YEN-VISION: Design and Development of a Smart Interactive Device to aid Recognition of Facial Expressions in Students Affected with ASD

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Abstract— This project presents a meticulously devised three-level methodology aimed at nurturing the social and emotional development of children diagnosed with Autism Spectrum Disorder (ASD). Acknowledging the unique challenges encountered by individuals on the spectrum, our approach seamlessly integrates interactive technologies and hands-on experiences to cultivate a supportive and captivating learning milieu.

Level 1, the foundational comprehension of emotions is facilitated through an interactive system. This system seamlessly integrates smiley balls, push buttons, LED indicators, and RFID technology under the astute guidance of a supervisor. Through tactile feedback and visually intuitive cues, children are adeptly guided to recognize and interpret emotions, thereby laying the groundwork for subsequent developmental stages.

Level 2 introduces a sophisticated learning phase, fostering increased autonomy. Employing a purpose-built device featuring smiley balls linked to push buttons, monitors, and a Raspberry Pi for efficient processing, children independently engage with emotions showcased on a monitor. Immediate feedback, facilitated by a dynamic lighting system, prompts self-assessment and deepens comprehension of authentic emotions.

Level 3, emphasis is placed on assessing individual reactions to diverse stimuli. A specialized device comprising a camera, monitors, and a Raspberry Pi endowed with machine learning capabilities captures and analyses facial expressions and emotional responses. Leveraging cutting-edge technology and machine learning algorithms, this stage endeavours to offer nuanced insights into emotional responses, thereby facilitating the development of tailored intervention strategies for fostering enhanced social and emotional development in individuals with ASD. This comprehensive methodology encapsulates a holistic approach to bolster the social and emotional growth of children with ASD, equipping them with indispensable tools and strategies to confidently navigate and flourish in social interactions.

I. INTRODUCTION

Autism Spectrum Disorder (ASD) poses unique challenges to individuals affected by it, particularly in the realms of social interaction and emotional comprehension. As researchers and educators continue to explore innovative approaches to support the needs of individuals with ASD, the development of assistive technologies has emerged as a promising avenue for intervention. In this context, the present study introduces "YEN VISION," a pioneering Endeavour in the design and development of a smart interactive device tailored to aid the recognition of facial expressions in students affected by ASD.

The complex nature of ASD necessitates a multifaceted approach to address the diverse needs of individuals on the spectrum. Central to the challenges faced by students with ASD is the difficulty in understanding and interpreting facial expressions, a fundamental aspect of social interaction. Recognizing this critical area of need, our research endeavors to bridge this gap through the integration of interactive technologies and hands-on experiences, culminating in the creation of the YEN VISION device.

In line with the principles of inclusive education and assistive technology, YEN VISION aims to empower students with ASD by providing them with tools to enhance their social and emotional development. By leveraging advancements in technology, particularly in the fields of machine learning and facial recognition, our device seeks to provide real-time feedback and support to students as they navigate social interactions. This paper presents a comprehensive overview of the design and development process of the YEN VISION device, encompassing three distinct levels aimed at nurturing the social and emotional growth of students with ASD. Through a detailed examination of each level, including the underlying methodology and technological components, we elucidate the rationale behind our approach and highlight its potential impact on the educational landscape for individuals with ASD.

In the subsequent sections, we delve into the methodology employed in the design and implementation of each level of the YEN VISION device, outlining the specific features and functionalities that distinguish it as a ground breaking tool in the field of assistive technology for ASD. Through a rigorous analysis of our findings and a discussion of their implications, we aim to contribute to the ongoing discourse on innovative interventions for individuals with ASD, ultimately striving towards a more inclusive and supportive educational environment.

II. OBJECTIVE

The primary objective of the "YEN VISION" project is to design and develop a smart interactive device specifically tailored to aid in the recognition of facial expressions among students affected by Autism Spectrum Disorder (ASD). Grounded in the understanding of the unique social and emotional challenges faced by individuals with ASD, our Endeavour seeks to address these obstacles through the innovative integration of technology and educational strategies.

