly due to morning meetings. By taking into consideration of these facts, Scrum is the most suitable methodology for the project.

2.1.1 Class Diagram

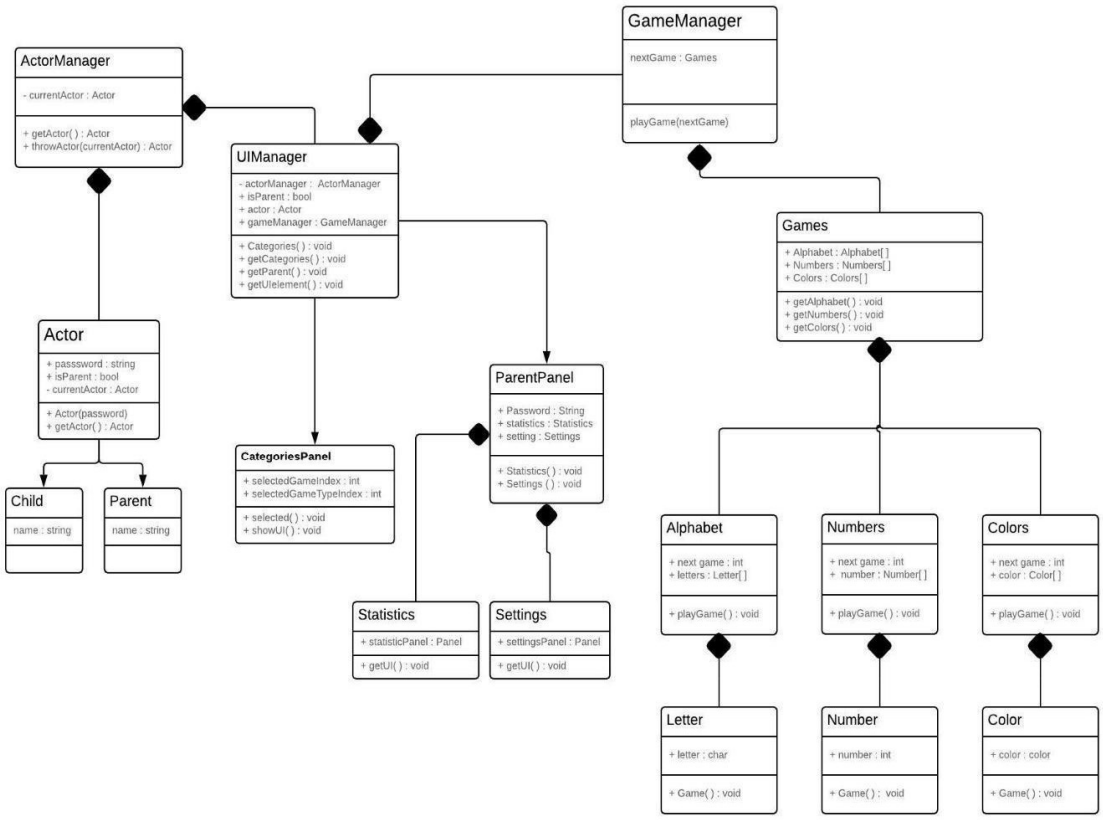

Figure-2 (Class Diagram)

2.2 Architecture Design of Game

When entering the application will face two options. These are the parent panel and the game panel. The parent panel will be able to view the statistics and settings from the repository within the application. The settings will have access to options where the parent can select the number of games to play and turn some in-game features on or off. The game panel includes educational and testing steps for children. Games are divided into 3 categories. The child will be able to see as many games on the screen as the parent allows and play them in order. Each category will contain its own type of games. In the games, there are educational, entertaining and test materials that deal with the subject of its kind. As the games are played, the next game will be passed and will close when the parent reaches the

daily game limit. For completed items, a statistic based on the trial period will be issued and saved to be shown to the parent in the repository in the game.

2.2.1 Options Menu

Summary: Participant can login to child mode, can enter parent mode. It can raise and lower the music in thegame with the help of sound control.

Basic Sequence:

1. The child can move to the play section by selecting options.
2. The parent can switch to the control menu by selecting the parent mode from the options menu.
3. The participant can change the volume level in the game by selecting Change volume settings from the options menu.
4. The participant can exit the system by pressing the exit button.

Exception: None

Post Conditions: None

Priority: Low

2.2.2 Parental Control Mode

Summary: This game can be used by kids and their parents. No registration is required for parents, but a simpleencrypted login is requested from the parents in order to prevent children from accessing it.

Actor: Parents

Precondition: User must run the program.

Basic Sequence:

1. The user can log into parent mode with a simple encrypted login. The password is displayed randomly and is used as a verification code.
2. The user can view the statistical history by selecting the Parent Mode.
3. The user can set or remove restrictions from the game in Parent Mode.

Exception: None

Post Conditions: None

Priority: Low

2.2.3 Child Learning and Gaming Mode

Summary: This game can be used by children. No registration is required for children. Children see the set ofgames their parents have set and can play designated games.

