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A Multi-Modal Approach for Early Autism Recognition Using Deep Learning and Sensory Data

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Abstract: With Early detection of Autism Spectrum Disorder (ASD) can make a life-changing difference in a child's journey, helping them receive the right support at the right time. This project introduces a smart, hybrid system that combines advanced deep learning technology with proven treatment methods, aiming to close the gap between diagnosis and meaningful help. It examines various types of information such as behavioural assessments and sensory response patterns to train a model that can identify early signs of autism with high accuracy and consistency. When the system detects a possible case, it provides structured, theory-based activities designed to develop cognitive, social, emotional, and communication skills in young children. These activities are based on widely accepted approaches and are intended to encourage steady developmental growth. A major strength of this system is its automated reporting feature, which gathers diagnostic insights, structured treatment recommendations, and predicted progress into a clear, easy-to-read report for parents, therapists, and healthcare professionals, ensuring everyone stays informed and aligned. By blending advanced computational analysis with trusted treatment practices, the system ensures both accurate detection and a smooth path to intervention. It supports early diagnosis, ongoing guidance, and continuous monitoring, helping reduce delays and improving engagement in a child's developmental plan. This combined approach demonstrates how technology and professional expertise can work together to create an accessible, practical tool for ASD management. Its goal is to transform early detection into immediate, meaningful action that nurtures potential, builds confidence, and helps shape a brighter future for every child.

Keywords: Autism Spectrum Disorder (ASD), Early Detection, Multimodal Deep Learning, Behavioural Analysis, Real-Time Screening System, Feature Extraction, Risk Assessment Model, Therapy Recommendation System, Clinical Decision Support, AI in Healthcare.

I. INTRODUCTION

Autism Spectrum Disorder (ASD) is a developmental condition that affects communication, social interaction, and behaviour. Early identification of autism is very important because timely support and therapy can significantly improve a child's development and quality of life. However, access to professional screening may not always be easily available to every family. This creates a need for a supportive system that can help in identifying early behavioural signs and guiding parents toward further evaluation if required. The proposed project presents a web-based Autism Behavioural Screening and Therapy System that uses a hybrid approach combining behavioural feature analysis and machine learning. The system captures video and audio during a structured screening session, extracts key behavioural features, and predicts an autism risk score. Based on the result, a downloadable report is generated, and therapy suggestions are provided when necessary. The system is designed as an assistive tool to promote early awareness and support informed decision-making, not to replace professional diagnosis.

II. LITERATURE SURVEY

Autism Spectrum Disorder (ASD) has been widely studied in the fields of psychology, neuroscience, and computer science. Many traditional screening methods are based on questionnaires, behavioural observation, and clinical interviews conducted by trained professionals. While these methods are reliable, they require expert involvement and may not always be easily accessible to families in remote or resource-limited areas. In recent years, researchers have explored the use of machine learning and deep learning techniques for early autism detection. Several studies have focused on analyzing facial expressions, eye gaze patterns, speech characteristics, and social response behaviours using computer vision and audio processing techniques. These approaches aim to assist professionals by providing automated behavioural analysis.

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IV. RESULTS AND DISCUSSION

The proposed system was developed to analyze facial images and assess the potential risk of autism using a hybrid deep learning approach., the model was trained and tested on a dataset of facial images. The results showed that the Multi Modal approach improved the accuracy of prediction compared to using a single model alone. The system successfully identified key facial features and expressions that are commonly associated with autism risk, demonstrating its effectiveness in early screening.

