



Imagine a classroom where learning a simple word

AUSTIM SPECTRUM DISORDER PREVALENCE



Global Context

1 in 127

children diagnosed with
ASD worldwide

Local Impact



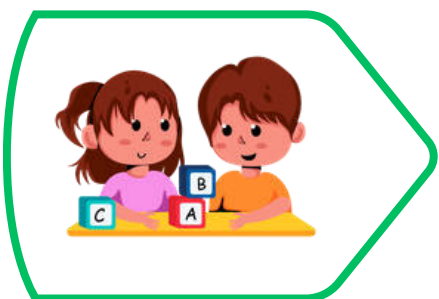
Sri Lanka

1 in 93

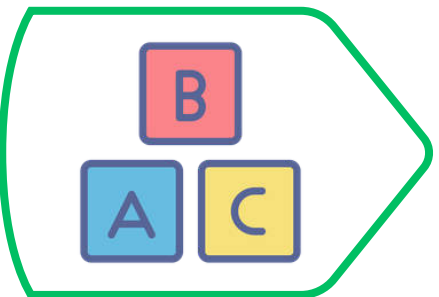
children affected

9000

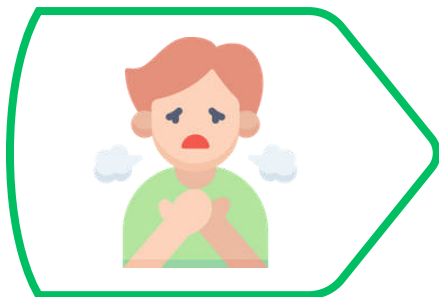
identified children



Children with ASD in Sri Lanka who experience difficulties in language comprehension and concept learning.



Traditional teaching methods lack visual structure and adaptive support needed for autistic learners.



Teachers manage multiple students with different learning needs without accessible tools to monitor progress or adapt lessons.

