Development of Virtual Reality Platform for Teaching Children with Special Needs

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Abstract. This study provides an overview at a possible solution to the problem of improving the quality of education for children with special needs through a virtual reality platform that uses machine learning. The purpose of this article is to use the abilities of VR and ML to help children with special needs to learn and socialize. The objects are the methods and tools of education for special needs. This platform is designed to solve the problems of children's difficulties with learning and socialization. For this purpose, the system was designed with the help of tools of virtual reality and machine learning. In this paper, we also give a description of the partial practical realization of the system. We conclude the investigation by highlighting the aspects that require further research and development.

Keywords: Virtual Reality, Machine Learning, Special needs.

1 Introduction

Students with special learning needs are more often enrolling in primary schools, so there is a problem for teachers and classmates because of apparent unclassified behavior to understand these children properly. As an example, Autism Spectrum Disorder (ASD) is a serious, incurable mental illness with complex phenomena and varying degrees of severity. Some people with special needs are low-talented, some are high-talented. The other ones are limited in language and speech. Almost all of them are clearly visible in social contexts, they cannot intuitively think about others and understand the social rules that most people automatically follow. They often show low sensitivity or hypersensitivity in their perception. Many have problems with concentration and focus. This group of people often suffers from stereotyped behavior. Some people are particularly interested in the topic, others do not understand it at all. Most of them have considerable difficulty manifesting adequate behavior in social situations, structuring themselves in everyday life and taking appropriate action. Frequent violations of small or large motor skills and poor space and time orientation skills are

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found. Problems often arise in the direct understanding and processing of what is being heard. All together, they have a qualitative deterioration of communication and interaction, as well as a limited range of interests [1].

Virtual reality. The combination of virtual reality and machine learning can be used in tandem to refine technological products and tools.

According to some experts, although the first presentation of virtual reality took place not too long ago, the origins of virtual reality can be traced back to the 1950s. The industry has obviously evolved over the last half-century. However, it is now changing faster than ever before. One of the most important reasons for the sudden evolution is the attempt to combine virtual reality and machine learning.

The example is technology ClassVR offers children exciting, wonderful oriented curricula, educational resources of virtual reality. Search can be done by subject, topic, or even keyword and find ready collections or individual resources to create their own lesson [1-3]. Computer vision expert Jack Clover delves into exploring the relationship between machine learning, artificial intelligence, and virtual reality. Artificial intelligence is a term that describes an algorithm that is based on its own knowledge base to deliver results that have a significant impact on users. With this concept in mind, it is easy to understand the importance of machine learning in this field. The connection to virtual reality becomes clearer when considering the increasing impact that machine learning has on it. A simple headset that displays digital images does not require artificial intelligence. However, virtual reality does depend on highly accurate AI algorithms to simulate reality. VR is a very powerful tool for helping children with special educational needs. Apps that already exist, help kids develop their learning and social behavior skills. These applications help children with special needs for several reasons:

- an opportunity to repeat the situation to look at another possible way of events;
- an opportunity to see places where the child has not been, in order to prepare for the trip morally;
- diving into an atypical place that they can get used to;
- the virtual world can become a safe place for a child to feel confident and calm;
- the possibility of increasing the level of empathy from others [5-6].

Machine learning. The purpose of machine learning is to program computers to use applications or past experiences to solve a particular problem. Pattern recognition, education, computer vision, bioinformatics, natural language processing, etc. are just a few of the areas where machine learning can be applied. ML / AI perspectives in personalized learning are mainly about optimizing, or at least improving learning. Coupled with a reliable assessment system, personalized learning enhanced by ML / AI may be able to tell teachers what the next lesson may be, which is optimal for the student's knowledge level, saving time and helping to improve the quality of learning.
ML and AI are helping to revolutionize education assessment. For example, Imbellus uses AI to understand the complexity of various forms of assessment tasks to help improve the ability to "level up" or to ensure test validity for each participant [4, 10,

14]. Machine learning has the potential to develop detailed personalized feedback logs for each student and to help set and achieve goals that are directly related to their strengths. More advanced ML platforms can gather information from a school or university curriculum, student essays, tests, and recommendations from teachers to determine what might be better for them. As a result, this technology will help students maximize their potential in certain areas of their strengths and interests, as well as address their weaknesses in order to turn them into more confident professionals in the future. Technology can also look at the grades and outcomes of extracurricular courses to identify potential career opportunities for each of them to succeed.