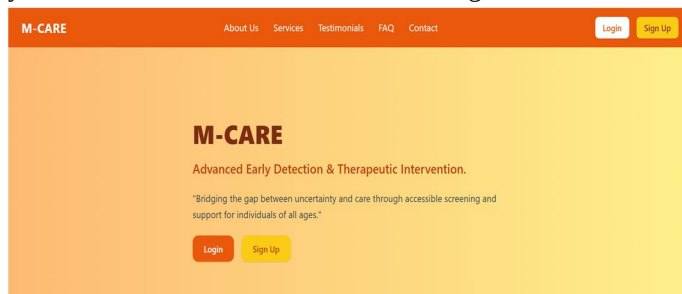


Figure 3.1: Home Page

The above page represents the landing page of the M-CARE system. It serves as the main entry point for users and introduces the platform's purpose, which is advanced early detection and therapeutic intervention for developmental concerns. The page includes navigation options such as About Us, Services, Testimonials, FAQ, and Contact, allowing users to explore information about the system. It also provides Login and Sign Up buttons to enable users to access or create their accounts. The design is simple and user-friendly, ensuring easy navigation and accessibility for all users.

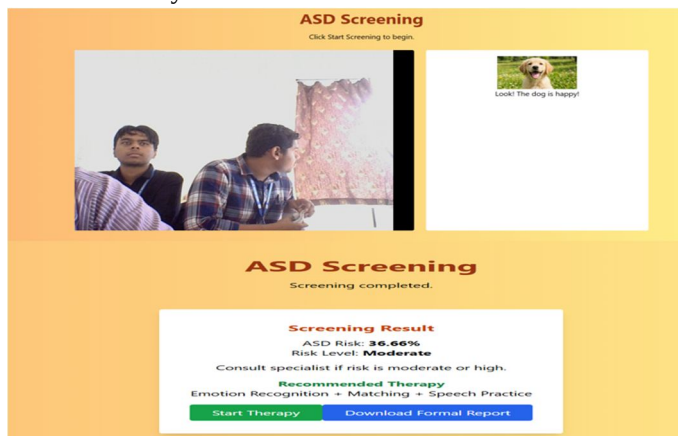


Figure 3.2: Screening page

The above page shows the ASD Screening Result section of the system. After the screening session is completed, the system displays the calculated autism risk percentage along with the corresponding risk level. It also provides a brief explanation of the result and suggests recommended therapy options based on the analysis. The page includes options such as "Start Therapy" and "Download Formal Report," allowing users to either begin the suggested intervention or download the detailed screening report for future reference. The layout clearly presents the outcome of the screening in a simple and understandable format for users.

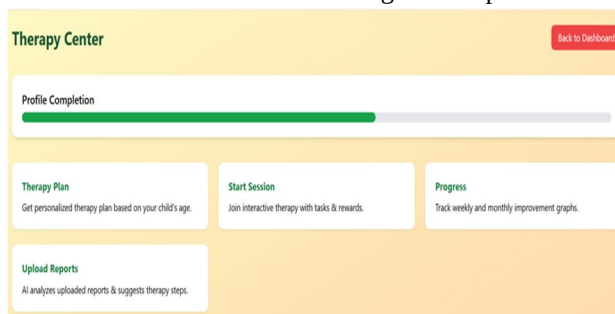


Figure 3.3: Therapy section page

The above page represents the detailed Therapy Centre section of the system. It provides various therapy session tools designed to support the child's development after the screening process. The page includes options such as uploading reports, generating a personalized therapy plan based on the child's age, starting interactive therapy sessions, and tracking progress through weekly or monthly improvement graphs. A profile completion progress bar is also displayed to monitor user activity and engagement. This section helps parents or guardians manage therapy activities in a structured and organized manner, promoting continuous improvement and regular follow-up.

