Augmented Reality Applications for Special Kids

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***Abstract*— As there is no medical test to detect some of the particular needs, there is much work to be done when it comes to caring for special children who have neuro-developmental disorders. Learning difficulties and poor social skills are special needs children's main problems. They are unable to converse like people in the physical world do. They can learn skills more effectively by using an augmented reality or augmented world to build these skills. It lessens the dread of close relationships. They employ virtual and augmented reality to hone their talents and as a platform for phobia therapy. Through the stimulation of augmented reality, these technologies provide children with straightforward techniques that help them become aware of and accepting of the real physical world. The understanding of concepts is enhanced when Augmented Reality (AR) and Virtual Reality (VR) are used in the teaching of special needs children. The stimulation of the real world and its objects, as opposed to learning from outdated or domestic teaching methods, can improve the experience of learning, understanding, and applying the knowledge or discipline gained from a process in the real world without the fear of being incorrect and by reducing the margin for error. This results in a child to have a regular life and a good education. In this work we have created an application using unity, vuforia, C#, android studio. Audio implemented in this app helps the children to learn the scenarios in English and Kannada. This app helps the parents and care taker to teach social behaviour to special children.**

Keywords*— *Augmented Reality, Virtual Reality, Special Kids, Social Needs, Unity, Vuforia., Audio

I. INTRODUCTION

AR and VR technologies are used in distance learning and various areas of education. These technologies are used in various fields like healthcare, automotive industry, retail, tourism, real estate, architecture, interior design and many more. In education, these can enhance the students' experience in the classroom and it expands learning opportunities. Various research shows that using AR/VR technologies have been improving the growth of the education and understanding ability of the students. AR VR technologies can be used for education of special kids, to develop their learning abilities and social skills.

Special kids – According to APA (American Psychological Association) dictionary of psychology- a child who requires special education for mental and physical development can be considered as special kids. Special needs include physical illness, learning disabilities and terminal illness. They need special attention, wide range of educational programs and emotional support. Special education means specially designed programs, services for learning of special kids. Special kids may require alternative approaches for the education. The more practical education will be helpful to understand the basic level education.

Some of the characteristics shown by the kids in the early age of development are less to no interest in sharing, trouble appreciating their own emotions, struggling in holding eye contact, problems in making friends, lack of communication skills, less grasping power, hypersensitivity, difficulty in accepting change of routine, repetitive movements, organizing things is a particular manner, upward slanting eyelids, Poor muscle tone, learning disabilities, Visual or hearing impairment, Physical strength, difficulty in attention span.

a) NEED FOR AR/VR TO SPECIAL KIDS

According to UNESCO, $3/4^{th}$ of children with special needs are at an age of 5, and $1/4^{th}$ of special needs kids are between age 5 to 19 years. They don't like to study and attend educational institutions. To educate them and to teach social skills and knowledge various technologies can be used.

By creating environments that simulates the physical presence of individuals in real world or augmented environment. AR will help kids with disabilities (like learning disabilities) to develop their knowledge, communication skills, behaviour towards the physical world. Kids with autism have challenges in behaviour towards real world, social skills, sensory and/or attention issues, verbal and/or non-verbal communication. For kids with autism spectrum disorder and down syndrome, imagining the scenario might be difficult that's why AR VR technology can be used. So that feared situation for special need kids can be given in a controlled way under the supervision. And it helps to improvise the condition of the special kids in learning behaviour, social skills, and phobia.

II. LITERATURE SURVEY

In the present day, everyone is trying to combine mixed or augmented reality technology with many other fields like movies, gaming, healthcare, etc. According to [1] many researchers agree that VR/AR technology is more useful in present education and other fields also. After refereeing many research papers and many research we found out that we can also use VR/AR in many other ways. In [2] the authors discussed [2] how VR/AR helps to make the 3D vision of the object which will be more attractive and more effective for the education system. They addressed how autistic child can be trained to behave in the public using AR/VR technology. [3] One of the studies in this paper helps the special kids in four educational directions they are societal adaptation/reconstruction, personal relevance, and development of cognitive skills. The researchers said they need VR in this field can be used effectively. The study of VR was focused on the improvement of social aspects, such as social skills and cognition. It was designed for meeting and behaving with new people. How to interact with new people and new places. The students completed the training sessions on VR[4].In [5] the studies was focused on cognitive-behavioural therapy (CBT). The technology uses a wide blue room, in which the participants need not wear

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headsets because they were able to see 360 degrees around spanning and moving in the room. They divided the treatment into 4 sessions and were giving treatments. In [6], they attempted to bring augmented reality and cognitive rehabilitation together which offers a cognitively engaging strategy for autism intervention. The approach focuses on treating the underlying cognitive deficits that underlie diseases, and it employs augmented reality to keep kids' concentration levels high.

