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Smart Autism Support System

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ABSTRACT: Autism spectrum disorder (ASD) can affect communication, social interaction, behaviour, and daily activities. Families and caregivers may need accessible ways to record observations, organize home-based activities, and review progress between professional appointments. This paper presents the design of a Smart Autism Support System, a web-based prototype intended to support caregivers and therapists with activity management, observation records, progress monitoring, support-level predictions, recommendations, and reports. The prototype uses a Python-based machine-learning component with a Logistic Regression model to classify records into Lower, Moderate, or Higher Support categories. The application uses a web interface, structured data storage, and a role-oriented workflow for caregiver and therapist activities. The current development dataset contains synthetic records; therefore, its predictions are suitable only for software demonstration and must not be interpreted as a clinical assessment or diagnosis. The system aims to make home-based tracking more organized and to provide a foundation for future evaluation with ethically collected, professionally reviewed data.

KEYWORDS: Autism Spectrum Disorder, Assistive Technology, Machine Learning, Logistic Regression, Home-Based Intervention, Caregiver Support, Progress Monitoring.

I. INTRODUCTION

Autism Spectrum Disorder (ASD) is a developmental condition that can affect communication, social interaction, behaviour, and learning. Every autistic person has different strengths and support needs. Consistent support at home can help families and caregivers take part in a person's daily learning and development, but finding suitable guidance and maintaining regular activities can be challenging.

The **Smart Autism Support System** is an AI- and machine-learning-based platform intended to support home-based therapeutic activities for autistic people. It aims to make relevant support more accessible to families and caregivers through a web-based system. By bringing technology and home-based support together, the project seeks to help caregivers engage with suitable activities and provide more consistent support at home.

This project explores how artificial intelligence and machine learning can be applied within a digital support platform. The paper describes the system's purpose, design, and implementation, along with its evaluation and limitations. The system is intended to assist caregivers; it should not be treated as a replacement for professional advice, diagnosis, or therapy.

II. LITERATURE SURVEY

[1] Extended Reality-Based Mobile App Solutions for Autism Therapy (Toma, M. V., Turcu, C., Urcu, C. O., 2024, JMIR Serious Games, DOI: 10.2196/49090)

This study focuses on extended reality applications for autism therapy. It uses AR and VR technologies to create interactive learning environments. Children interact with digital objects and activities. The system improves communication and social interaction skills. Results show positive therapy outcomes in children with autism.

[2] Digital Interventions for Autism Spectrum Disorders: A Systematic Review (Wang, L., Huang, Y., and Chen, Z., 2024, Pediatric Integrative, DOI: 10.1002/ped4.12417)

This paper reviews digital technologies used in autism intervention. It analyzes mobile apps, AI tools, and digital therapy systems. Different treatment methods are compared for effectiveness. The study shows digital systems support behavioral development. Results indicate improved communication and learning skills.

[3] AutNet: A Personalized Multimodal Emotion Recognition Framework for Autism Spectrum Disorder (Kurian, J., George, A., and Thomas, 2024, IEEE, DOI: 10.1109/TNSRE.2024.3354897)

This paper proposes an emotion recognition framework for autism support. The system analyzes facial expressions, speech, and behavior. Machine learning models identify emotional states. Personalized feedback is generated for therapy improvement. Results show higher emotion detection accuracy.

[4] AI-Assisted Early Screening, Diagnosis, and Intervention for Autism Spectrum Disorder (Zhang, Y., Liu, H., and Zhao, W., 2025, Frontiers in Psychiatry, DOI: 10.3389/fpsyt.2025.1547480)

This research proposes an AI-based autism screening system. Machine learning models analyze behavioral and facial data. The system helps detect autism symptoms at an early stage. It supports medical diagnosis and therapy planning. Results show improved screening accuracy.

