# An Aiml-Enabled Android Application for Improving Cognitive Ability of Children with Autism Spectrum Disorders

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## ABSTRACT

This methodology focuses on developing an Android application with two modules: User and Psychologist. The User module is further divided into three components: a Chatbot, Emotion Recognition, and Collaboration. The Chatbot allows users to interact through speech and text using Speech-to-Text and Text-to-Speech APIs. The system processes user input using a trained Natural Language Processing (NLP) model to provide relevant responses, both in text and voice. The Emotion Recognition module analyzes user's mood swings by uploading images categorized by emotions like happiness, anger, and sadness, displaying personalized greetings accordingly. The third component, Collaboration, connects users with a psychologist, enabling communication about autism-related queries via chat. The application aims to provide accessible mental health support, improving user interaction and emotional well-being through innovative technologies. This project combines AI-driven interaction, emotional analysis, and expert collaboration to create a comprehensive mental health assistance platform.

**Keywords:** Autism Spectrum Disorder, Emotion recognition, Chatbot, Natural Language Processing(NLP), Mental health assistance platform.

## INTRODUCTION

we have various algorithmic predictions for Autism Spectrum Disorder (ASD) by combining Machine Learning with the dataset provided. The proposed approach is based on the predictive method where the data preprocessing and data evaluation models are used. The study of approach focuses on ASD with several machine Learning algorithms such as, SVM, KNN, Random Forest, Decision Tree to measure the accuracy and precision among the data and determine the hidden information and patterns [1].Autism Spectrum Disorder (ASD) presents unique challenges, including social skill deficits, repetitive behaviors, and communication difficulties, warranting innovative healthcare approaches. Traditional treatments have shown limited success, necessitating a shift towards assistive technologies. Current research lacks tangible solutions for ASD, emphasizing the need for a new paradigm. Leveraging AI and IoT technologies, our system utilizes heart rate and EEG sensors for data collection, employing fast geometric ensembling for feature extraction and a Radial Basis Function Network (RBFN) for classification [2]. This study employs diverse machine learning methods to identify crucial ASD traits, aiming to enhance and automate diagnostic process [3]. A systematic literature review of dialogue agents for artificial intelligence and agent-based conversational systems dealing with cognitive disability of aged and impaired people. Main challenges and desired characteristics of the conversational agents, and chatbot support for aged people and people with cognitive disability [4]. The behaviors of children with autism spectrum disorder (ASD) are often erratic and difficult to predict. Most of the time, they are unable to communicate effectively in their own language. Instead, they communicate using hand gestures and pointing phrases. Because of this, it can be difficult for caregivers to grasp their patients' requirements, although early detection of the condition can make this much simpler [5]. Facial expression can be an alternative and efficient solution for the early diagnosis of Autism. Face identification, facial feature

extraction, and feature categorization are the three stages of emotion recognition. A total of six facial emotions are detected by the propound system: Happy, Sadness, and Anger. This section proposes an enhanced deep learning (EDL) technique to classify the emotions using convolutional neural network [6]. Health professionals have used traditional methods in the therapies performed on patients with the aim of improving the expression of emotions by patients. However, they have not been sufficient to detect the different emotions expressed in the face of people according to different sensations. we propose the construction of an intelligent mirror to recognize five basic emotions: angry, scared, sad, happy and neutral. This mirror uses convolutional neural networks to analyze the images that are captured by a camera and compare it with the one that the patient should perform, thus supporting the therapies performed by health professionals in children with ASD [7].The technology that is integrated into digital mental health interventions and holds conversations with the human user via artificial intelligence is referred to using a variety of terms, including virtual companion, chatbot, and virtual assistant [8]. Smart monitoring and assisted living systems for cognitive health assessment play a central role in assessment of individuals' health conditions. Autistic children suffer from some difficulties including social skills, repetitive behaviors, speech and nonverbal communication, and accommodating to the environment around them [9]. People with autism spectrum disorders have difficulties with communicating and socially interacting through facial expressions, even with their parents. The proposed approach applies person identification and emotion recognition. The objective of this work is to monitor and identify the people with autism spectral disorder based on sensors and machine learning algorithm [10].
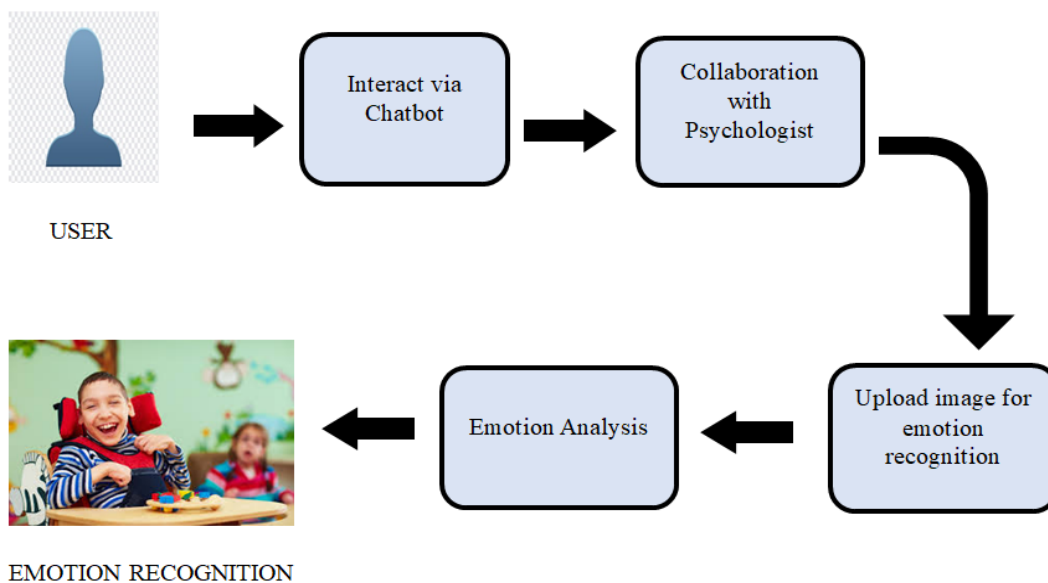
## PROPOSED METHODOLOGY