IMPACT OF THE PROBLEM

USERS



Autistic Children



Special Education Teacher



Principal

Difficulty Acquiring English Language

Limited Academic Progress

Lower Confidence and Engagement

Overseeing Multiple Students at once

Unable to Personalize Content Delivery

Hard to Track Individual Progress

Unable to ensure Inclusive Education Compliance

No Data on Student Outcomes

Hard to Justify Resources

Shared Need : Adaptive Platform

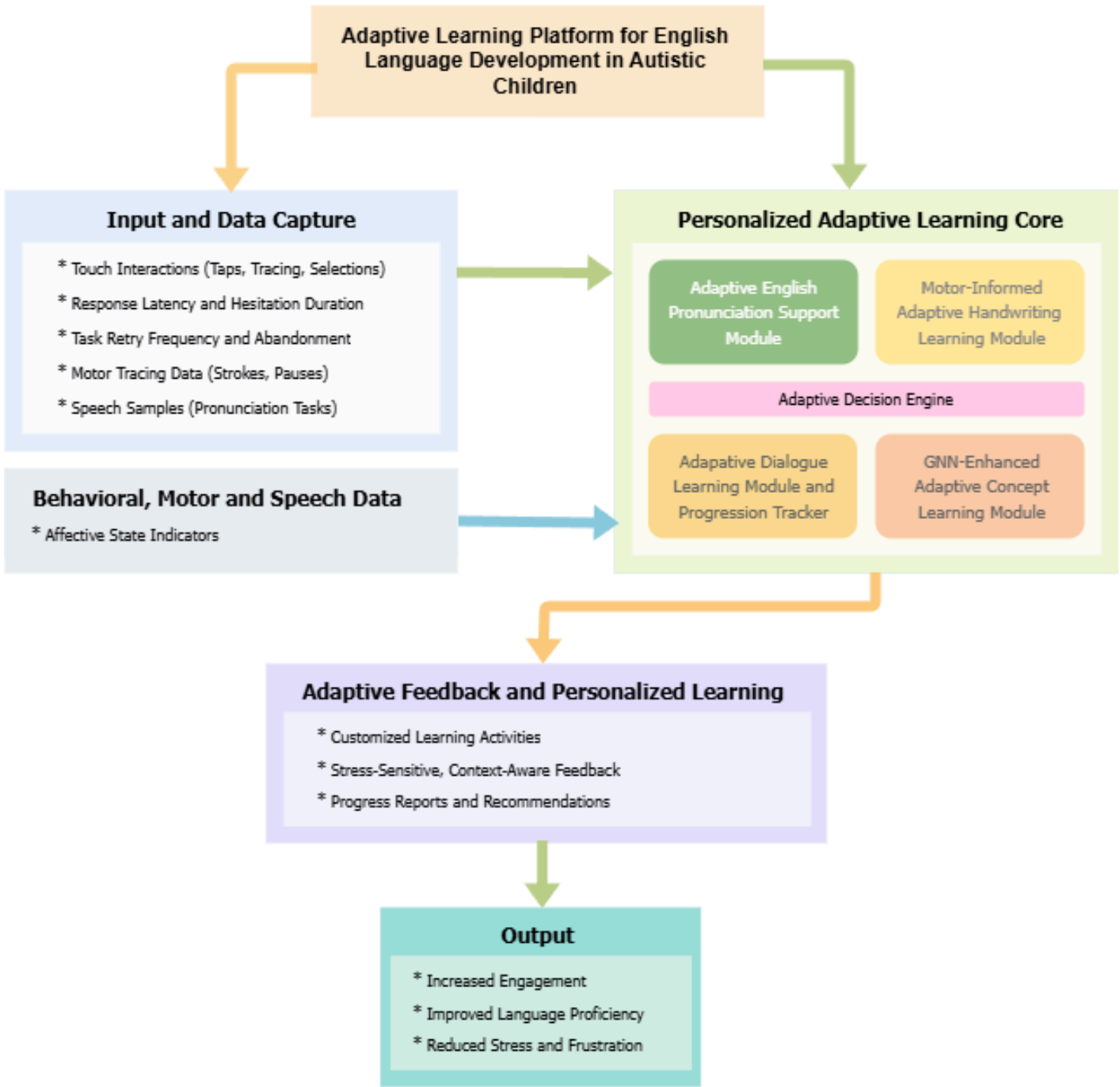
EXISTING APPLICATIONS AND THEIR LIMITATIONS

Feature / Capability	Read Along	Proloquo	Avaz AAC	Otsimo	MITA	AutiSpark	Writing Wizard	LetterSchool
Designed specifically for ASD learning	✗						✗	✗
Multimodal learning (image + audio + interaction)								
Structured pronunciation learning	✗	✗	✗	✗	✗	✗	✗	✗
Speech recording and pronunciation evaluation	✗	✗	✗	✗	✗	✗	✗	✗
Pronunciation similarity scoring	✗	✗	✗	✗	✗	✗	✗	✗
Adaptive learning progression	Limited	✗	✗	Limited	Limited	Limited	✗	✗
Teacher monitoring dashboard	✗	Limited	Limited	Limited	✗	✗	Limited	✗
Activity-based reinforcement learning								
Handwriting motor performance analysis	✗	✗	✗	✗	✗	✗	✗	✗
Motor difficulty identification	✗	✗	✗	✗	✗	✗	✗	✗
Adaptive handwriting learning sequence	✗	✗	✗	✗	✗	✗	✗	✗
Dialogue / communication learning	✗			✗	✗	✗	✗	✗
Teacher progress reports and analytics	✗	Limited	Limited	Limited	✗	✗	Limited	✗
Curriculum-aligned structured learning	✗	✗	✗	✗	✗	✗	✗	✗

ADAPTIVE LEARNING PLATFORM FOR ENGLISH LANGUAGE DEVELOPMENT IN AUTISTIC CHILDREN IN SRI LANKA



AURIVA : ADAPTIVE LEARNING PLATFORM FOR ENGLISH LANGUAGE DEVELOPMENT IN AUTISTIC CHILDREN IN SRI LANKA



Overview of the Proposed Adaptive Learning Framework

Feature / Capability	Proposed Integrated System
Designed specifically for autistic learners	
Multimodal learning (image, audio, flashcards, visual guidance)	
Structured pronunciation learning module	
Speech recording and pronunciation capture	
Pronunciation similarity scoring	
Adaptive word progression based on performance	
Activity-based reinforcement learning	
Teacher monitoring dashboard	
Student performance analytics	
Handwriting motor performance analysis	
Motor difficulty identification	
Adaptive handwriting learning sequence	
Dialogue-based functional English learning	
Curriculum-aligned structured learning	
Integrated learning analytics across modules	

Feature Coverage of the Proposed Adaptive Learning Platform

IT22084590 | H H Jayasundera

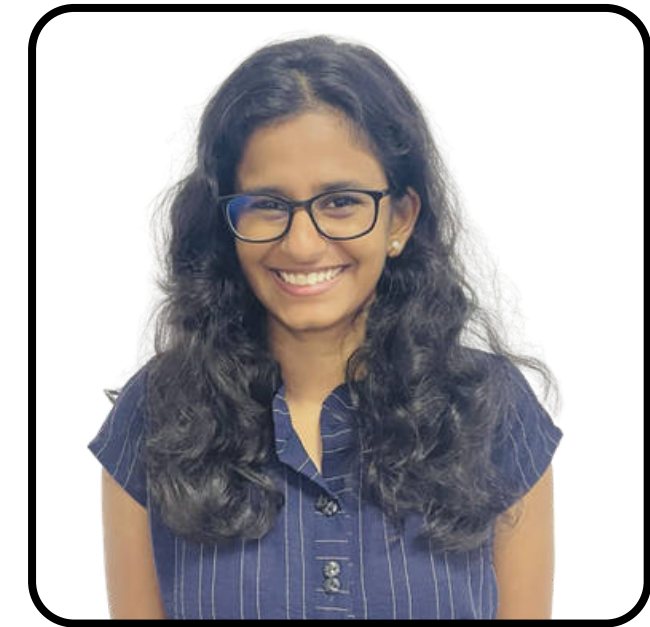
GNN-Enhanced Adaptive Concept Learning Module

Contribution to the Overall System

Delivers the core vocabulary and concept foundation that feeds directly into the Pronunciation, Writing, and Conversational modules, with a GNN-powered analytics engine drives personalized learning paths shared across the whole system.

Novelty

Combines a GNN-driven Graph Knowledge Base for relational concept analytics, Applied Behavioral Analysis-grounded mastery criteria, pre-classified concept attribute logic, and LLM-generated teacher feedback for the Sri Lankan autism education context.