Actor: Child

Precondition: User must run the child game mode program.

Basic Sequence:

1. When the child enters, he / she is faced with 3 education and the game of that education. These are basic alphabets, colors and numbers.
2. When the child starts with the alphabet, other types of selected games come in a loop.
3. The child may leave without completing all the games determined daily.
4. The child can exit the game by completing all the games determined daily

Exception: None

Post Conditions: None

Priority: Low

2.3 Activity Diagram

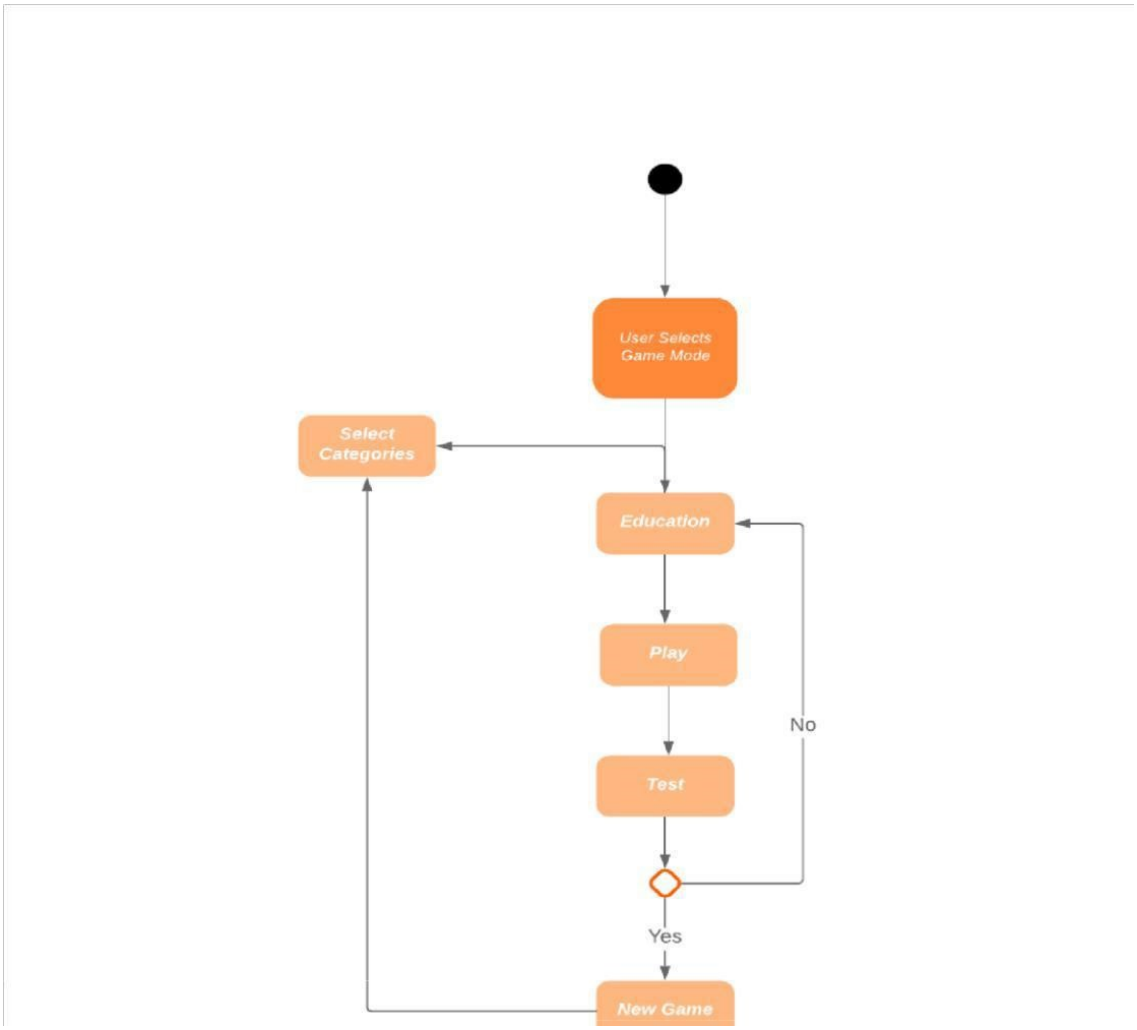

Figure-3 (Activity Diagram)