Fig 2.1 Block diagram of proposed methodology

**Module Description**

**User register and Login**

The User module of the Smart Mental Health Assistant is designed to provide personalized mental health support through three key components: Chatbot, Emotion Recognition, and Collaboration. The Chatbot enables users to interact with the system using both speech and text, powered by Speech-to-Text and Text-to-Speech APIs, and utilizes a trained Natural Language Processing (NLP) model to provide relevant responses. The Emotion Recognition component analyzes users' mood swings through image uploads categorized by emotions such as happiness, anger, and sadness, offering personalized greetings based on the analysis. Lastly, the Collaboration component connects users with psychologists for specialized communication regarding autism-related concerns via chat, fostering expert guidance and support. This module aims to enhance user engagement and emotional well-being by integrating AI-driven interaction, emotion analysis, and professional collaboration.

## Chatbot

The Chatbot module of the Smart Mental Health Assistant allows users to interact with the application through both speech and text. Utilizing Speech-to-Text and Text-to-Speech APIs, the system enables seamless voice and text communication. The Chatbot leverages a trained Natural Language Processing (NLP) model to understand and process user input, providing contextually relevant and personalized responses. This AI-driven interaction helps users express their feelings and concerns in a conversational manner, offering emotional support and guidance based on the user's inputs, thus enhancing the overall mental health experience.

## Emotion Recognition

The Emotion Recognition module of the Smart Mental Health Assistant analyzes users' emotional states by processing images uploaded by the user, which are categorized into various emotions such as happiness, sadness, anger, and more. Using advanced image processing and machine learning techniques, the system detects subtle emotional cues in the images and provides personalized greetings and responses based on the identified mood. This component helps in understanding the user's emotional fluctuations, offering timely support and promoting emotional well-being by tailoring interactions to the user's current emotional state.

## Collaboration

The Collaboration module of the Smart Mental Health Assistant connects users with psychologists for professional support and guidance, particularly for addressing autism-related concerns. Through a secure chat interface, users can communicate directly with mental health experts, asking questions, sharing experiences, and receiving personalized advice. This module ensures users have access to expert knowledge and assistance, fostering a supportive environment for managing mental health challenges and facilitating informed discussions about emotional well-being.

## Psychologist register & login

The Psychologist module of the Smart Mental Health Assistant is designed to provide mental health professionals with a platform to interact with users, offering expert support and guidance. Psychologists can communicate with users through a secure chat interface, addressing concerns, providing therapy insights, and offering personalized advice, especially in areas such as autism and emotional well-being.

## Software Requirements

- FRAMEWORK : FLUTTER

- OPERATING SYSTEM : WINDOWS 10

- IDE : ANDROID STUDIO

- DATABASE : FIREBASE

## Systematic Approach to App Development

### Framework – Flutter

Flutter is a UI toolkit by Google used in Android Studio to build cross-platform apps using a single Dart codebase. It allows fast development with features like hot reload and a wide range of customizable widgets. With the Flutter plugin, Android Studio supports Flutter projects, Dart coding, and UI debugging tools. Developers can also access native Android features using platform channels. Flutter gets linked with Android Studio through the Flutter and Dart plugins, which you can install from the Android Studio Plugins Marketplace. Once installed, Android Studio can create, run, and debug Flutter apps directly. The Flutter plugin integrates tools like hot reload, the Flutter inspector, and emulators, while the Dart plugin adds language support. Together, they connect Flutter's framework with Android Studio's powerful development environment.