In the education system, VR/AR technology is used widely nowadays. They now become an effective education system. They can create any augmented videos or images which are useful for the children.it will be more useful and easier to understand the working or process of the machine. There are many useful projects which help teachers to teach social skills and behaviour to the students [7]. According to [8] AR/VR are used in neurosurgeries. As this is the most complicated and sensitive surgery this is also controlled by machines and computers. They use VR as the output screen when they are doing surgery. They use MR technologies to control the needles and other medical equipment. The main questions addressed in [9] are what kind of augmented compatible devices are to be provided and why we need to provide. For different purposes there are several different devices that are designed in Augmented Reality. For example, heads up displays, Holographic displays, etc. [10] The researcher's studied many documents based on VR/AR technology. They found that this can be more useful in educating the children in a better way so that they can get and understand the information easily and can develop it in their life. They took the child who has autism or autism spectrum disorder (ASD) and analysed his disorder and characterized him based on it. They innovated the technology that could help that child. In the present day, everyone is trying to combine augmented and mixed reality (AR/VR) technology with many other fields like movies, gaming, healthcare, etc. They have used this because it was a very difficult task to make just types of children behave correctly in the public

The authors have reviewed various VR and AR assessments and interventions and validated their benefit and acceptability among individuals with ASD [11]. These assessments focused on building social skills and targeted children and adolescents. The authors have identified issues like less participants (low female representation) which need to be addressed. The authors recommend for studies utilising augmented reality with more rigorous designs utilising tried-and-true, empirically supported intervention techniques. [12] The authors have highlighted the impact of fears and phobias on daily lives of autistic children. In order to combat this, the authors created and presented a treatment that combines cognitive behavioural therapy (CBT) and immersive augmented reality (AR) exposure to lessen anxiety. This treatment was successful in a pilot scale trial. Data from 6-month study revealed positive response and real life functional improvements in participants. According to the authors' preliminary research, graded exposure combined with CBT may be a successful treatment for autistic individuals with phobias. For the purpose of examining the influence and efficacy of augmented reality on the social, cognitive, and behavioural domains in autistic children and adolescents, the authors have created an evidence-based systematic review that incorporates pertinent scientific databases [13]. The research studies analysed provided encouraging results on the efficacy of augmented reality-based therapies for the promotion, support, and preservation of health and wellbeing in autistic children and adolescents. The authors also suggested scope and direction for future work. In [14] the authors have highlighted the positive influence and importance of AR, VR and DL in the lives of children suffering from ADHD. The authors have discussed how to accurately detect ADHD in children using a sensitive and specific ADHD-VR diagnostic tool prototype using DL model. The four-step strategy that the authors have suggested is a mixed-method research design that combines qualitative and quantitative approaches to lessen bias and gather crucial data to assure the validity and applicability of the study findings. The researcher's studied many documents based on VR/AR technology. They found that this can be more useful in educating the children in a better way so that they can get and understand the information easily and can develop it in their life. They took the child who has autism or autism spectrum disorder (ASD) and analysed his disorder and characterized him based on it. They innovated the technology that could help that child [15]. VR/AR technology now become an effective education system. They can create any augmented videos or images which are useful for the children.it will be more useful and easier to understand the working or process of the machine. There are many useful projects which help teachers to teach social skills and behaviour to the students. The researchers' observation of this leads to more improvement in design processes. the designing of any automobile parts or any other electric, mechanical part VR/AR technology will also play a major role in that. They have created multiple interior designs for houses, colleges, schools, and many other buildings. [17] In the present day, everyone is trying to combine augmented and mixed reality (AR/VR) technology with many other fields like movies, gaming, healthcare, etc. They have developed many applications to healthcare issues and enhanced traditional solutions in healthcare. Nowadays in medical field they are using AR/VR technology in many complicated surgeries. Researchers [18-22] contend that the inclusion of robots in an interactive game will help youngsters with autism spectrum disorders enhance their motor skills and boost the expression of verbal and nonverbal communication.

A. AUGMENTED REALITY

AR enhanced version of the real physical world environment or the habitat which is achieved through the digital visual elements, sound and other technologies which stimulates artificial objects in the real environment. Augmented reality basically uses sensors to collect the data from the physical environment. and then it will transmit them to an AR application. So, this application helps us to see through this image and get the data through this live view. So also, we can say that it is totally different from virtual reality. AR helps us to complete the tasks better and efficiently. The main goal of AR is to enhance performance and perception of the world and it is infiltrating many industries of our society today.

Tools available for AR: Amazon Sumerian, AR.js, Vuforia, Apple ARKit, Wikitude, MaxST, ARToolKit, HoloLens and many more available in market. These tools are used to create 3D objects, simulation and VFX, animation and development of virtual environments.