2 Description of the Platform

Our main goal is to help improve the learning and social skills of students with special learning needs using virtual reality and machine learning. Children, especially when they are very young, do not understand their differences from others and because of that they primarily need to be taught to realize their identity and social behavior properly. Later they can learn various subjects, such as mathematics, biology, history, art, music, physics, etc. Our system will help children develop their social skills in order to not deal with the misunderstanding of others. The teacher or assistant teacher chooses a lesson according to the level of knowledge and social skills of the student, and the child is going through a lesson as he wants. Because the lesson is designed in the form of a game, the child will not even notice that he is automatically receiving new knowledge and skills. At the end of each lesson accomplishments of completed tasks of the student are displayed as stars. The more stars student gather, the better his skills and knowledge will be.

Examples of social lessons that a child can learn [7-9]:

- a route to school;
- behavior in computer class;
- interaction with peers;
- behavior in the store;
- safety skills (fire, chemicals and so on. d.).

For a comprehensive picture of the essence of the system under study, we depict a tree of goals.

In order to represent the functionality and interaction of processes in a system, there are many methodologies. The IDEF0 methodology was chosen to represent this information system because it is the most common one for use where it is necessary to illustrate methods that require simple and clear definitions.

In addition to the inputs and outputs, the methodology has controls and mechanisms. The former serves as the kind of guide and instruction on which the interaction of functional blocks should take place. The second is, in fact, people with certain skills, equipment, hardware, etc. who serve as tools when executing the system.

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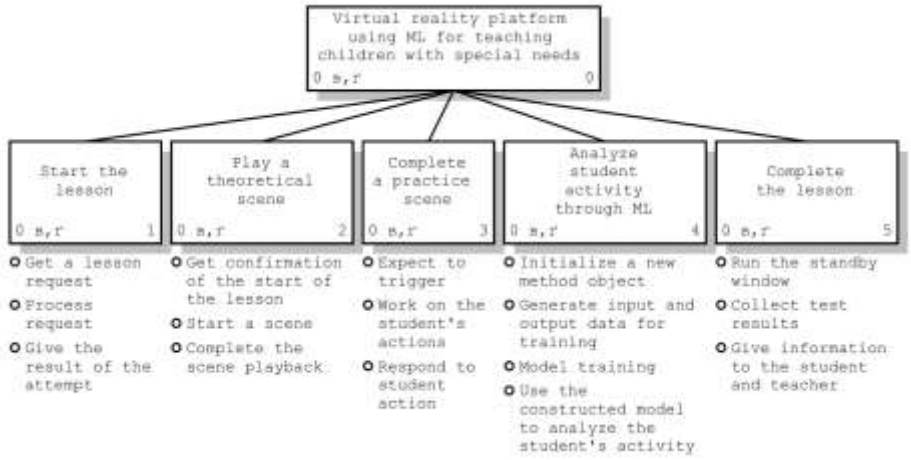

Fig. 1. Goal tree

The following four types of arrows are used for diagram A0. Input: Student's self-study, Choosing a lesson by a teacher. Output: "Test results for the student", "Test results for the teacher". Controls: “AR interface”, “Information technology tools (glasses, controllers, tablets, etc.)”, “Recommendations for the education of students with special needs”. Mechanisms: "Student with special needs", "Teacher", "Hard-ware".