3. USE CASE REALIZATIONS

LERE Project

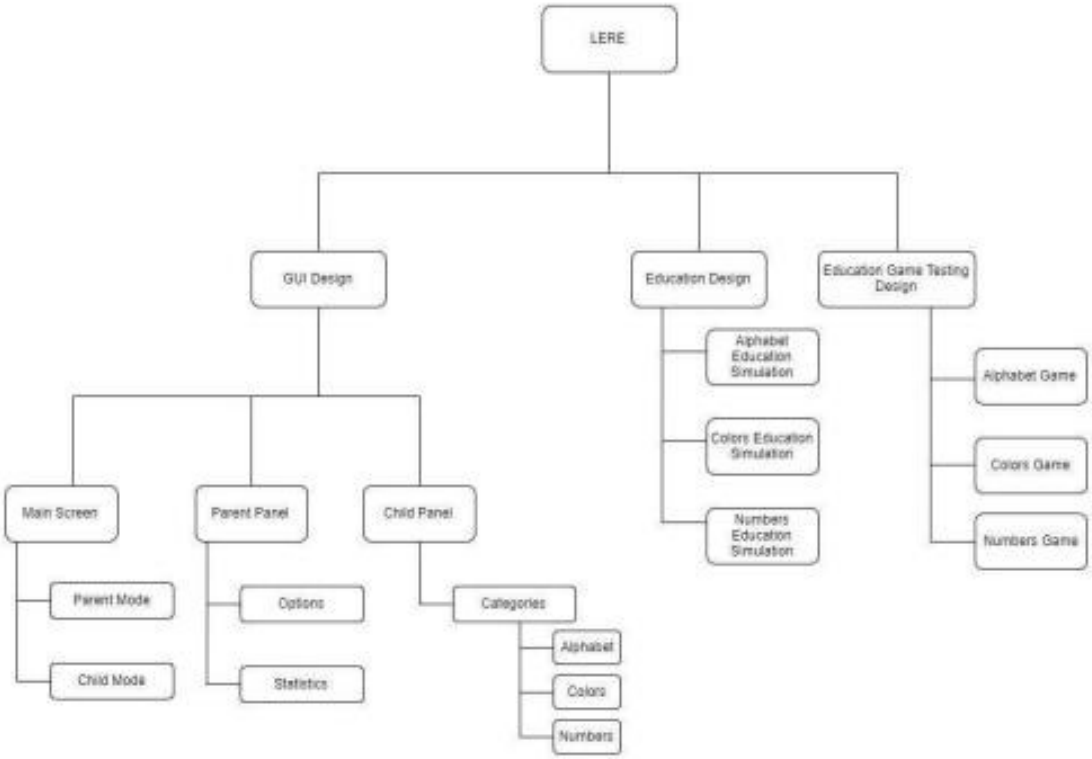

Figure-4 (Use Case Realizations)

3.1 Brief Description of Figure

3.1.1 GUI Design

The main menu is the start page. From here the user can select the parent panel or the child panel. If the user selects the child panel, a menu of 3 game categories is displayed. These ; alphabet, colors and numbers. The game starts by selecting the desired game. Selecting the Parental panel displays 2 options. These ; options and statistics. Options include music on / off, volume on / off, and game restrictions. Voice, music and restrictions can be controlled at any time. If the statistics option is selected, the game history is displayed.

3.1.2 Education Design

This is the part where the content is taught. Since more than one sensation is needed for the child to learn, sound and visuality will be utilized at the same time. The content will be associated with other objects, increasing the child's persistence in memory and facilitating learning. In particular, it is necessary to benefit from the concrete elements that it can see every day. When time passes over an item, the tutorial items will come back to refresh the child's knowledge.

3.1.3 Education Game Testing Design

Some mini-tests will be carried out to reinforce the contents we have taught and to test whether they have been learned. At the end of each game, the results of these tests will be sent to the parental panel as statistics. The tests should be such that they do not give negative feedback and reduce the motivation of the child when the child makes a mistake. When he does it right, he will benefit from visuals and sounds that will increase his motivation and show that he is doing it right. After a certain period of time, the content will be shown again after the training so that the content will not be forgotten and repeated. This will keep the information and statistics up to date.

3.1.4 UI Design

Figure-5 (Player mode selection)

Figure-6 (Game Categories)