B. VUFORIA

The cutting-edge AR building engine Vuforia offers an easy-to-use platform for building AR applications for iOS and Android devices. Vuforia has a wide range of features and is compatible with various tools. Building such applications requires a 3D design tool where such items, known as 3D models, may be developed because many AR applications incorporate the display of virtual 3D objects over the real world. Unity3D, a potent game engine that enables the creation of 2D and 3D scenarios, games, and simulations, now holds the top spot in the ranking of such tools. AR applications have been made using a combination of Vuforia and Unity3D. The built-in support for Vuforia in Unity3D makes it simpler to create AR applications.

C. UNITY

One of the most effective game platforms, Unity 3D enables to create both 3D and 2D models. Additionally, it offers several capabilities, including the ability to add movement, sound, text, and photos. In addition to creating 2D and 3D games, it is fantastic for designing for virtual reality (VR) and augmented reality (AR). Anyone can use Unity for free and quickly learn how to make games because of this. While we are working on the special kids this platform will be more useful. When it comes to kids based on the many research, most of them are more attracted to cartoons than real-world objects. Kids' minds and eyes are catchier to the cartoons at that age so we are using the blender to create the charters that are useful to show them how they should behave or do work. For example, there are two images here: Figure 1, the real-world image, and Figure 2 is a cartoon image. For kids, the cartoon image is attracted more than a real-world image. Their eyes are attracted to the colourful images and animated images. That will be a stick in their mind easily and they do what they saw in cartoons more than what they are heard.

III. AUGMENTED REALITY APPLICATIONS

- ***Full-Body tracking solutions.*** Manus VR stands for the most innovative full-body tracking AR/VR solutions. In order to enable full-body, tactile interactions in virtual reality, Manus introduces Polygon full-body tracking for VR and sophisticated Prime II gloves. Manus, a motion capture specialist, enters a new era of team collaboration in hyper-realistic immersive VR through natural body movements and accurate touch sensations. Now, Manus offers users a comprehensive, reliable, and effective VR system created especially for teams working in the enterprise sectors of the automotive, manufacturing, engineering, and life sciences, as well as those who develop virtual experiences for media and entertainment.
- ***Marker-based apps.*** The most well-known AR software principle is certainly this one. Markers come in many forms, from basic geometric shapes (which are typically wrapped in QR codes) to real-world things like human faces that are too complex for digital interpretation. These solutions require a lot of man hours to implement, which makes them somewhat resource-intensive. It takes a long time to process many diverse events.
- ***Gyroscope-based apps.*** Another typical method of using AR software is to simply use the data that the gyroscope of the user's smartphone has gathered. This in-built functionality allows developers to add life to virtual 3D things on top of actual objects in the real world.
- ***SLAM apps.*** These approaches make use of the Simultaneous Localization and Mapping principle, which is based on simultaneously gathering data from a number of sensors. They draw up three-dimensional objects on the background of real objects without utilising any markers, much like the gyroscope-based apps in the prior example.

IV. METHODOLOGY

The methods utilised to accomplish the social-emotional learning (SEL) utilising AR approach scenarios outlined for children with ASD is shown in Figure 1. By generating certain situations that assist them explain the important social skills to thrive in this world, this application can be used to educate kids valuable social-emotional abilities.

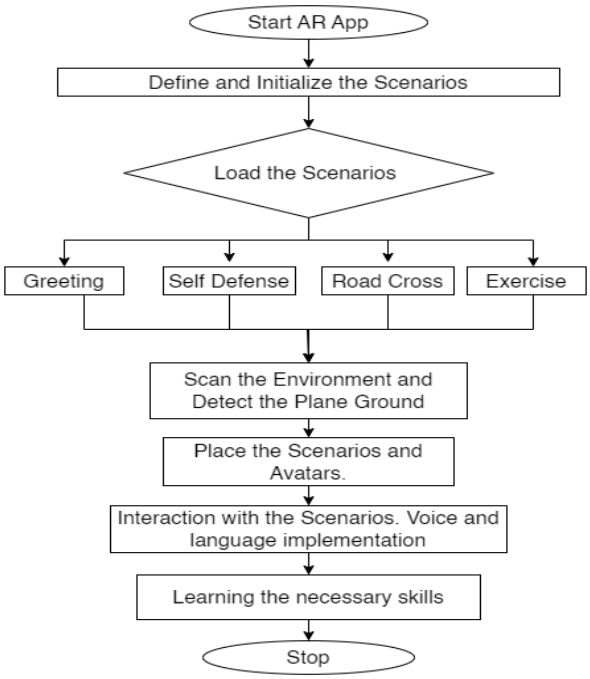

Fig 1. Process Diagram

The application is implemented using Unity and Vuforia framework. To carry out the research work few suggestions are taken from student counsellors who are helping special kids to lead a normal life. The skeleton of the algorithm of the application is presented in the following algorithm 1.

