A Computer Vision-Based Physical Activity Application for Children with Autism

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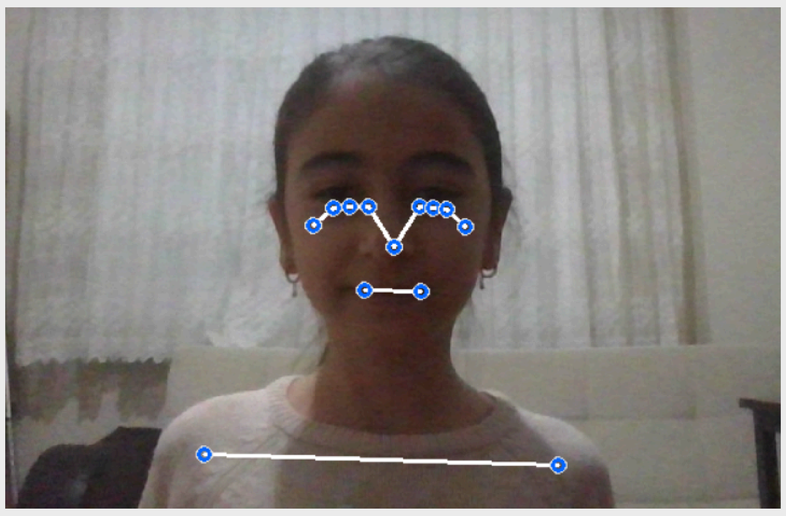
Abstract

Autism Spectrum Disorder (ASD) is a neurological condition characterized by challenges in social interaction, com- munication, repetitive behaviors, and restricted interests. While the exact cause remains unknown, ASD results from genetic and environmental factors and persists throughout life. Early diagnosis and intervention enhance quality of life and potential. Games have proven effective in nurturing socialization, skill ac- quisition, and adaptability in children with ASD, leveraging their structured and visually appealing design. This project adopted a game-based approach to support motor skills, socialization, and learning in children with ASD. Using computer vision techniques, children's movements were captured via cameras and trans- formed into interactive virtual characters in real time. Activities included movement mimicry games to improve attention and motor skills, dance games for physical coordination, and turn- based games to enhance social skills. The system, developed using Google MediaPipe and Unity, is cost-effective and suitable for preschools and home use. Feedback from educators at the Autism Sports and Life Center guided system refinement. Although in development, the project offers a robust foundation for fostering independence and social participation in children with ASD.

Introduction

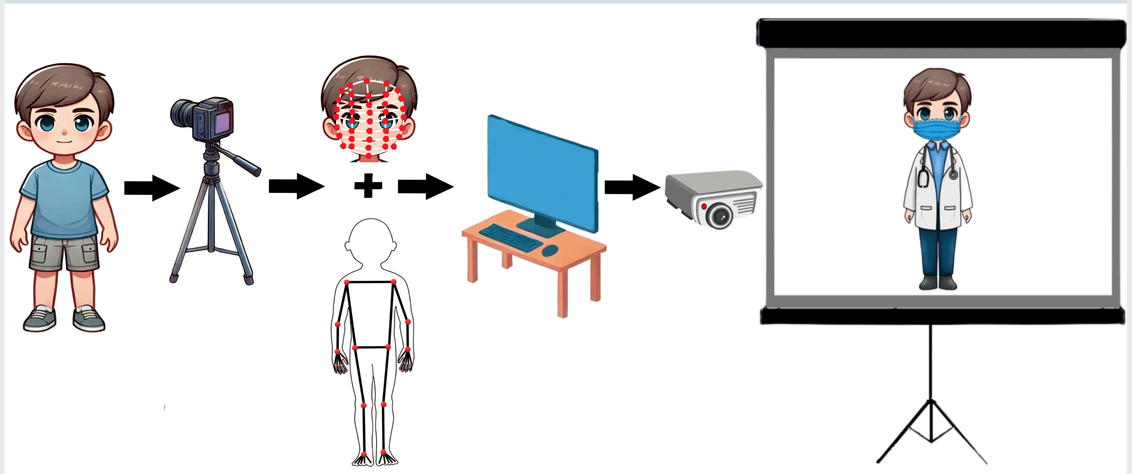
Play is a critical tool for children with autism, fostering skill acquisition, emotional development, and social interaction. Studies show that play therapy supports social skills and reduces problematic behaviors [1]. Traditional sedentary approaches fail to address the physical development needs of these children.

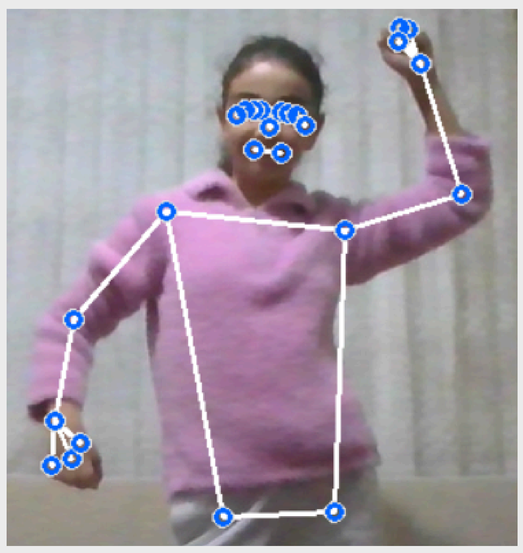
Given the rise in sedentary lifestyles post-pandemic and its negative impacts [2], this study offers an innovative system combining physical activities with technology, addressing a significant gap by promoting active engagement and motor skill development in children with ASD [3-5].

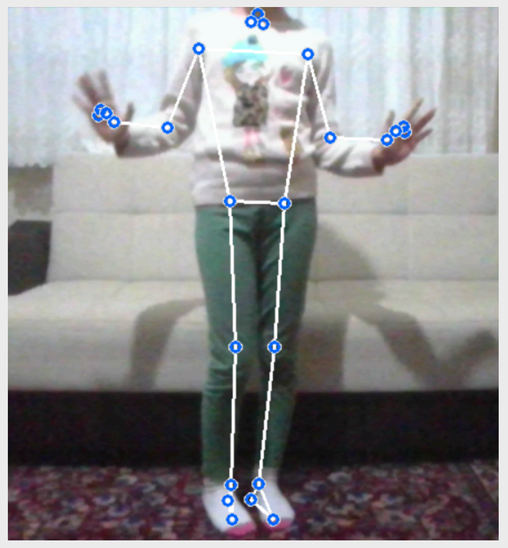


Methods

This game software supports skill development for children with autism using a computer, projector, and camera as input. It scans users, creates virtual characters with image processing, and mirrors their movements in real time. Activities are controlled through physical motions or facial expressions, rewarding children and recording data such as activity duration, preferences, and progress in JSON format. Tools like C#, Unity, and Google MediaPipe enable face and body detection, fostering interaction and monitoring emotional responses for developmental tracking.







Conclusion

This study shows that a game-based, technology-supported application enhances physical, cognitive, and social skills in children with Autism Spectrum Disorder (ASD). Tested at the İzmit Municipality Autism Sports and Life Center, it improved motor coordination, attention, and socialization. The system promotes independence, integrates technology into autism education, and offers a cost-effective solution for preschools and homes. Future work will focus on long-term effects, adapting activities for different needs, expanding device compatibility, and incorporating AI for personalized, culturally sensitive experiences.

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