CSE7101- Capstone Project
Review-1

PSCS_19_COMPUTERIZED COGNITIVE RETRAINING PROGRAM FOR HOME TRAINING OF CHILDREN WITH DISABILITIES

Batch Number:CSE-19

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Content:-

- Problem Statement
- Objectives
- Background and Related work for title Selection
- Analysis of Problem Statement
- Innovation or Novel Contributions
- Git-hub Link
- Timeline of the Project
- References

Abstract:-

Computerized Cognitive Retraining Programs (CCRP) represent a growing area of interest in the field of special education and rehabilitation, particularly for children with disabilities who face challenges in cognitive, academic, and social development. These programs are designed to strengthen fundamental cognitive processes such as attention, memory, language, reasoning, and executive functions through structured, computer-based activities and interactive exercises. By incorporating adaptive algorithms, gamification strategies, and multimedia elements, CCRP provides an engaging and motivating learning environment that can be customized according to the child's individual needs, abilities, and pace of progress.

Abstract:-

Moreover, CCRP offers scalability and flexibility, making it possible to design programs that address diverse needs ranging from mild learning difficulties to more severe cognitive impairments. The integration of progress-tracking features provides valuable data for therapists, educators, and parents, enabling them to adjust interventions and measure outcomes effectively. While evidence supports the effectiveness of these programs, further research is needed to establish standardized protocols, evaluate long-term benefits, and ensure accessibility across different socio-economic contexts.

In conclusion, computerized cognitive retraining for home-based use holds significant promise as a cost-effective, accessible, and child-centered approach to supplement traditional therapeutic practices. By harnessing technology to provide personalized, engaging, and continuous cognitive stimulation, CCRP can play a vital role in enhancing independence, academic readiness, and overall quality of life for children with disabilities.

Problem Statement Number: PSCS_19:-

Organization: Presidency University
Category (Hardware / Software / Both) : Software

Problem Description:

The AI-Enhanced Gamified Cognitive Companion is a home-based cognitive retraining platform designed for children with disabilities. It uses AI-driven personalization, augmented reality exercises, gamification, and multimodal interaction to improve attention, memory, and problem-solving skills. The system adapts tasks based on real-time performance, offers a caregiver AI assistant for monitoring progress, and provides an engaging, accessible learning environment that supports long-term cognitive development.

OBJECTIVES:-

- Create a home-based cognitive retraining program for children with disabilities.
- Use AI to adjust exercises based on child's performance.
- Add games and AR to make learning fun and engaging.
- Allow touch, voice, and gesture controls for accessibility.
- Give caregivers simple tools to track progress.

Background and Related Work:

- Children with disabilities often face challenges in attention, memory, and problem-solving.
- Traditional therapy can be costly, hard to access, and needs regular travel.
- Computerized cognitive retraining (CCR) helps improve skills at home.
- Existing apps are less adaptive and lack engaging features.
- Research shows gamification, AR, and AI make learning more effective and fun.

Github Link:-

The Github link provided should have public access permission.

Github Link

Analysis of Problem Statement:-

Technology Stack Components:

- **Frontend:** React Native (cross-platform mobile app for Android & iOS)
- **Backend:** Node.js with Express.js
- **Database:** MongoDB
- **AI/ML:** TensorFlow Lite (on-device), PyTorch (server)
- **AR:** ARCore / ARKit
- **APIs:** Google Speech-to-Text, WebRTC for social mode
- **Hosting:** AWS / GCP cloud
- **Security:** End-to-end encryption, HIPAA/GDPR compliant

Analysis of Problem Statement (contd...):-

Software Requirements:

- Node.js with Express.js
- MongoDB database
- TensorFlow Lite / PyTorch for AI models
- ARCore / ARKit SDKs
- Google Speech-to-Text API
- WebRTC for live interactions

Hardware Requirements:

- Smartphone or tablet (Android/iOS) with camera and microphone
- Desktop or laptop for caregiver/therapist portal
- Internet connection (minimum 2 Mbps)
- Optional: AR-capable device for augmented reality features

Analysis of Problem Statement (contd...):-

•**Target Users:** Children with disabilities (e.g., autism, ADHD, intellectual disabilities).

Main Challenges:

•Limited access to specialized therapy.
•Lack of personalization in existing tools.
•Low engagement due to repetitive tasks.

Proposed Solution:

•AI-powered personalized exercises.
•Fun, gamified, and AR-based activities.
•Caregiver monitoring and therapist support.

Expected Outcome:

•Improved cognitive skills (memory, attention, problem-solving).
•Higher engagement and consistent therapy at home.