[5] Observational Study on AI-Based Therapy Platform for Children with Autism Spectrum Disorder (Atturu, H. Reddy, P., and Rao, S., 2025, Asian Journal of Psychiatry, DOI: 10.1016/j.ajp.2025.104381)

This study evaluates an AI-based therapy platform for autism care. The system monitors therapy sessions and child responses. Machine learning techniques analyze behavior patterns. Personalized therapy suggestions are generated automatically. Results show better emotional and communication development.

III. METHODOLOGY

1) System Architecture

The system architecture of the **Smart Autism Support System** consists of four main components: users, web application, backend, and database.

- **Users:** Children with autism, caregivers, and therapists interact with the system to access its features and review information.
- **Web Application:** Provides a user-friendly interface for child profiles, assessments, learning activities, progress tracking, recommendations, and settings.
- **Backend (Python):** Processes user inputs, performs data preprocessing, executes machine-learning predictions, generates support recommendations, and analyzes progress.
- **Database:** Stores user information, child profiles, assessment results, activity records, predictions, therapy suggestions, and progress data.

These components work together to provide an organized platform for autism support, activity management, and progress monitoring.

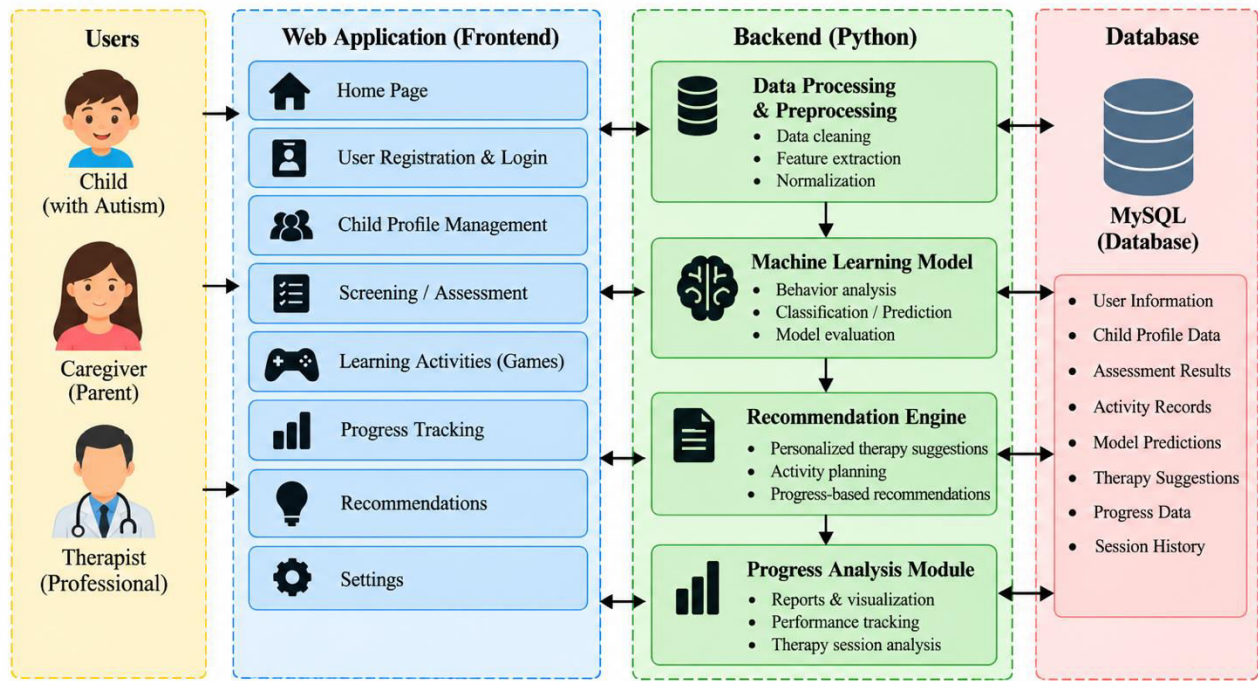


Fig. 1. System Architecture of Smart Autism Support System

2) Data Flow Diagram

The Data Flow Diagram represents the flow of information within the **Smart Autism Support System**. It explains how data is collected, processed, analyzed, and converted into useful outputs.