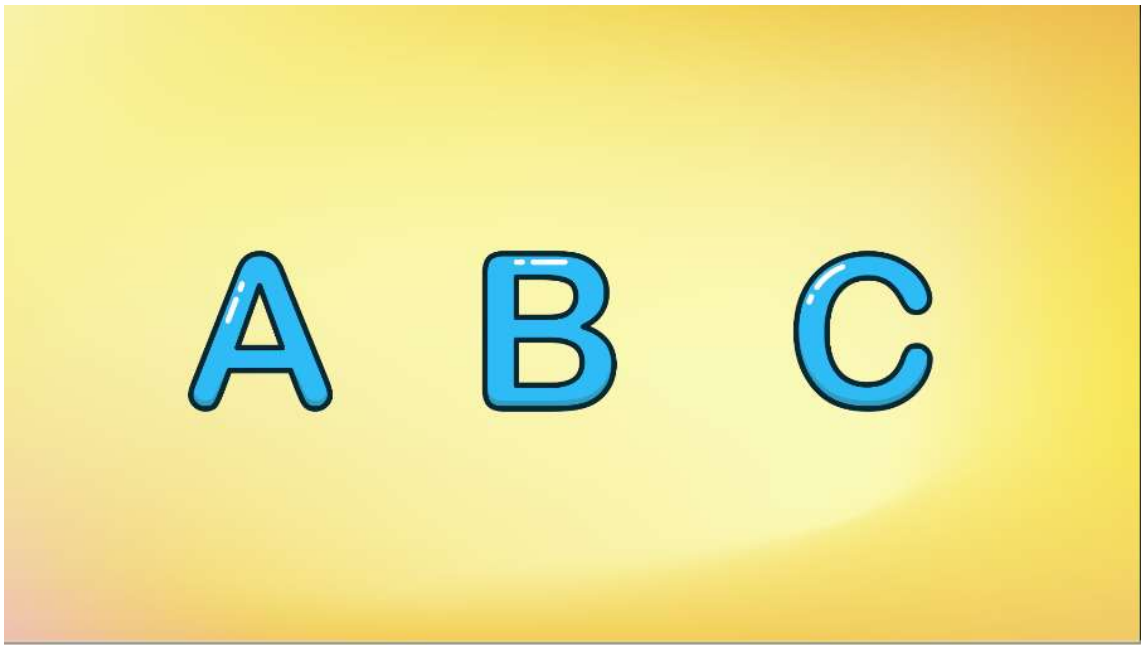

Figure-7 (Letters selection)

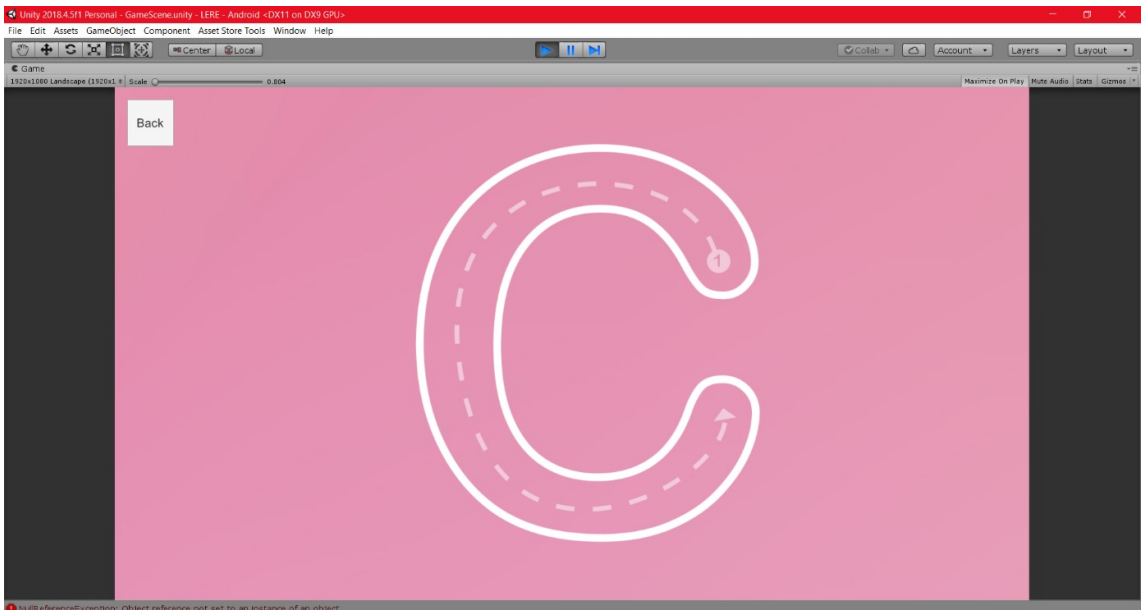

Figure-8 (C- Drawing Education)