Innovation or Novel Contributions:-

1. **Gamified Therapy:** Fun, game-like activities to keep children engaged.
2. **Adaptive Learning:** Exercises change difficulty in real time based on performance.
3. **Offline Capability:** Can be used without constant internet access.
4. **Progress Visualization:** Easy-to-read graphs and charts for parents and therapists.
5. **Social Learning Mode:** Connects children for collaborative cognitive games.
6. **Parent/Therapist Dashboard:** Personalize training schedules and track improvements.
7. **Multimodal Interaction:** Supports touch, voice, and gesture control for accessibility..
8. **AI Care Assistant:** Gives caregivers recommendations and explains progress in simple language.

Existing Methods and Drawbacks:-

Traditional In-Person Therapy

- Structured sessions in clinics/schools
- Led by trained therapists
- Paper-based or physical exercises

Educational / Game-Based Apps

- Puzzle & memory apps
- Provide basic practice
- Mostly entertainment-oriented

Computerized Cognitive Retraining (CCR)

- Software-based cognitive tasks
- Adaptive difficulty (limited)
- Web/mobile platforms

Existing Methods and Drawbacks:-

AI/ML Adaptive Platforms

- Personalize exercises in real-time
- Adjust difficulty using performance data
- Some use analytics & feedback loops

AR/VR Rehabilitation Tools

- Immersive therapy via AR/VR
- Engages children in interactive worlds
- Motivating and fun

System Modules:-

Child Application Module

- Gamified cognitive training exercises
- Multimodal inputs: touch, voice, gesture
- Adaptive difficulty levels
- AR-based interactive learning
- Offline support with sync

Caregiver Portal

- Track child’s progress with dashboards
- AI-based recommendations in simple language
- Manage daily/weekly schedules
- Provide feedback to therapists
- Secure role-based login

System Modules:-

Therapist Portal

- Create & assign training plans
- Remote monitoring of progress
- Generate reports & assessments
- Communicate with caregivers

Adaptive Learning Engine

- AI/ML-driven difficulty adjustment
- Predicts next exercises
- Logs & analyzes performance data

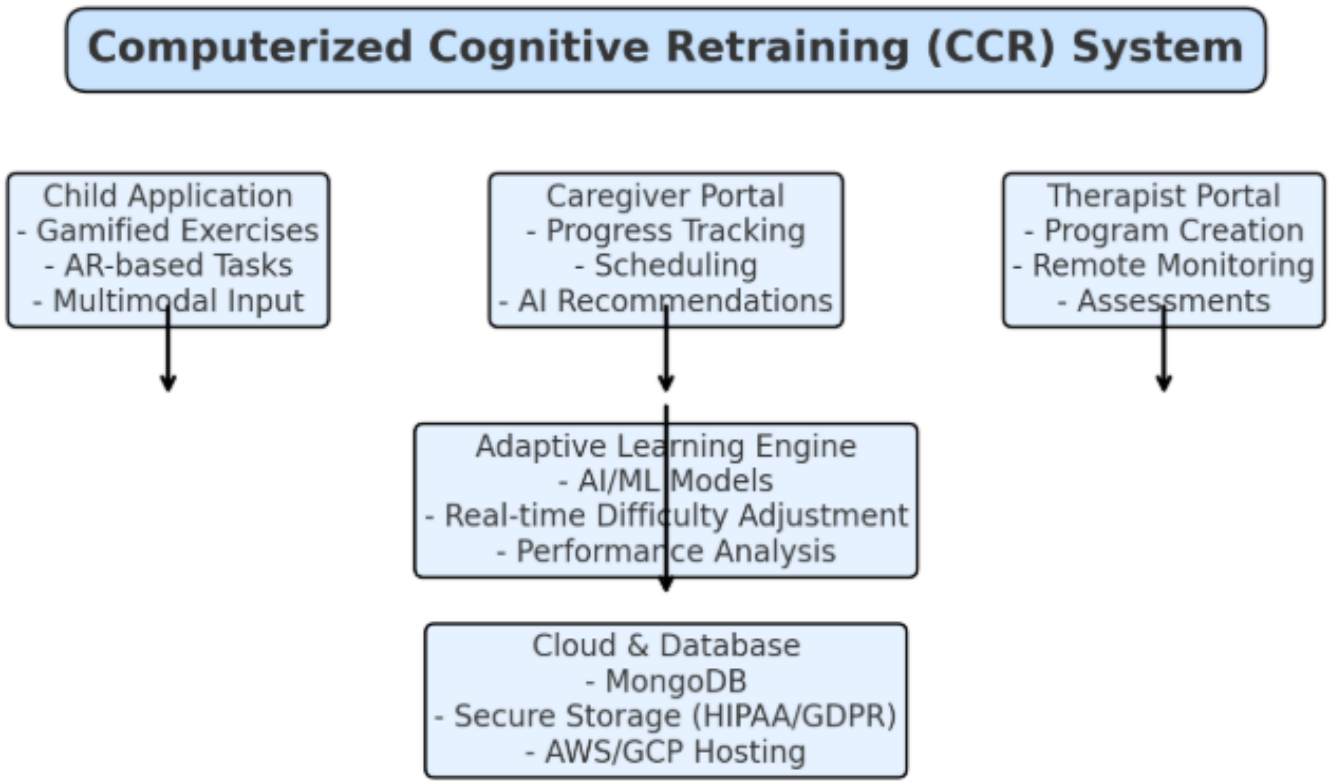
Analytics & Reporting Dashboard

- Progress trends: charts & graphs
- Cognitive skill analysis
- Alerts & reminders