Initially, the system collects available user inputs, including behavioral observations, activity records, and relevant profile information. The collected data is passed through the preprocessing stage, where it is cleaned, organized, and prepared for analysis.

Next, the machine-learning model analyzes the processed data to generate predictions based on its trained patterns. The system uses the available information to provide relevant support recommendations and suggested activities for caregivers and therapists.

The results are displayed through the user interface, allowing users to review the available information and monitor progress over time. The database stores important records, such as user details, assessment results, activity information, predictions, and progress reports.

The system can use previously stored records for future reference and progress tracking. Overall, the data flow helps organize information efficiently and supports caregivers and therapists in managing home-based autism support activities.

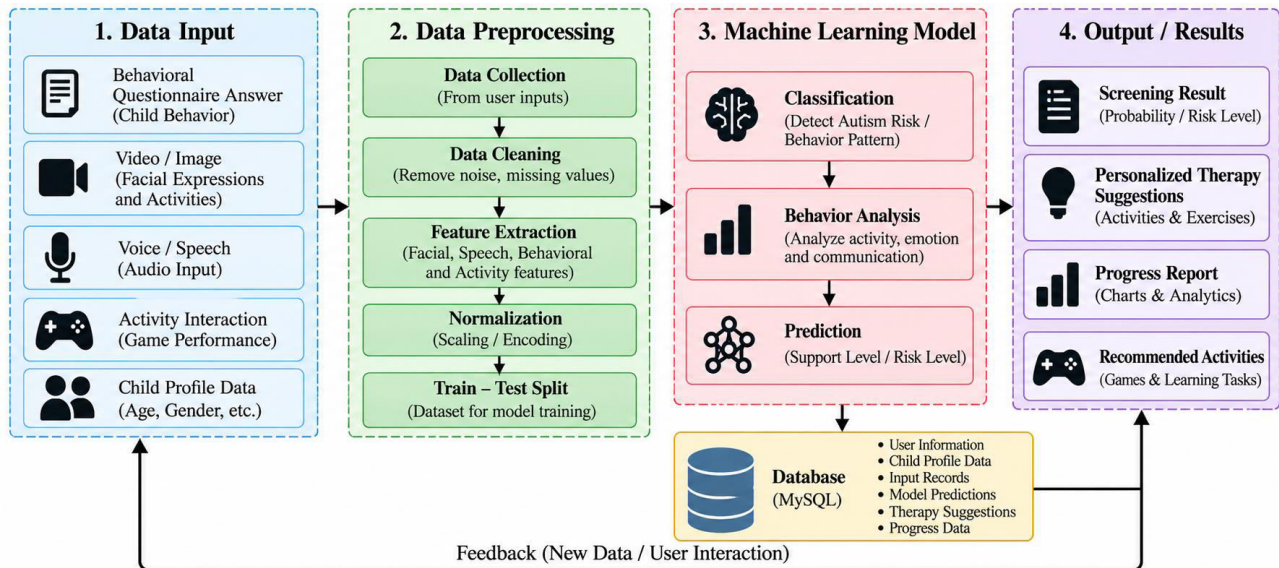


Fig. 2. Data Flow Diagram of Smart Autism Support System

3) Machine Learning Models

The project considers the following machine-learning models:

- **Logistic Regression:** Classifies input data into predefined support categories.
- **Random Forest:** Can analyze behavioral data and identify patterns.
- **Support Vector Machine (SVM):** Can classify data into different categories.
- **K-Nearest Neighbors (KNN):** Classifies new data based on similar existing records.