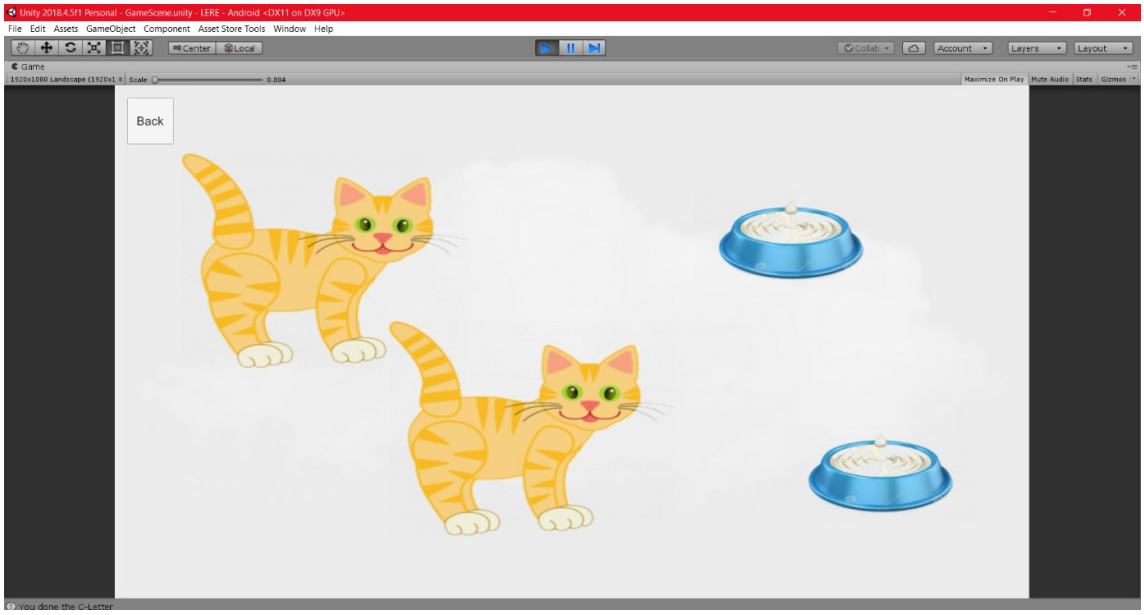

Figure-9 (C- Game Part)

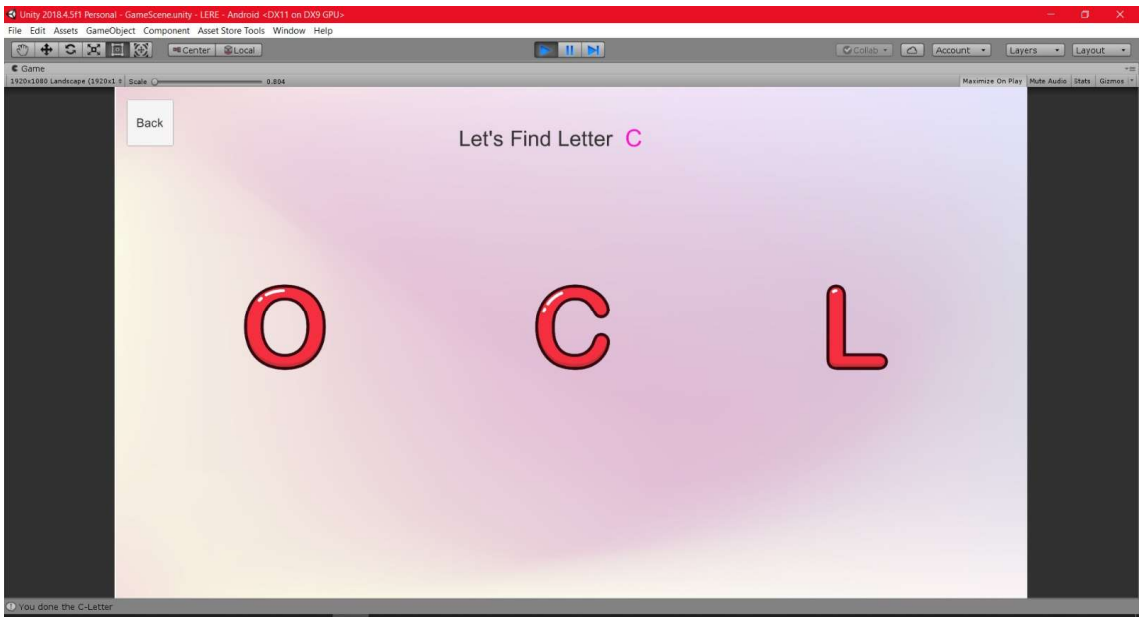

Figure-10 (C- Test Part)

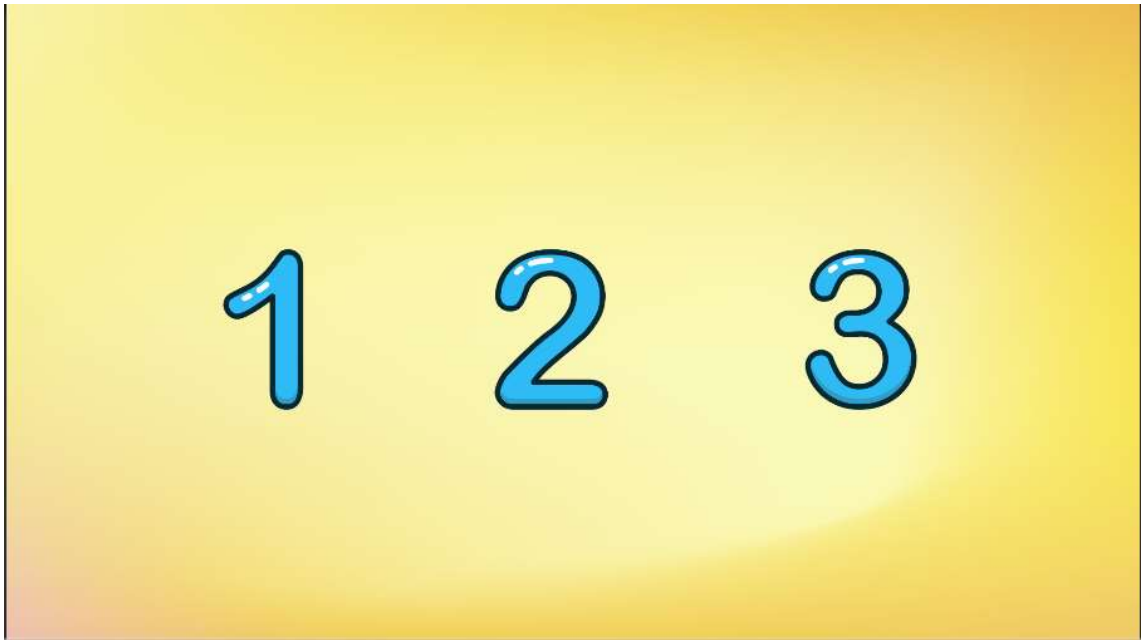

Figure-11 (Numbers Selection)

