AI-Based Pictorial Mental Health Screening Tool for Children

Group 2 - DSI Project
Team: DAN, Innovision, Innovaid, Social Reformer

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Overview

An AI-powered, non-verbal screening tool that uses pictorial submissions from children aged 3-18 to identify developmental and cognitive challenges. The tool employs a scalable architecture using Flutter for the frontend and Node.js, Twilio, and MongoDB for the backend.

Problem Statement

Children often struggle to express mental health concerns verbally, leading to delayed diagnosis and interventions. Traditional methods are resource-intensive, and rural/underserved areas lack access to efficient tools. A non-verbal, scalable, and accessible solution is critical for timely mental health support.

Objectives

- **Primary Objective:** Develop an AI tool for analyzing pictorial submissions to identify mental health challenges.
- **Supporting Goals:**
  - Enhance early detection and intervention.
  - Improve accessibility and reduce screening time for professionals.
  - Streamline mental health diagnostic processes.

Users and Stakeholders

Key Users

- Primary Users: Children aged 3-18 (via pictorial submissions).
- Secondary Users: Parents, educators, therapists, healthcare professionals.

Stakeholders

- Beneficiaries: Schools, NGOs (e.g., CHOICE Foundation), healthcare systems, policymakers, and society at large.

Technology Stack

Frontend Implementation: Flutter

- Developed a responsive UI using Flutter for a seamless experience across devices.
- Features:
  - Login pages for NGOs, schools, professionals, and parents.
  - Interactive child interface for drawing submission.
  - Professional dashboards for accessing and annotating reports.
  - School analytics dashboard for well-being insights.
  - Notifications and offline functionality.

Backend Implementation: Node.js, Twilio, and MongoDB

- **Node.js:**
  - Centralized server for handling API requests.
  - Implements RESTful architecture for data exchange between Flutter and the backend.
- **MongoDB:**
  - Database stores user profiles, pictorial submissions, AI analysis results, and reports.
  - Schema includes collections for:
    * Users (NGOs, schools, professionals, and parents).
    * Child submissions with AI annotations.
    * Professional feedback and intervention records.
- **Twilio:**
  - SMS notifications for report updates and alerts.
  - Secure two-factor authentication for user logins.

AI/ML Model Integration

- **AI Model:**
  - Convolutional Neural Network (CNN) for interpreting children's drawings.
  - Reinforcement learning for feedback-driven model improvement.
- Hosted AI models on a cloud-based platform for scalability and performance.

Deployment Strategy

- Flutter frontend deployed via Google Play Store and as a Progressive Web App (PWA).
- Backend Node.js server deployed on AWS EC2 with a load balancer.
- MongoDB hosted on MongoDB Atlas for reliability and security.
- Twilio integrated for SMS notifications and real-time alerts.

Workflow Diagrams

UML Class Diagram

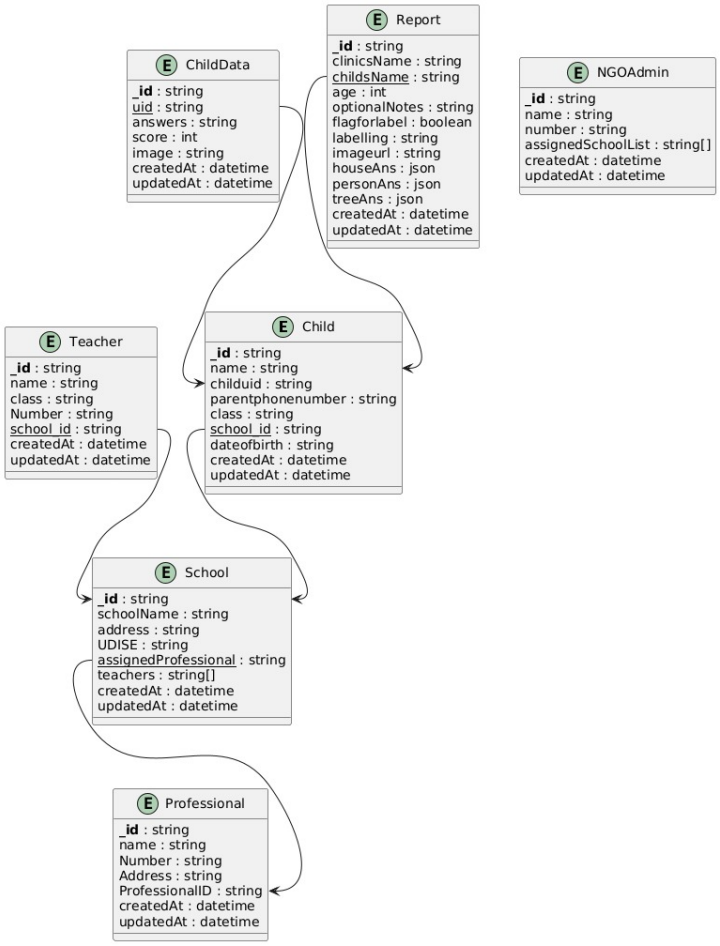

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Figure 1: UML DB Schema

- Includes entities for Users, Pictorial Submissions, Reports, and Interventions.

State Diagram

- Doctor's Workflow: Login → View Reports → Label Data → Save Updates.
- School's Workflow: Login → Upload Submissions → Access Analytics Dashboard.

Sequence Diagram

- Login Process, Pictorial Submission, Data Labeling, and Report Generation.

Societal Impact

- **Children:** Safe, stigma-free tool for mental health expression.
- **Parents:** Early insights into mental well-being.
- **Schools:** Improved student monitoring and reduced undiagnosed issues.
- **Healthcare:** Streamlined workload for professionals.

Challenges and Mitigation

- **Data Privacy:** Encrypted databases and role-based access.
- **Cultural Relevance:** Adaptation with NGOs for local contexts.
- **AI Bias:** Continuous training with diverse datasets.

Timeline

Milestone	**Timeline**
Research and Ideation	Month 1
Prototype Development	Month 2
2nd iteration	Month 3
Internal Testing	Month 3-4
Final Product	Month 4

Conclusion

This AI-based, non-verbal mental health screening tool leverages Flutter for a simple-to-use UI and Node.js, Twilio, and MongoDB for a robust backend that helps manage numerous Image-based submissions as well as provide AI Model based scores returned for each of the submissions.

It addresses a critical gap in pediatric mental health through early detection and intervention. By integrating advanced AI and scalable technology to speed-up the initial screening process!