3

Learning Tiers

90%

ABA Mastery
Threshold

GNN

Adaptive
Intelligence

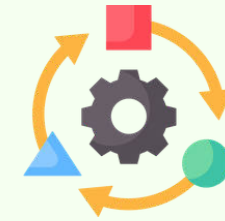
GNN-Enhanced Adaptive Concept Learning Module

PROBLEM



No Curriculum Alignment

Existing tools are not mapped to Sri Lankan Grade curriculum, leaving teachers without structured concept sequencing



Non-Adaptive Delivery

Available apps apply identical content to all children, ignoring individual learning profiles, sensory needs, and cognitive pace of autistic learners.



No Graph-Based Logic

No existing solution models conceptual relationships or confusion patterns using a GNN

MAIN OBJECTIVE

Develop a GNN-enhanced adaptive concept learning module that teaches English vocabulary and attributes to autistic children through a structured three-tier architecture driven by graph-based relational analytics

SUB OBJECTIVES

Design a three-tier concept architecture (Visual Familiarization → Word Recognition → Attribute Introduction) ensuring progressive mastery of each concept.

Build a GNN inference engine over a Graph Knowledge Base (GKB) for confusion detection, learning path recommendation, and per-concept difficulty prediction.

Implement ABA-grounded adaptive scaffolding with graduated relearn pathways and a 90% mastery criterion, operating independently of GNN outputs.

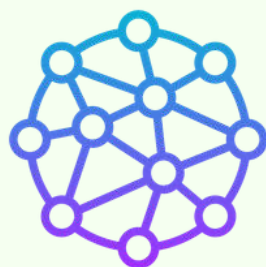
Generate LLM-driven teacher feedback enriched by GNN analytics, surfacing confusion clusters, prerequisite gaps, and actionable insights in plain language.

GNN-Enhanced Adaptive Concept Learning Module

RESEARCH METHODOLOGY

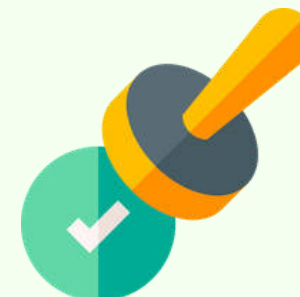
01 Technologies Utilised

- GNN - confusion detection, path recommendation, difficulty prediction
- LLM - plain-language teacher insights & reports
- ABA rule engine - 90% mastery gating
- React Native · Node.js · FastAPI · PostgreSQL



02 Validate & Evaluate

- Quantitative : functional testing of tier progression, mastery & confusion logic
- Qualitative : teacher usability sessions, SUS questionnaire
- Observational : supervised child sessions - engagement & distress indicators

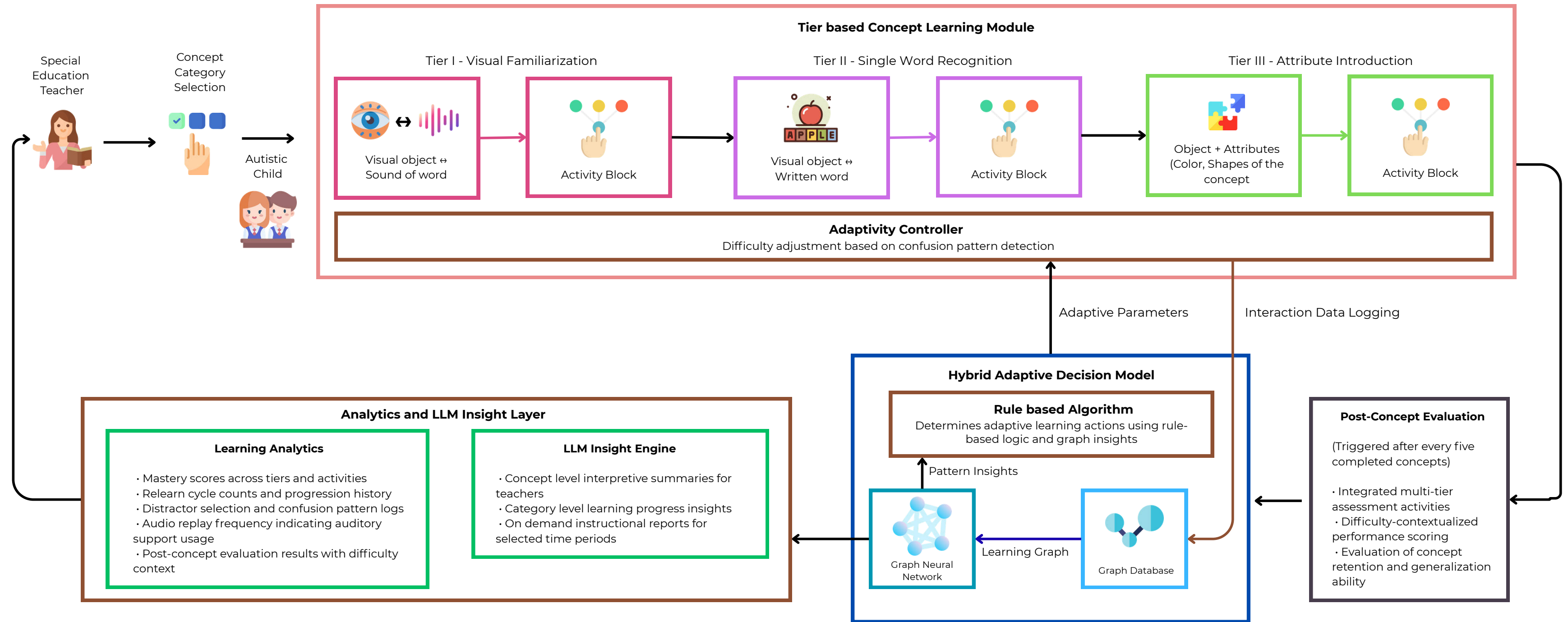


02 Data, Security & Ethics

- Auto-logged data : mastery scores, distractor patterns, relearn cycles
- SLIIT ethical clearance + written informed consent (Principal & teachers)
- No PII sent to LLM API - anonymized structured payloads only