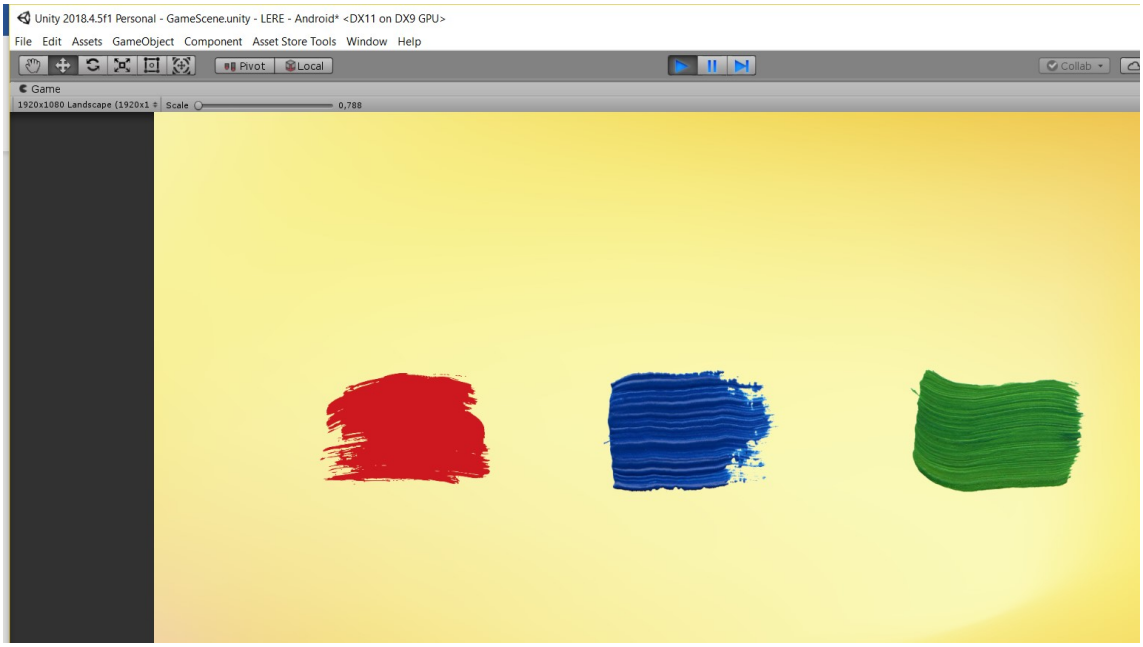

Figure-12 (Colors Selection)

5. Work Plan

Figure-10 (Work Plan)

6.Test Plan

1.Introduction

1.1 Version Control

Version No	Description of Changes	Date
1.0	First Version	April 15, 2020

1.2 Overview

The use case of the game system and game modes that users will going to use which had been determined in SRS document will be tested.

1.3 Scope

This document encapsulate the test plan of the use cases, test design specifications and the test cases correspond to test plan.

1.4 Terminology

Acronym	Definition
GUI	Graphical Users Interface
CM	Child Mode
PM	Parent Mode

2 FEATURES TO BE TESTED

This section lists and gives a brief description of all the major features to be tested. For each major feature there will be a Test Design Specification added at the end of this document.

2.1. Graphical User Interface (GUI)

In this project, games and user-accessible panels were made with GUI. There are two buttons that separate users on the start screen, category buttons that provide access to games, and some display buttons on the parent's panel. Apart from these, there are games, trainings and tests.

3 TEST DESIGN SPECIFICATIONS

3.1. Graphical User Interface (GUI)

3.1.1. Child Mode Button (GUI.CHM_BTN)

User can enters child game mode by clicking Child mode button.

3.1.2. Parent Mode Button (GUI.PM_BTN)

User can enters parent mode by clicking Parent mode button.

3.1.3. Categories Alphabet Button (GUI.CTG_A_BTN)

User can enters Alphabets by clicking Alpahet button.

3.1.4. Categories Numbers Button (GUI._CTG_N_BTN)

User can enters Numbers by clicking Numbers button.

3.1.5. Color Button in Categories (GUI.CTG_C_BTN)

Using this button, the user switches to the color category series.

3.1.6. Button of All Letters (GUI.LTR_BTN)

With this button, the user selects letters to enter the education-game-test series created for each letter in the alphabet category.

3.1.7. Button of All Numbers (GUI.NBR_BTN)

With this button, the user selects a number to enter the education-game-test series created for each number in the number category.