1. Enhancing Social Interaction: The project aims to enhance the social interaction skills of students with ASD by providing them with a tool that facilitates the recognition and interpretation of facial expressions. By fostering a deeper understanding of non-verbal communication cues, YEN VISION seeks to empower students to engage more effectively in social interactions and forge meaningful connections with their peers.

2. Facilitating Emotional Comprehension: Central to the development of individuals with ASD is the ability to comprehend and navigate the complexities of emotions. YEN VISION endeavors to support this aspect of emotional development by offering real-time feedback and guidance in identifying and understanding facial expressions. Through interactive engagement with the device, students can gain valuable insights into the emotional states of others, thereby fostering empathy and emotional intelligence.

3. Promoting Independence and Autonomy: Another key objective of the project is to promote independence and autonomy among students with ASD. By providing them with a user-friendly and intuitive interface, YEN VISION empowers students to actively participate in the learning process and make informed decisions regarding social interactions. Through personalized feedback and tailored intervention strategies, the device aims to instil confidence and self-reliance in students as they navigate social environments.

4. Advancing Assistive Technology: Beyond its immediate application in educational settings, the YEN VISION project contributes to the advancement of assistive technology for individuals with ASD. By harnessing the capabilities of machine learning and facial recognition technology, the device represents a cutting-edge solution that holds promise for addressing the unique needs of individuals on the autism spectrum.
spectrum. Through ongoing research and development, we aspire to refine and expand upon the functionalities of YEN VISION to further enrich the lives of individuals with ASD and promote inclusivity in society.

In essence, the objectives of the "YEN VISION" project extend beyond the mere creation of a technological device; they encompass a broader vision of empowerment, inclusion, and innovation in supporting the social and emotional development of individuals affected by ASD. Through a creative and emotionally resonant approach, we endeavor to pave the way for a more compassionate and understanding world for individuals with ASD.

III. METHODOLOGY

The "YEN VISION" project unfolds in a meticulously designed three-level framework, each level tailored to foster the social and emotional development of students affected by Autism Spectrum Disorder (ASD).

a. Level

Level 1: Foundation of Understanding

At the foundational level, aptly named the Foundation of Understanding, the journey begins with the cultivation of fundamental knowledge about facial expressions and emotions. Guided by dedicated educators and supervisors, students delve into a realm of discovery using a specialized device brimming with interactive elements. This level employs a multifaceted approach, integrating smiley balls, push buttons, LED indicators, and RFID technology to create an immersive learning environment. Through tactile feedback and visual cues, students embark on an exploration of basic emotions, guided gently by supervisors. In this nurturing space, students are encouraged to engage with the device, selecting emotions that resonate with them as they navigate through a spectrum of expressions. Through this interactive process, the groundwork is laid for deeper comprehension and recognition of emotions, providing students with a solid foundation upon which to build their understanding.

Level 2: Implementing the Knowledge

Building upon the solid groundwork established in Level 1, Level 2, aptly titled implementing the Knowledge, focuses on empowering students to apply their newfound understanding in practical scenarios. Equipped with a purpose-built device featuring smiley balls, push buttons, monitors, and advanced processing capabilities, students embark on a journey of autonomy and self-discovery. In this stage, students are presented with real-world scenarios depicted on monitors, each evoking a range of emotions. With the interactive interface at their fingertips, students independently select the emotions they perceive, honing their skills through hands-on engagement.

Immediate feedback provided by the device through dynamic lighting serves as a guiding beacon, illuminating the path towards greater accuracy and comprehension. Through iterative exploration and practice, students gain confidence in their ability to interpret facial expressions, paving the way for deeper insights and understanding.
Level 3: Validating the Knowledge

The culmination of the YEN VISION journey unfolds in Level 3, validating the Knowledge, where students embark on a quest to validate and refine their understanding of facial expressions. In this advanced stage, students are presented with dynamic stimuli captured through a specialized device comprising cameras, monitors, and cutting-edge processing capabilities. As students interact with the device, their facial expressions and emotional responses are captured in real-time, providing invaluable insights into their inner world. Leveraging machine learning algorithms and facial recognition technology, the device offers personalized feedback, validating the accuracy of students’ interpretations and guiding them towards a deeper understanding. Through this immersive and experiential process, students transcend the realm of theoretical knowledge, gaining profound insights into the intricacies of human emotions. Armed with newfound understanding and confidence, students emerge from Level 3 equipped to navigate the complexities of social interaction with grace and empathy.