GNN-Enhanced Adaptive Concept Learning Module



Dependencies & Common Components

- Shared User Authentication: Principal/Teacher login & session management
- Avatar Feedback : Acknowledgements made for the child
- Student Profile Store: UI preferences & learning history
- Teacher Dashboard: Common statistic surface for all 4 modules

IT22166838 | M C GUNAWARDENA

Adaptive Dialogue Learning And Progression Tracker



Contribution to the Overall System

To empower autistic ESL children to progress from vocabulary recognition to functional dialogue through a three phase guided learning pathway with tolerant speech assessment

Novelty

- Pragmatic contextual awareness building and analysis
- Building conversations with the child's mastered vocabulary and concepts using a constrained LLM with turn validation
- Speech assessment with element, keyword and fuzzy matching with a fallback for non verbal children.

3

Learning Levels

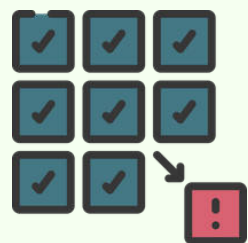
Contextual
Awareness

LLM

Turn Generation

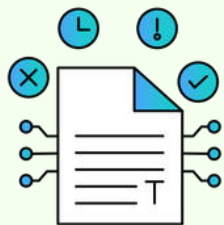
Adaptive Dialogue Learning And Progression Tracker

PROBLEM



Vocabulary Isolation

Familiarization, Writing and pronunciation of vocabulary is taught in isolation. Application in real life is a struggle



No Contextual Awareness

Existing applications do not teach the child when and where to use taught words



No Tolerant speech assessment

Existing applications do not have tolerant speech assessment for non native english speakers

MAIN OBJECTIVE

To design and evaluate a module that guide autistic ESL learners to learn and use functional vocabulary in simple conversations through a three phase module, achieving at least 75% speech assessment accuracy and 70% learner task-completion within the 9 month project period.

SUB OJECTIVES

Design & Develop a three level module for Vocabulary Familiarization, Contextual awareness and Conversation building

Use an LLM to generate vocabulary conversation turns using the child's mastered words

Build a Multi Layered Speech Assessment Pipeline

Design a Mastery Gated Progression and Non-Verbal Fallback System

Adaptive Dialogue Learning And Progression Tracker

Knowledge Domains contributing to Methodology

1. Adaptive Learning Systems

Rule-based mastery detection algorithm grounded in mastery detection. Children advance only when learning is demonstrated, not on a fixed time schedule.

2. NLP & Speech Processing

Multi-layer speech assessment: Speech to Text transcription → empty check → keyword matching → fuzzy string matching

3. Pragmatic Language Teaching

Phase 3 Contextual Understanding Check operationalises pragmatic competence teaching children WHEN to use a phrase, not just how to say it.

4. LLM-Based Content Generation

Vocabulary-constrained prompting strategy using an API. Post-generation validation layer cross-checks all turns against child's live mastery profile.

Latest Technologies Utilised

1. LLM

Used in vocabulary-constrained turn generation for Level 2 personalized dialogue.

2. Speech to Text

to obtain the transcription of the child's spoken audio

3. Fuzzy Matching

For tolerant speech assessment

4. NLP - Natural Language Processing

Named entity recognition for Level 3 element detection

5. Rule-Based Mastery Detection Algorithm

Rule based controller to determine how the child advances and content redirection

Validation, Data Availability, Security & Ethics

Validation

- Functional correctness - unit and integration tests covering turn generation, speech pipeline, progression logic and API connections
- Speech assessment accuracy - 30 to 50 audio clips from partner school manually labelled and tested against system output, target $\geq 80\%$ classification accuracy
- Pilot study - session completion rate target $\geq 75\%$, with learning progression tracked across sessions
- Educator evaluation - teacher report usefulness using a survey
- System reliability - system availability target $\geq 95\%$ with no backend errors during sessions

Security & Ethics

- Student privacy - child names stored separately, all session tables reference children by system-generated ID only
- Secure storage - all data stored in password-protected database, accessible only to authorised users
- Access control- role-based permissions, child session data not accessible to unauthorised requests
- Consent - written informed consent taken from the partner special education school
- Child safety - non-verbal fallback pathway, no failure messages, positive reinforcement at every response level to prevent distress

Data Availability

- Sri Lankan Grade 1–3 English curriculum for Dialogue, Greeting and Magic Words
- Dialogue word list, contextual image pairs and scene assets prepared from curriculum content
- Child interaction data - turn scores, transcripts number of correct attempts collected live during sessions
- Audio recordings captured during speech practice