3.1.8. Button of All Colors (GUI.CLR_BTN)

With this button, the user selects the color to enter the color series created for each color in the color category.

3.1.9 Passing The Next Step (GUI.GMS_NXT_BTN)

Go to next step of the current element. Player pass the next step.

3.1.10 Going Back To Corresponding Elements Menu (GUI.GMS_BCK_BTN) Player goes back to corresponding element which are letters or colors or numbers menu.

3.1.11 Going Back To Categories Menu (GUI.CTG_BCK_BTN)

Player goes back to categories menu which player can select a categories from.

3.1.12 Going To Home Screen (GUI.HOME_BTN)

Player goes directly to home screen which player can select the user mode.

3.1.2 Test Cases

TC ID	Requirements	Priority	Scenario Description
GUI.CHM_BTN	3.1.1	H	Select “Child” button. After selecting, Categories(Alphabet, Numbers, Colors) will be displayed.
GUI.PM_BTN	3.1.2	H	Select “Parent” button. After selecting, Options will be displayed.
GUI.CTG_A_BTN	3.1.3	H	Select “Alphabet” button. After selecting some letters(A,B,C) will be displayed.
GUI._CTG_N_BTN	3.1.4	H	Select “Numbers” button. After selecting some numbers(1,2,3) will be displayed.
GUI.CTG_C_BTN	3.1.2	H	Select the "Color" button. After selection, the Color category is displayed.
GUI.LTR_BTN	3.1.2	H	Select the "Letter" button. After selection, the series of letters is displayed.
GUI.NBR_BTN	3.1.7	H	Select the "Number" button. After selection, the series of numbers are displayed.
GUI.CLR_BTN	3.1.8	H	Select the "Colors" button. After selection, the series of each color is displayed.
GUI.GMS_NXT_BTN	3.1	H	Go to next step of the current element. Player pass the next step.
GUI.GMS_BCK_BTN	3.1	L	Player goes back to corresponding element menu.
GUI.CTG_BCK_BTN	3.1	L	Player goes back to categories menu.
GUI.HOME_BTN	3.1	H	Player goes directly to home screen which player can select the user mode.

3.2. Child Mode

3.2.1.Explore Map (CM.EXM)

Children can find and use all the games for their learning process.

3.2.1.1 Education

3.2.1.1.1 .Explore Map (CM.EDU_EXM)

Player learns current element via those educations.

3.2.1.1.2 Test Cases

TC ID	Requirements	Priority	Scenario Description
CM.EDU_EXM 0	3.1.1	H	Joystick mechanic (path) to draw continues lines on canvas.

3.2.1.2 Game

3.2.1.2.1 .Explore Map (CM.GAME_EXM)

The user can switch to the game part in each category by clicking the "Game" button. The user can play games within the categories of letters, colors, and numbers.

3.2.1.2.2 Test Cases

TC ID	Requirements	Priority	Scenario Description
CM.GAME_EXM 0	3.1.1	H	With Joystick mechanic, the position of the game objects in the game is changed.
CM.GAME_EXM 1	3.1.2	H	With Hold mechanics, the state change of game objects in the game is triggered.

3.2.1.3 Test

3.2.1.3.1 .Explore Map (CM.TST_EXM)

User can test yourself every categories and every single letter,number or color by clicking Test button.

3.2.1.3.2 Test Cases

TC ID	Requirements	Priority	Scenario Description
CM.TST_EXM 0	3.1.1	H	Tap mechanic (press the buttons) to select a choice.

4. Detailed Test Cases

4.1 GUI.CHM_BTN

TC_ID	GUI.CHM_BTN
Purpose	Select the "Child" mode button.
Requirements	3.1
Priority	High.
Estimated Time Needed	No estimated time needed
Dependency	Application running on home screen.
Setup	All user enterance displayed.
Procedure	[A01] Select to Child mode.
	[A02] Go to categories.
Cleanup	Back

4.2 GUI.PM_BTN

TC_ID	GUI.PM_BTN
Purpose	Select the "Parent" mode button.
Requirements	3.1
Priority	High.
Estimated Time Needed	No estimated time needed
Dependency	Application running on home screen.
Setup	All user enterance displayed.
Procedure	[A01] Select to Parent mode.
	[A02] Go to options and settings.
Cleanup	Back

4.3 GUI.CTG_A_BTN

TC_ID	GUI.CTG_A_BTN
Purpose	Select the "Alphabet" category button.
Requirements	3.1
Priority	High.
Estimated Time Needed	No estimated time needed
Dependency	Categories must be displayed.
Setup	Child mode selected.
Procedure	[A01] Select to Alphabet category.
	[A02] Go to Alphabet series.
Cleanup	Back

4.4 GUI._CTG_N_BTN

TC_ID	GUI.CTG_N_BTN
Purpose	Select the “Number” category button.
Requirements	3.1
Priority	High.
Estimated Time Needed	No estimated time needed
Dependency	Categories must be displayed.
Setup	Child mode selected.
Procedure	[A01] Select to Number category.
	[A02] Go to Number series.
Cleanup	Back