4) Implementation

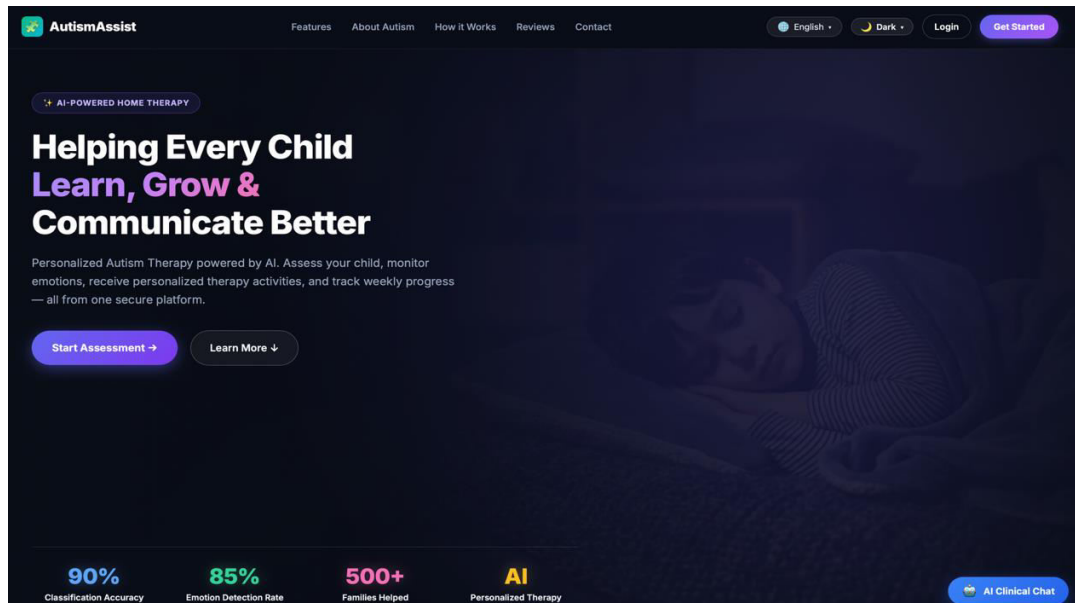
The Smart Autism Support System is implemented using Python and machine-learning techniques to support autism-related activities. HTML, CSS, and JavaScript are used to develop the user interface, while Python handles backend processing and machine-learning operations. Logistic Regression, Random Forest, Support Vector Machine (SVM), and Decision Tree are used for model comparison. The trained model analyzes input data and generates predictions based on predefined categories. The system also provides support recommendations and progress-monitoring features. Finally, testing and evaluation are performed to check system functionality and assess model performance.

5) Evaluation Methodology

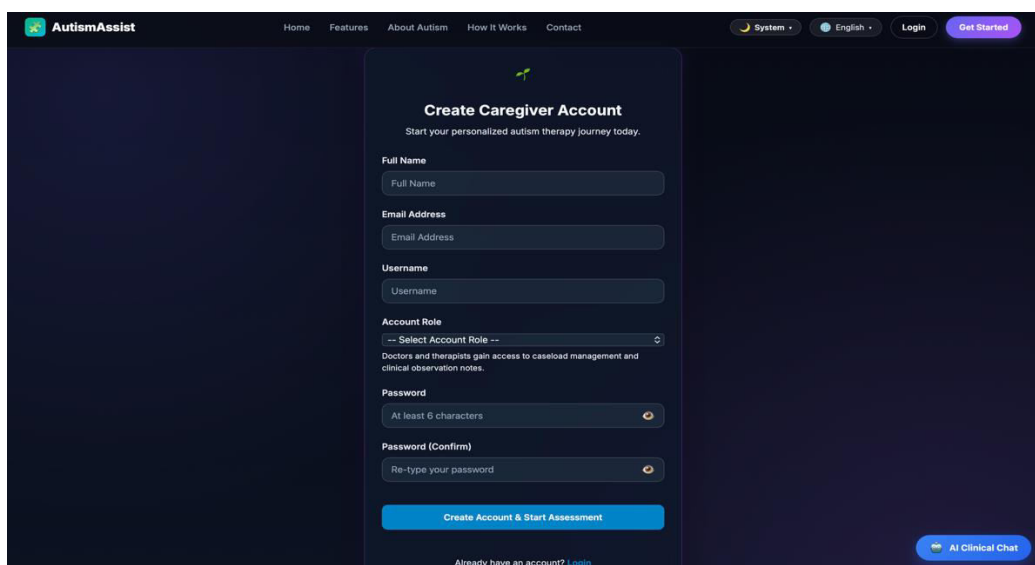
The Smart Autism Support System is evaluated to verify the functionality of the application and the performance of its machine-learning models. The dataset is divided into training and testing sets to train the models and evaluate their predictions. Logistic Regression, Random Forest, Support Vector Machine (SVM), and Decision Tree are compared using evaluation metrics such as accuracy, precision, recall, and F1-score. The application is also tested to ensure that data processing, predictions, recommendations, and progress monitoring work correctly. The evaluation helps identify the model that performs best on the test dataset. Since the project uses synthetic data, the results demonstrate model performance on that dataset and do not establish clinical accuracy or the ability to diagnose autism.