Dependencies & Common Components

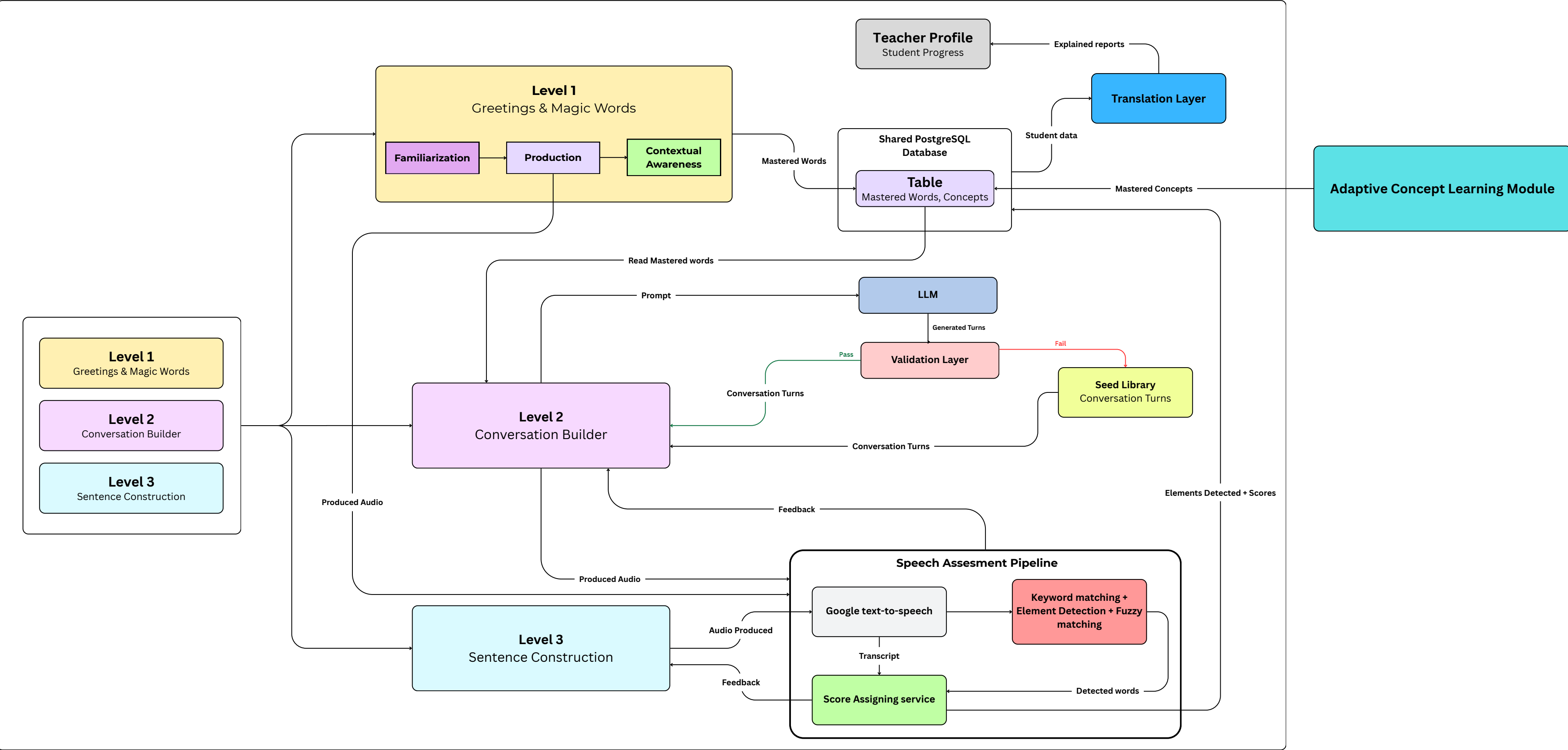
Shared User Authentication: Principal/Teacher login & session management

Student Profile Store: UI preferences & learning history

Avatar Feedback : Acknowledgements made for the child

Teacher Dashboard: Common statistic surface for all 4 modules

Adaptive Dialogue Learning And Progression Tracker - System Overview



Motor-Informed Adaptive Handwriting Learning Module

Contribution to the Overall System

To help children with Autism Spectrum Disorder improve handwriting through a motor-informed adaptive learning component that personalizes letter practice based on motor abilities, enabling them to write words with less difficulty.

Novelty

- Automated motor difficulty detection from digital handwriting strokes
- Motor score-driven adaptive letter sequencing algorithm
- Dynamic personalization of handwriting learning tasks



Stroke Trajectory Analysis

X-Y Writing Movement Tracking

Motor Comfort Score

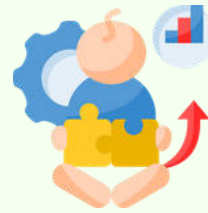
Rule-Based Evaluation Model

Adaptive Learning

Motor-Based Letter Sequence

Motor-Informed Adaptive Handwriting Learning Module

PROBLEM



No Motor-Based Learning

Existing handwriting learning apps mainly focus on alphabet tracing without analyzing children's motor abilities.



Fixed Letter Learning Sequence

Most systems teach letters in alphabetical order, ignoring the child's motor skill development.



No Stroke Movement Analysis

Current tools do not analyze handwriting stroke trajectory, speed, pauses, or smoothness to understand motor difficulties.

MAIN OBJECTIVE

To design and evaluate a motor-informed adaptive handwriting learning module that detects motor difficulties and provides adaptive letter learning sequences, enabling ASD children to progress from letter formation to writing simple English words with improved motor control and reduced writing difficulty.