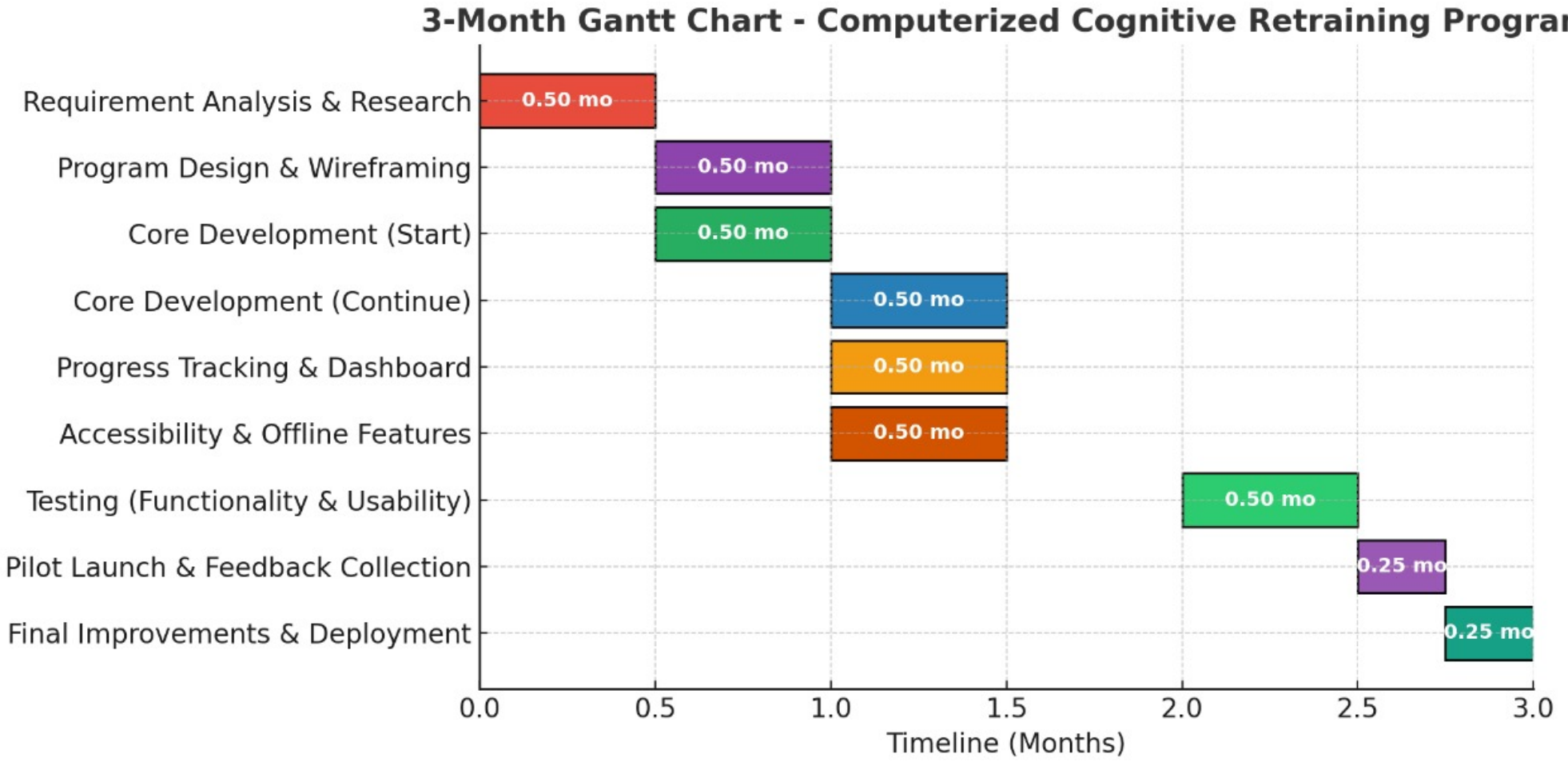
Security & Data Management

- OAuth2.0 / JWT authentication
- End-to-end encryption
- HIPAA/GDPR compliance
- Cloud storage with backups

Architectural Diagram:-



Timeline of the Project (Gantt Chart):-



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Thank
You!