## Dart – Programming language

Dart is the primary programming language used with the Flutter framework in Android Studio. It helps developers build cross-platform apps for Android, iOS, web, and desktop from a single codebase. Dart is known for its fast performance and supports hot reload, allowing instant UI updates during development. In Android Studio, Dart is used for both designing UI and writing app logic using Flutter. Dart is linked with Android Studio through the Flutter plugin, which includes Dart support by default. Developers use Dart to build cross-platform apps using the Flutter framework. Android Studio provides tools like code completion, debugging, and UI design for Dart code. The Flutter SDK, which includes the Dart SDK, integrates seamlessly with Android Studio. This setup allows building Android apps efficiently with a single Dart codebase.

## Firebase – Web service

Firebase in Android Studio is used to add backend services like user authentication, real-time database, and cloud storage. It helps you send push notifications and track user behavior with analytics. You can also monitor app crashes and performance. It makes app development faster by handling server-side functions easily. Firebase gets linked with Android Studio through the Firebase Assistant tool. You can open it from Tools > Firebase, and it helps you connect your app to Firebase. Once connected, it automatically adds the required dependencies and configurations in your project files (like build.gradle). This links your app with Firebase services directly from Android Studio.

## Android studio software - IDE

Android Studio is the official integrated development environment (IDE) for Android app development, developed by Google. It provides tools for coding, designing, testing, and debugging Android apps. Built on IntelliJ IDEA, it supports Java, Kotlin, and Dart (with Flutter). Android Studio offers features like a code editor, emulator, and real-time app preview to streamline development. Android Studio is a powerful IDE used to develop Android applications. It offers a user-friendly interface, intelligent code editor, and built-in tools for testing and debugging. With features like a layout editor and emulator, it simplifies app development. Android Studio supports multiple programming languages, including Java, Kotlin, and Dart (via Flutter).

# RESULTS AND DISCUSSION

The proposed methodology of this Android application comprises three main layers: the User Interface (UI), the Application Logic, and the Backend Services. The User Interface layer includes the User module, which consists of three components: the Chatbot, Emotion Recognition, and Collaboration. The Chatbot facilitates interaction via text and voice, leveraging Speech-to-Text and Text-to-Speech APIs, and processes user input using an NLP engine. The Emotion Recognition component analyzes user emotions by uploading images and categorizing emotions like happiness, anger, or sadness, offering personalized greetings. The Collaboration component connects the user to a psychologist for real-time chat support, specifically addressing autism-related queries.
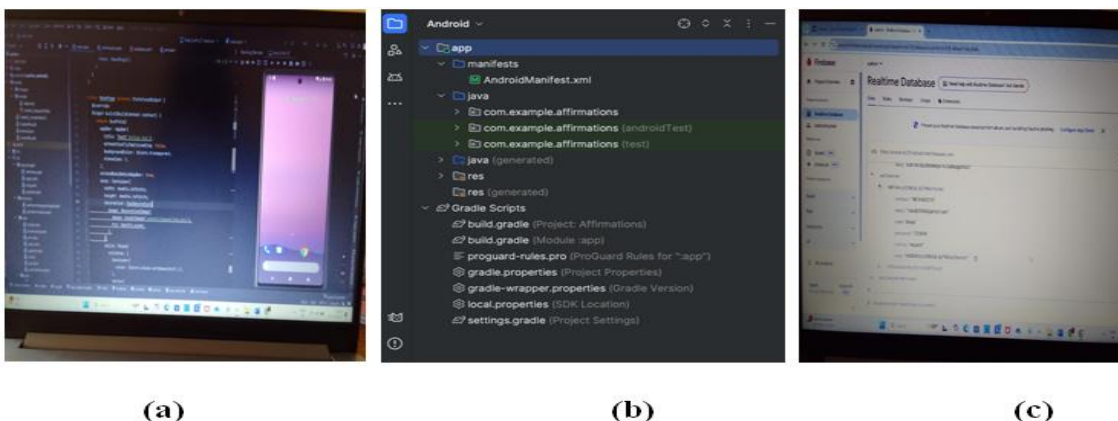