SUB OBJECTIVES

Handwriting Data Capture

Design a tablet-based handwriting data capture mechanism to record stroke trajectory, speed, pauses, and direction during writing.

Motor Score Model

Develop a rule-based motor scoring model to evaluate handwriting performance.

Stroke Complexity Classification

Classify motor difficulties and letters based on stroke complexity (straight, curve, mixed strokes).

Adaptive Letter Sequencing

Design an adaptive letter sequencing mechanism to provide personalized handwriting learning based on motor ability.

Teacher Monitoring & Reports

Develop a progress monitoring and explainable reporting module for teachers.

Motor-Informed Adaptive Handwriting Learning System - Research Methodology

Knowledge Domains contributing to Methodology

1. Digital Handwriting Analysis

Tablet stylus input used to capture and analyze handwriting strokes.

2. Motor Skill Assessment for Handwriting

Shape-drawing tasks used to identify motor control difficulties.

3. Adaptive Learning Systems

Rule-based adaptive learning mechanism that adjusts the letter learning sequence based on the child's detected motor ability.

4. Explainable Learning Analytics

Teacher reports explaining motor performance and recommended exercises.

Data Availability

1. Stylus-enabled tablets capture stroke data (X-Y coordinates, speed, stroke order).

2. Handwriting activities (letter tracing, writing in boxes, picture-letter tasks) adapted into the tablet-based system.

3. Interaction data collected during learning sessions forms the handwriting dataset for motor analysis.

Motor-Informed Adaptive Handwriting Learning System

Validation and Evaluation

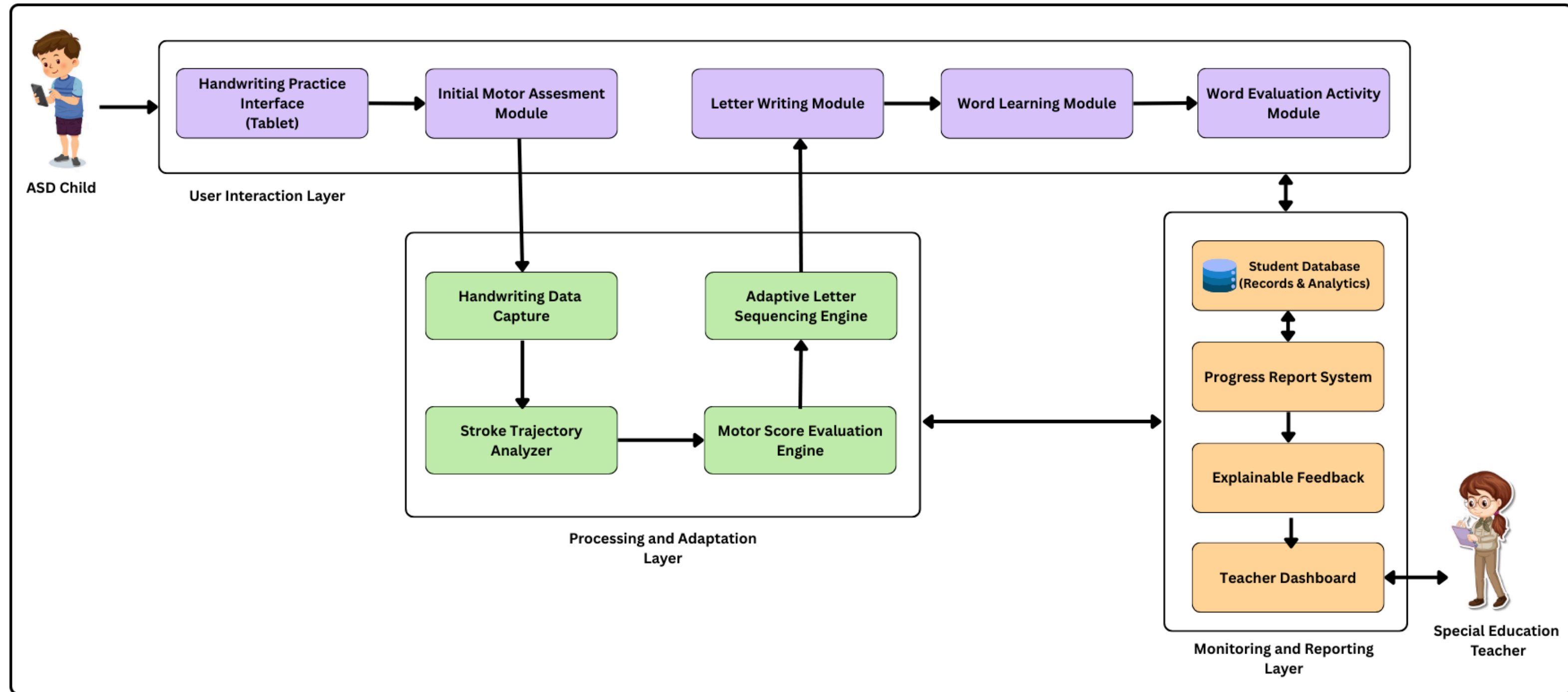
- Letter writing accuracy measurement
- Motor score improvement tracking
- Analysis of speed, stability, and pauses in handwriting
- Completion of handwriting tasks



Security & Ethics

1. **Student privacy** – personal identifiers removed and data anonymized.
2. **Secure storage** – handwriting data and scores stored in protected databases.
3. **Access control** – only authorized teachers/admin can view student reports.
4. **Consent** – data collected only with school permission.
5. **Child safety** – interface designed to be simple, supportive, and stress-free for ASD learners.