4.5 GUI.CTG_C_BTN

TC_ID	GUI.CTG_C_BTN
Purpose	Select the "Color category" button.
Requirements	3.1
Priority	High.
Estimated Time Needed	No estimated time.
Dependency	Color category is displayed.
Setup	Child mode selected.
Procedure	[A01] Select the "Color" button.
	[V02] Go to colors.
Cleanup	Back

4.6 GUI.LTR_BTN

TC_ID	GUI.LTR_BTN
Purpose	Select the "Letter" button.
Requirements	3.1
Priority	High.
Estimated Time Needed	No estimated time.
Dependency	Letter category is displayed.
Setup	Child mode selected.
Procedure	[A01] Select the "Letter" button.
	[V02] Go to letter category.
Cleanup	Back

4.7 GUI.NBR_BTN

TC_ID	GUI.NBR_BTN
Purpose	Select the "Number" button.
Requirements	3.1
Priority	High.
Estimated Time Needed	No estimated time.
Dependency	Number category is displayed.
Setup	Child mode selected.
Procedure	[A01] Select the "Number" button.
	[V02] Go to number category.
Cleanup	Back

4.8 GUI.CLR_BTN

TC_ID	GUI.CLR_BTN
Purpose	Select the "Color" category.
Requirements	3.1
Priority	High.
Estimated Time Needed	No estimated time.
Dependency	Color category's elements displayed
Setup	Child mode selected.
Procedure	[A01] Select the "Color" category.
	[V02] Go to colors category.
Cleanup	Back

4.9 GUI.GMS_NXT_BTN

TC_ID	GUI.GMS_NXT_BTN
Purpose	Going to next step
Requirements	3.1
Priority	High.
Estimated Time Needed	No estimated time needed
Dependency	Current step must be completed.
Setup	Child mode selected.
Procedure	[A01] Go to an element from categories.
	[A02] Complete the step properly.
	[A03] Click Next Button
Cleanup	Back to elements menu

4.10 GUI.GMS_BCK_BTN

TC_ID	GUI.GMS_BCK_BTN
Purpose	Going back to elements menu
Requirements	3.1
Priority	High.
Estimated Time Needed	No estimated time needed
Dependency	Element must be started
Setup	Child mode selected.
Procedure	[A01] Go to element from categories
	[A02] Click Back button
Cleanup	Back to elements menu

4.11 GUI.CTG_BCK_BTN

TC_ID	GUI.GMS_BCK_BTN
Purpose	Back to categories menu
Requirements	3.1
Priority	High.
Estimated Time Needed	No estimated time needed
Dependency	Elements menu is displayed
Setup	Child mode selected.
Procedure	[A01] Go to categories
	[A02] Select categories
	[A03] Click Back button
Cleanup	Go back to categories menu or element menu

4.12 GUI.HOME_BTN

TC_ID	GUI.HOME_BTN
Purpose	Go to Home Screen
Requirements	3.1
Priority	High.
Estimated Time Needed	No estimated time needed
Dependency	The simulation is executed
Setup	Child or parent mode selected.
Procedure	[A01] Select a user mode
	[A02] Click the Home button
Cleanup	Go to Home Button

4.13 CM.EDU_EXM 0

TC_ID	CM.EDU_EXM 0
Purpose	Drawing lines on screen
Requirements	3.1
Priority	High.
Estimated Time Needed	No estimated time needed
Dependency	Education of the element running
Setup	Child mode selected.
Procedure	[A01] Go to elements menu.
	[A02] Select an element.
	[A03] Draw lines according to instructions
Cleanup	Go to next step or back previous

4.14 CM.GAME_EXM 0

TC_ID	GUI.GAME_EXM 0
Purpose	Joystick mechanic, the position of the game objects in the game is changed.
Requirements	3.1
Priority	High.
Estimated Time Needed	No estimated time needed
Dependency	The education phase should be completed successfully.
Setup	The game needs to be opened.
Procedure	[A01] Replace object.
	[A02] Drop the game object to the correct position.
Cleanup	Back

4.15 CM.GAME_EXM 1

TC_ID	GUI.GAME_EXM 1
Purpose	Hold mechanics, the state change of game objects in the game is triggered.
Requirements	3.1
Priority	High.
Estimated Time Needed	No estimated time needed
Dependency	The education phase should be completed successfully.
Setup	The game needs to be opened.
Procedure	[A01] Trigger the object.
	[A02] Change the state of the object.
Cleanup	Back

4.16 CM.TST_EXM 0

TC_ID	GUI.TST_EXM 0
Purpose	Select the Test option for all categories.
Requirements	3.1
Priority	High.
Estimated Time Needed	No estimated time needed
Dependency	Categories must be displayed.
Setup	Child mode selected.
Procedure	[A01] Select to Test option.
	[A02] Go to Alphabet, Number or Color test game series.
Cleanup	Back

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