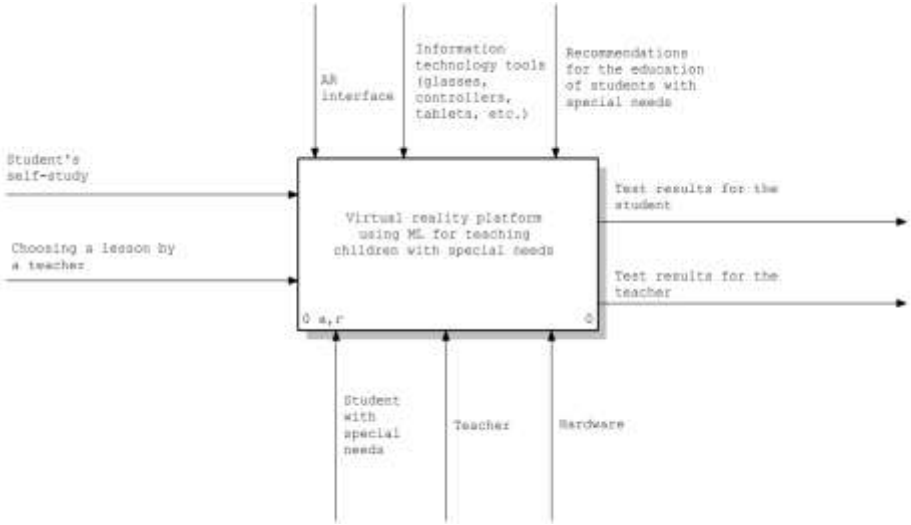

Fig. 2. Context chart A-0

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After determining the A0 level, which represents the main purpose of the system, at least one decomposition is made (usually two). Although, if required by the system, up to eight decompositions can be made for greater detail and clarity in illustrating the main functionality.

After breaking down the main functional block "Virtual reality platform using ML for teaching children with special needs", five new features were created: "Start the lesson", "Play a theoretical scene", "Complete a practice scene", "Analyze student activity through ML", "Complete the lesson".

All the arrows that were used in the previous diagram remain at this level. In addition, several new inputs and outputs have been added: "Running the theoretical part of the lesson", "Running the practical part of the lesson", "Data on student activity", "Running the standby window", "Data analyzed" [11-13].

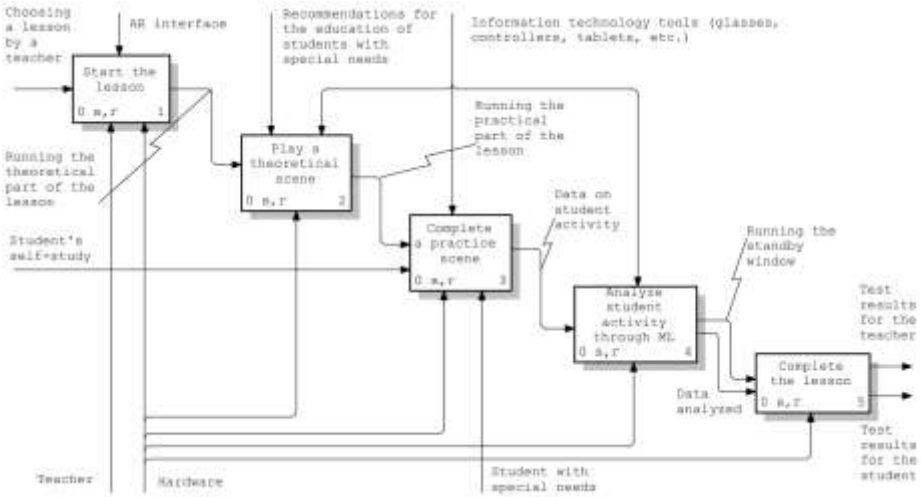

Fig. 3. IDEF0. Figure A0. Decomposition of the system.

4 Conclusions

After proceeding a detailed analysis, we can conclude that after successfully completing lessons given by the system, children would become more socialized, their level of knowledge would increase, there would be fewer conflicts with others. It should be noticed that this kind of learning would work only if parents are positive to help children understand what they learned. Virtual reality is a very powerful tool to help students with special learning needs to improve themselves. System designed with the help of machine learning methods and tools. It helps the system to predict student`s steps, so the system can suggest the alternative way the student can do.

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