Motor-Informed Adaptive Handwriting Learning Module- System Overview



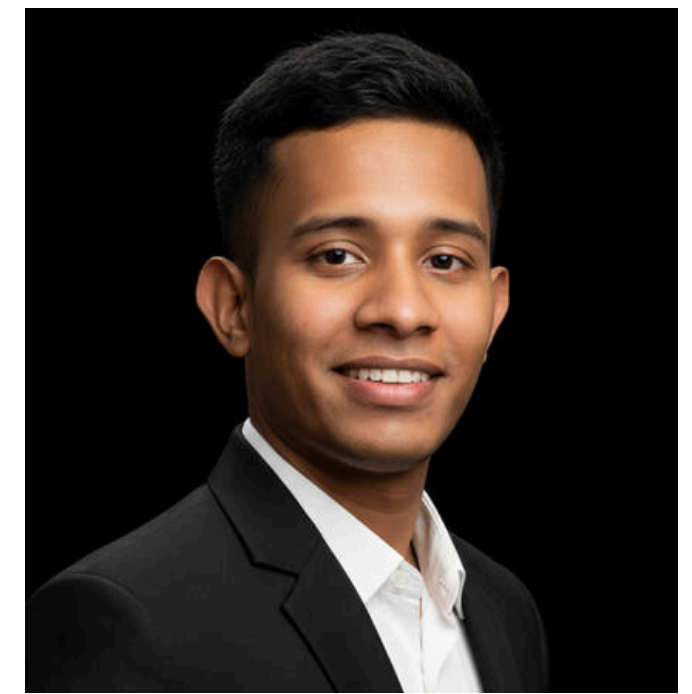
Dependencies & Common Components

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Student Profile Store: UI preferences & learning history

Teacher Dashboard: Common statistic surface for all 4 modules



Adaptive English Pronunciation Support Module

Developing for ASD learners in Sri Lanka to support foundational English pronunciation in an adaptive and teacher-assisted manner.

Novelty

- Combines multimodal practice, activity-based reinforcement, adaptive next-word selection, and pronunciation similarity analysis in one Module.

Adaptive English Pronunciation Support Module - Novelty

Problem Definition

- Autistic learners may need more repetition, visual support, and individualized pacing for English pronunciation.
- English is learned as a second language, so pronunciation, vocabulary, and comprehension become harder together.
- Traditional classroom methods are usually fixed and not designed for learner-specific progression.
- Teachers need a practical way to monitor word-level performance and overall progress without burdening the student.

Gap: limited integration of multimodal practice, pronunciation scoring, adaptation, and teacher analytics in one classroom-usable Module.

Research Objective

Design and develop an adaptive pronunciation support component for Grade 3 ESD learners to strengthen foundational English pronunciation through multimodal practice, similarity-based evaluation, achieving at least 75% speech similarity accuracy, and adaptive progression based on learners' performance on each word, achieving at least 75% within the 9 month project period.

Sub Objectives

- Support practice with images, audio, and visual cues (lip sync movements).
- Measure performance through reference comparison and similarity scoring
- Personalize progression by selecting easier related words when the learner performs below the expected outcome.
- Empower teachers with dashboard records, audio playback, and progress views for each category.

Adaptive English Pronunciation Support Module - Methodology

Technical Methods and Algorithms

- Multimodal learning support: images, flashcards, audio, visual pronunciation guidance (lip sync movements)
- Speech recording during pronunciation activities
- Acoustic feature extraction: MFCCs (Mel-Frequency Cepstral Coefficients)
- Apply DTW (dynamic time wrapping) comparison method
- Pronunciation similarity scoring using UK-accent reference audio
- Rule-based adaptive word selection based on score, sound similarity, vowels, and difficulty

Tools and Platforms

- Stakeholder interfaces: React Native
- Backend logic and audio handling: FastAPI (Python)/ Node
- Storing words, scores, recordings, and progress: PostgreSQL
- Speech preprocessing and similarity analysis: librosa, NumPy, SciPy
- API testing: Postman