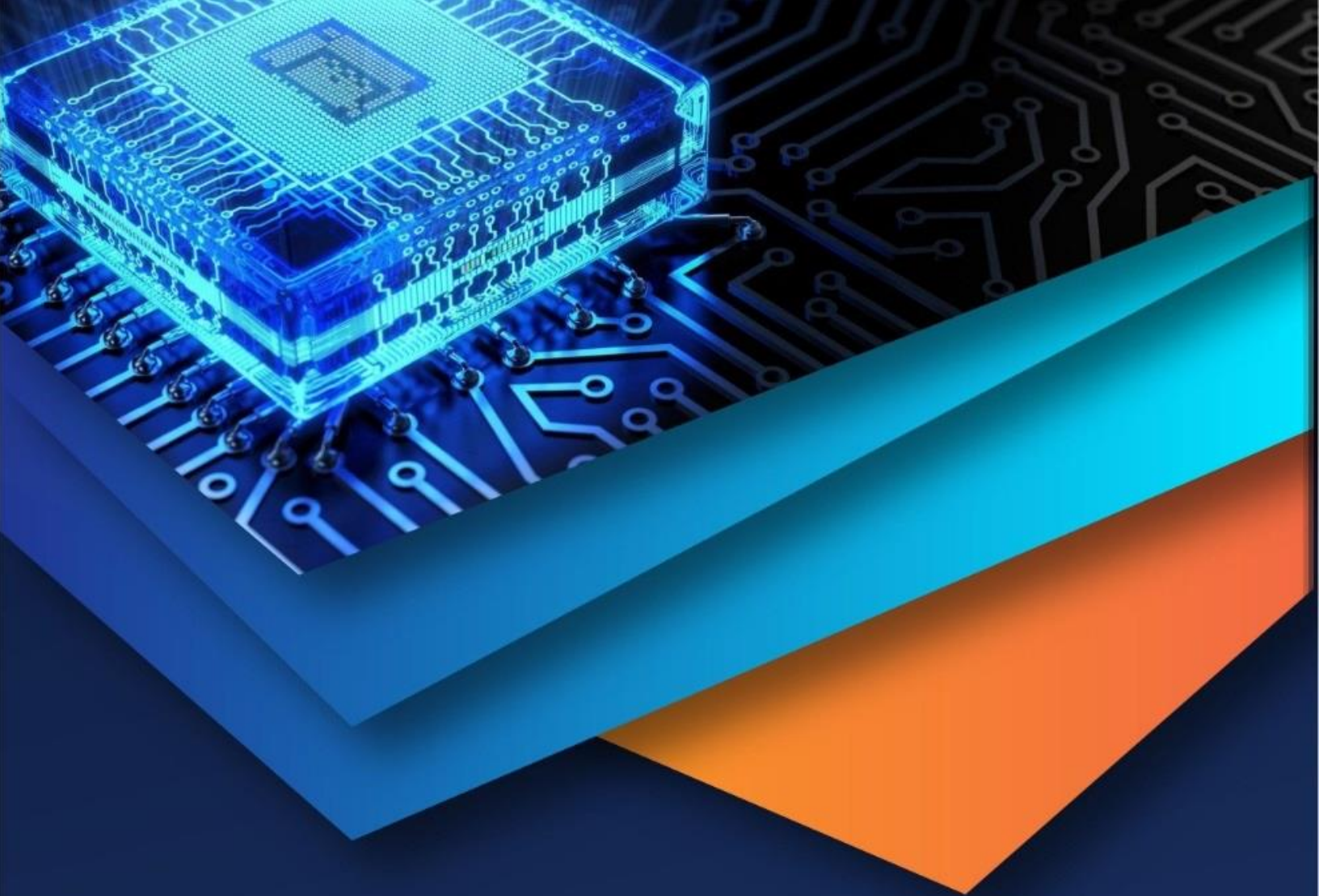
V. CONCLUSION

This project presents a practical and user-friendly system for early Autism Spectrum Disorder (ASD) risk assessment and therapy support. The system combines behavioural observation through video and audio analysis with machine learning to estimate autism risk in a structured manner. By guiding users through a screening session and automatically generating a detailed report, the platform simplifies the initial evaluation process and makes it more accessible.

In addition to screening, the system provides therapy suggestions and progress tracking features, helping parents and caregivers take the next step if a higher risk level is identified. The integration of screening, report generation, and therapy support within a single platform makes the system organized and easy to use. Although it is not a substitute for professional medical diagnosis, it acts as an assistive tool that promotes early awareness and timely intervention. Overall, the project demonstrates how technology can be effectively applied to support early developmental assessment and structured therapeutic guidance.

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