

Bridging the gap: Exploring Robotic solutions for Children with Dyslexia

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***Index Terms*—Dyslexia, IoT, Social Robot, well-being.**

***Abstract*—This paper proposes a combination of IoT, robotics, and psychological support to help children with dyslexia improve their reading skills. Through IoT-enabled reading glasses and a reading assessment robot, real-time feedback is provided to parents and educators based on eye movements, reading speed, and comprehension. Interactive stories and personalized support engage children, while psychological strategies reduce anxiety during learning. This interdisciplinary approach offers accessible solutions to meet the specific needs of dyslexic children.**

I. INTRODUCTION

In recent years, the number of people suffering from dyslexia has increased significantly. According to estimates, about one in ten people are affected by dyslexia. Considering that the world population is about 7.8 billion, it can be inferred that there are about 780 million individuals with dyslexia worldwide.

Dyslexia is a disorder characterized by an unexpected difficulty in reading and understanding text. It is often caused by problems in the phonological processing of words. This is reflected in the comprehension of words, their correct perception, and the interpretation of variations in the sounds produced. The use of technological aids, such as text-to-speech software, speech recognition programs, social robots, etc., can promote the autonomy and inclusion of people with dyslexia, improving their ability to learn and communicate [1] [2].

Nowadays, robots have gained significant popularity and are being extensively utilized in various sectors, including industry [3], healthcare [4], education [5], and others. The classification of robots is quite complex and depends on several factors, such as architecture, scope, positioning, etc. [6]. Another important key classification factor is on the basis of the main functionality it can perform: the Autonomous Mobile Robot (AMR) is a type of robot that uses sensors and

cameras to move autonomously [7], while Automated Guided Vehicles (AGVs) require physical guidance for movement [8]. In addition, there are also Humanoid Robots (HR), which are designed with a very human-like structure and are capable of human-like movement [9].

In this article, we present an idea of the integration of a social humanoid robot with IoT glasses to support dyslexic children.

II. PROJECT IDEA

The goal of the work is to help children with dyslexia make reading easy and interactive and to provide real-time feedback through careful data analysis in order to monitor dyslexia symptoms and progress made over time. This is made possible through an entire IoT ecosystem that integrates robots and sensors in order to create interconnected environments, tools, and platforms that improve dyslexia support for children. By combining robotics, data analytics, and IoT connectivity, ideas can be developed that aim to provide personalized, adaptive, and affordable solutions to meet the needs of children with dyslexia.

In fact, one could think about the use of specific reading glasses equipped with IoT sensors that can detect text in order to transmit it to a robot that is able to make an assessment on reading in real time and provide feedback at the end of reading to parents, tutors or teachers. Adults can then have a clear understanding of the child's progress, strengths, and areas where additional support may be needed. This assessment can be done through various parameters, such as eye movements, reading speed, and comprehension level. In addition, the robot can access a wide range of interactive stories in order to engage dyslexic children through voice narration by the robot and the use of interactive images. This allows the child to interact and make decisions that influence the narrative flow.

According to the above, one could then think of an initial architecture that includes the following main components:

- **IoT reading glasses:** reading glasses are equipped with IoT sensors that detect text while reading. The sensors can be based on technologies such as **OCR (Optical Character Recognition)** [10] to convert visual text into digital format and *Eye Tracking* [11] to record eye movement during reading.
- **Reading evaluation robot:** the robot acts as a processing device in that it receives data from the detected text and processes it using text analysis algorithms. These algorithms can be designed to identify key words, assess pronunciation correctness, and detect reading errors, and then provide immediate feedback on the child's reading performance.

In addition, it would be appropriate to introduce psychological support for the child in order to foster the development of a sense of self-acceptance, promoting a positive self-image and solid self-esteem despite difficulties with reading and writing. Dyslexia can often cause a high level of anxiety, frustration and stress in the individual due to the daily challenges faced. Therefore, it is desirable to provide psychological support that can teach the child strategies to manage anxiety, such as practising deep breathing techniques, visualisation or cognitive restructuring. Such strategies can reduce stress levels and promote a feeling of calm during school activities.

To monitor the onset of anxiety and stress states, special sensors could be used. For example, the analysis of video recordings, tone of voice analysis and the use of IoT sensors such as heartbeat and perspiration detection could be used to measure and analyse such signals. The aim would be to alert the robotic system if frustration is detected, enabling it to provide the necessary psychological support.

III. CONCLUSIONS AND FUTURE WORK

The integration of IoT and robotics support has great potential in supporting children with dyslexia. The goal is to make reading easier, interactive, and personalized, while providing real-time feedback to monitor progress and effectively address dyslexia symptoms. By combining innovative technologies such as IoT sensors in reading glasses and assessment robots, along with psychological support, a holistic approach can be created to improve the reading experience of dyslexic children.

This interdisciplinary approach recognizes the importance of technological advances and psychological well-being in addressing the challenges of dyslexic children. This approach enables them to develop self-acceptance, manage anxiety, and build coping strategies, creating an environment conducive to their learning and growth.

In addition, this work aims to promote a sense of inclusiveness and equal opportunity for children with dyslexia by providing adaptive solutions that meet their specific needs. Through continuous data analysis, personalized feedback, and access to interactive stories, the project seeks to promote

engagement, confidence, and love of reading among dyslexic children.

Overall, by harnessing the potential of IoT, robotics, and psychological support, this idea aims to revolutionize dyslexia support, making reading an enjoyable and empowering experience for every child, regardless of their learning differences.

Regarding future developments, these could include integrating real-time language translation to support children with dyslexia who may have difficulty with multi-language environments. Also, among the sensors, the use of smartwatches could be considered, which can provide personalized support to children with dyslexia by enabling real-time reminders or offering guided exercises in real-time.

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