IV. EXPERIMENTAL RESULTS

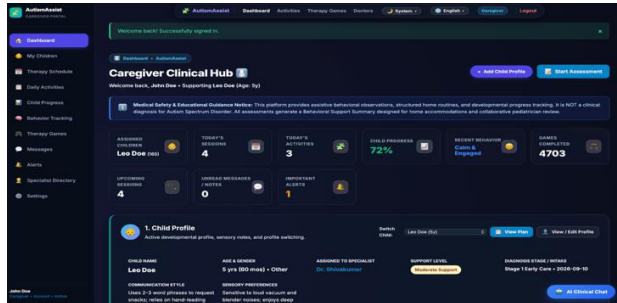
The Smart Autism Support System was developed using Python and machine-learning techniques. The performance of four models—Logistic Regression, Random Forest, Support Vector Machine (SVM), and Decision Tree—was compared. Based on the previously reported results, Logistic Regression achieved the highest accuracy of **90.00%**, followed by Random Forest at 89.17%, SVM at 86.67%, and Decision Tree at 75.00%. These results indicate that Logistic Regression performed best on the project's test dataset. However, because the dataset contains synthetic records, these results do not establish clinical accuracy or the ability to diagnose autism.



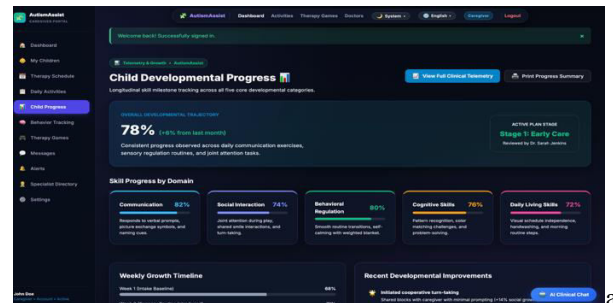
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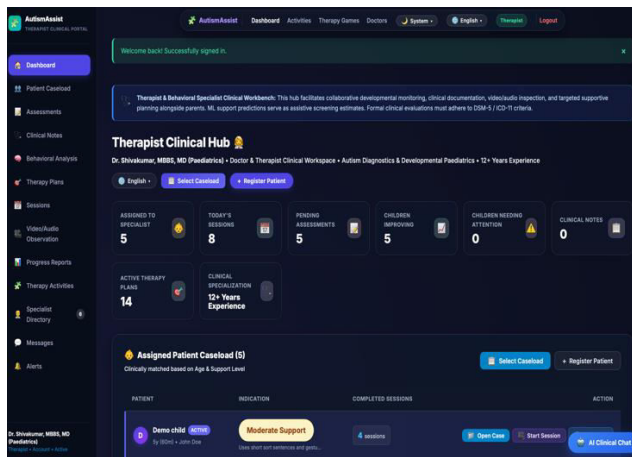
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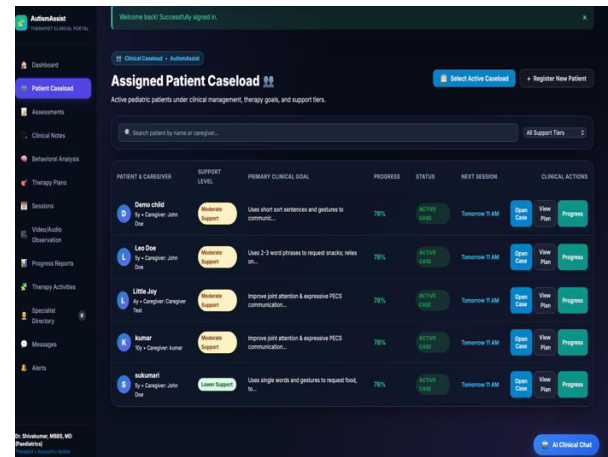
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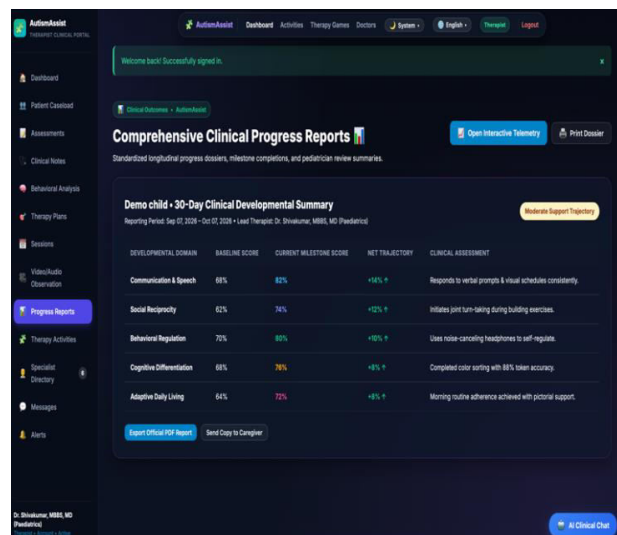
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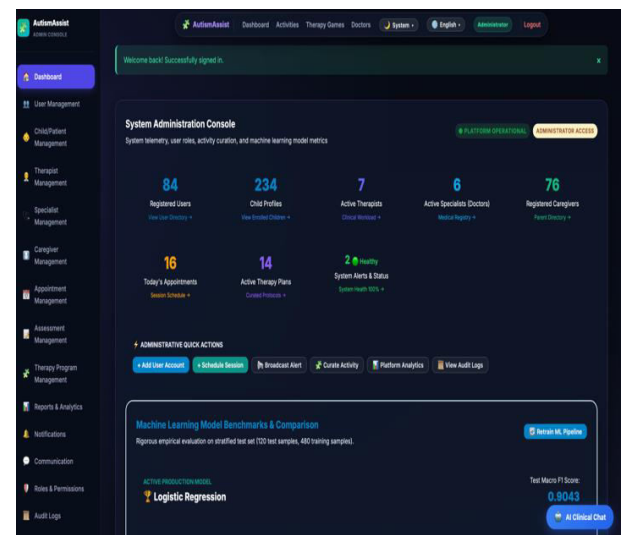
E)



F)



G)



H)

Fig.3. Screenshots of the Smart Autism Support System: (a) Home page; (b) sign-in page; (c) caregiver dashboard; (d) caregiver child-progress view; (e) therapist dashboard; (f) patient caseload; (g) clinical progress report; and (h) admin dashboard.

V. CONCLUSION

The Smart Autism Support System provides an AI- and machine-learning-based platform to support autism-related activities, behavioural observation, and progress monitoring. The system uses machine-learning models such as Logistic Regression, Random Forest, Support Vector Machine (SVM), and Decision Tree to analyze data and generate predictions. It also provides support recommendations and helps caregivers organize activity records. The system aims to make home-based support more accessible and convenient for caregivers and therapists. In the future, the project can be improved by using real-world datasets, enhancing prediction performance, and introducing additional personalized support features. However, the current system is a supportive tool and does not replace professional medical assessment or diagnosis.

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