In essence, the three-level methodology of the YEN VISION project embodies a holistic approach to supporting the social and emotional development of students affected by ASD, fostering empowerment, autonomy, and validation at every step of the journey.

b. Working principle

The "YEN VISION" project operates on a three-level framework, each level employing distinct methodologies to facilitate the recognition of facial expressions in students affected by Autism Spectrum Disorder (ASD). Below are the working principles of each level, accompanied by corresponding flowcharts.

Level 1: Foundation of Understanding

Working Principle: At Level 1, the Foundation of Understanding, students engage with a specialized device equipped with interactive elements such as smiley balls, push buttons, LED indicators, and RFID technology. Guided by educators, students learn to recognize and interpret basic emotions through tactile and visual cues provided by the device.

As shown in the below flowchart a.

Level 2: Implementing the Knowledge

Working Principle: In Level 2, implementing the Knowledge, students utilize a purpose-built device featuring smiley balls, push buttons, monitors, and advanced processing capabilities. Through independent exploration of real-world scenarios displayed on monitors, students apply their understanding of facial expressions, honing their skills through hands-on engagement. As shown in the below flowchart b.

Level 3: Validating the Knowledge
Working Principle: Level 3, validating the Knowledge, involve the use of a specialized device comprising cameras, monitors, and cutting-edge processing capabilities. As students interact with the device, their facial expressions and emotional responses are captured in real-time. Leveraging machine learning algorithms, the device offers personalized feedback, validating students' interpretations of facial expressions and guiding them towards a deeper understanding.

Flowcharts

In essence, the "YEN VISION" project employs a progressive three-level approach to support the social and emotional development of students with ASD, guiding them from foundational understanding to independent application and validation of knowledge.

IV. RESULTS

Our project, YEN-VISION, utilizes a three-level framework to develop an interactive device aiding students with Autism Spectrum Disorder in enhancing social and emotional skills, particularly in recognizing facial expressions. At Level 1, an immersive learning environment introduces basic emotions through tactile feedback and visual cues. Level 2 enhances autonomy with a purpose-built device, engaging students in real-world scenarios for hands-on practice. Level 3 employs specialized technology to capture and analyze facial expressions in real-time, offering personalized feedback. Witnessing significant growth in students' social and emotional development, we're committed to advancing assistive technologies for ASD individuals. Future plans involve refining YEN-VISION with the latest in machine learning and facial recognition to create a more inclusive environment where every ASD individual can thrive.

V. ACKNOWLEDGEMENT

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VI. CONCLUSION

In conclusion, the "YEN VISION" project represents a significant step forward in the realm of assistive technologies for individuals affected by Autism Spectrum Disorder (ASD). Through a meticulously designed three-level framework, we have endeavored to foster the social and emotional development of students with ASD by facilitating the recognition of facial expressions.

From the Foundation of Understanding to the Validation of Knowledge, each level of the YEN VISION project has been carefully crafted to provide students with a supportive and engaging learning environment. By integrating interactive technologies with hands-on experiences, we aim to empower students to navigate the complexities of social interaction with confidence and empathy.

As we reflect on the journey of the YEN VISION project, we are encouraged by the positive impact it has had on the lives of individuals with ASD. Through ongoing research and collaboration, we remain committed to advancing the field of assistive technologies and promoting inclusivity in education and society.

In the spirit of continuous improvement and innovation, we look forward to further refining and expanding upon the YEN VISION project, with the ultimate goal of enhancing the quality of life and opportunities for individuals affected by ASD. Together, let us continue to strive towards a future where every individual is valued, supported, and empowered to reach their full potential.

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