Fig.3.1 (a)App developmental process using code (dart programing language) in Android Studio Software (b) Android Application – Project view structure (c)Firebase- Web service

The Application Logic layer processes data from these modules, running NLP models for text understanding, emotion detection models for image analysis, and managing user-psychologist interactions. The Backend Services layer stores and manages data, ensuring smooth interaction between users and psychologists while ensuring user privacy and data security.
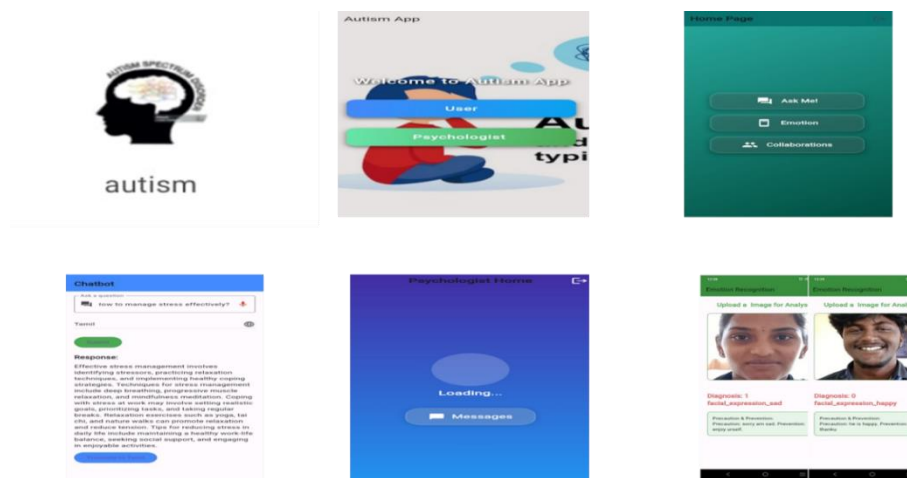


Fig 3.4 Fig.3.1 Software App Development Pages

**Model Evaluation**

**Step 1:** The Android application is developed with two main modules:

- ➤ User Module

- ➤ Psychologist Module

**Step 2: Application Logic Layer** - Processes inputs from the UI layer using NLP models for understanding text, emotion detection models for analyzing images, and manages interactions between users and psychologists

**Step 3: Psychologist Module** - Facilitates communication with users for mental health support. Helps in providing professional guidance based on user input and emotional analysis. Enables real-time chat with a psychologist. Focuses on addressing autism-related queries.

**Step 4: Chatbot -** Allows interaction via speech and text. Uses Speech-to-Text and Text-to-Speech APIs. Processes input using a trained NLP model to generate appropriate responses.

**Step 5: Emotion Recognition -** Users upload images for mood analysis. Detects emotions such as happiness, anger, and sadness. Provides personalized greetings based on detected emotions.

## CONCLUSION

An Android Assistant app integrates advanced technologies like AI-driven chatbots, emotion recognition, and psychologist collaboration to provide comprehensive mental health support. By leveraging NLP, image analysis, and real-time communication, the application offers personalized and accessible emotional well-being assistance. This innovative platform not only improves user engagement but also fosters a more supportive environment for individuals seeking mental health resources, with future enhancements offering even greater capabilities for personalized care and interaction. This methodology encompasses the development of a comprehensive Android application designed to address mental health concerns through innovative technological solutions. It includes the creation of a user-friendly platform that integrates AI-driven features such as a Chatbot for interactive communication, Emotion Recognition for assessing and responding to users' emotional states, and a Collaboration module to connect users with psychologists for professional support. The application focuses on users' emotional well-being by utilizing Speech-to-Text and Text-to-

Speech APIs to facilitate seamless interaction, while the Emotion Recognition module expands the system's ability to understand users' feelings through image analysis. Additionally, the project enables users to receive specialized guidance on autism-related queries, fostering an inclusive environment for mental health discussions. The scope of this application also extends to supporting a broad user base, aiming to provide accessible mental health assistance anytime, anywhere, while continually improving user engagement through AI-powered and professional support channels.

## Future Enhancement

In future, smart monitoring and assisted living systems for cognitive health assessment play a central role in assessment of individuals' health conditions. We can also detect the integration of real-Time Facial Emotion Detection. Autistic children suffer from some difficulties including social skills, repetitive behaviors, speech and nonverbal communication, and accommodating to the environment around them. People with autism spectrum disorders have difficulties with communicating and socially interacting through facial expressions, even with their parents. it may focus on crisis alert system. It ensures timely intervention during emergencies to enhance user safety. Offline Mode Support allows the application to function without an active internet connection. It ensures users can access key features and data even when offline.

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