Algorithm 1

Step 1: ***Start***
Step 2: ***Define and Initialize the scenarios.***

```
public void LoadStartScene() {
int currentSceneIndex =
SceneManager.GetActiveScene().buildIndex;
SceneManager.LoadScene(0); }
```

Step 3: ***Load the Scenarios on function call.***

```
public void LoadGreeting() {
SceneManager.LoadScene(1);
    }
     public void LoadDancing() {
SceneManager.LoadScene(2);
}
```

Step 4: ***Scan the environment.***
Step 5: ***Detect the Plane Ground.***
Step 6: ***Place the scenarios and avatars.***
Step 7: ***Interaction with the scenarios. Voice and Language implementation.***

```
public GameObject voice;
 public void Playvoice()  {
     voice =
object.GetComponent<avatar>().set=file(audio
}
```

Step 8: ***Learning the necessary skills.***
Step 9: ***Stop.***

V. Results And Discussion

Scenarios will help the special kids to learn easily and practice in daily life. In this work we have created few scenarios. We used few avatars to simulate the scenarios. The parents or the caretaker can make the students to watch these scenarios and can explain to them how to behave in the society. The user interface of the application is shown in Fig2 and the user can select any one from the option specified. Few examples of the scenario are presented in the below Fig 3 and Fig 5.

Some additional features are voice over, the avatar speaks and imitates the scenarios so that the child can interact with the avatar and gain necessary skills, this can be a great way of teaching children. And we have added multiple language support for the kids as this can be used by different regions.

Fig 2: User Interface of the application

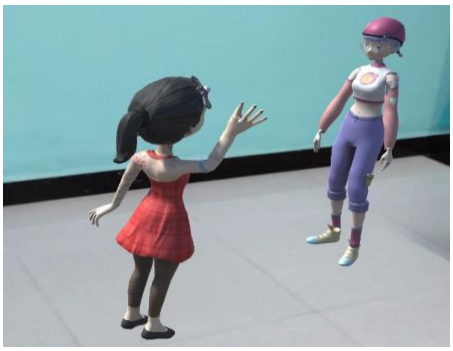

Fig 3: Greeting

For special children who ae in the nursery classes teaching alphabets is very difficult, so we created AR application which will help to understand and learn better. For example, if alphabet 'A' is pressed the child will be able to see Aeroplane is augmented in to the real world with the phonetics sound. This is created for all the 26 English alphabets and a sample is presented in Fig 6.

Fig 4: AR Experience with the application

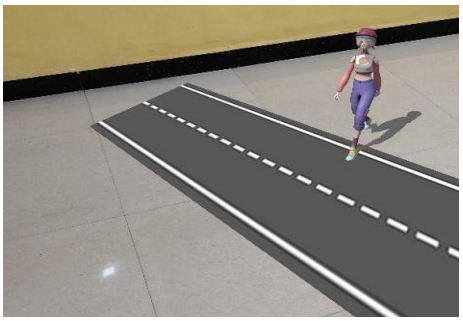

Fig 5: Road Crossing

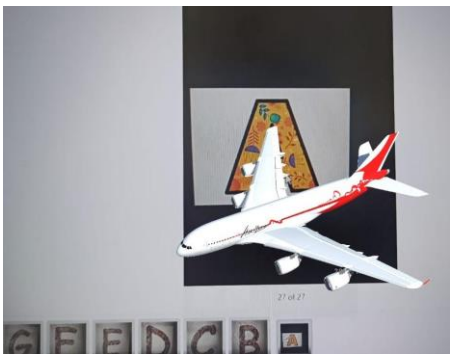

Fig 6: English Alphabets Learning

VI. CONCLUSION

The recent technological advancements have tremendously changed the scope and applicability of learning aids which encompasses learning everyday tasks, enhancing communication skills, boosting cognitive abilities and many more. Children with special needs are always battling the fear of performing daily tasks without making mistakes. AR tools can help children with special needs to interact with augmented environments through simulations thus helping them overcome fear of making mistakes and encouraging them to learn and perform day to day tasks, understand concepts, and interact with people, and hence becoming an indispensable tool in the field of teaching and guiding children with special needs. Conventional and Traditional methods of teaching are often ineffective and obsolete as they lack any actual world simulation. AR tools have an edge over traditional methods as they enhance learning experience by implementing real world simulations where the child can learn, grasp knowledge, and build cognitive, communication, disciplinary skills without the fear of being wrong and removes margin of mistakes. The AR app presented in this work includes the languages English and Kannada. Can add more languages for future enhancement. The scenarios and avatar can interact with the child as it contains voice over which makes it more interactive. AR tools can provide a more realistic and free learning space to children with special needs thus helping them reach their potential and achieve independence in their daily lives.

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