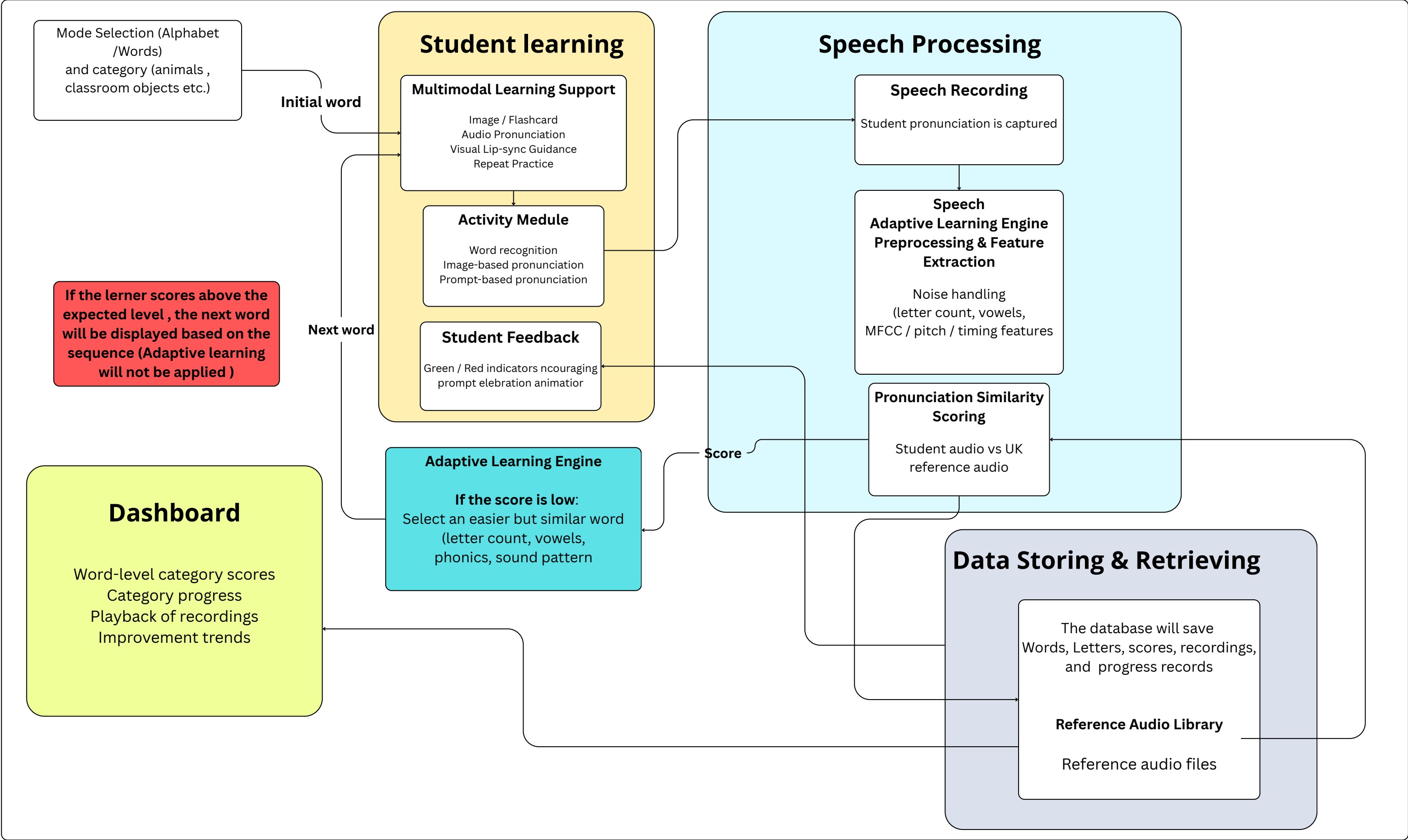
Data Collection and Ethical Considerations

- References based on the Grade 3 English syllabus and teacher guide
- Includes alphabet, familiar words, images, and UK reference audio
- Student recordings collected only during learning activities
- Privacy, consent, secure storage, and educational use are ensured

Validation Strategy and Performance Metrics

- Metrics: word-level pronunciation score, category progress, repeated-attempt improvement, practice frequency, completion progress, teacher feedback

Adaptive English Pronunciation Support Module - System Overview



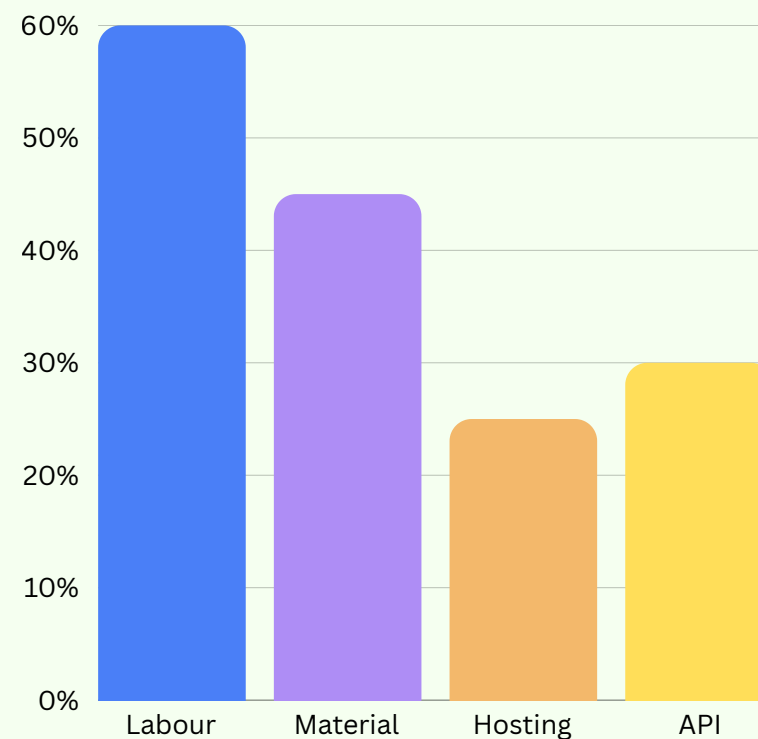
ADAPTIVE ENGLISH LANGUAGE LEARNING FOR ASD CHILDREN IN SRI LANKA

BUDGET

Estimated Total Budget

LKR 34,000

Cost Breakdown



REVENUE MODEL



Freemium Trail

Free Trial - to evaluate before committment

Tier I - Up to 30 students

Small Special Education Units

Tier II - 30 – 120 students

Mid-Scale Schools, Larger Special Education Units

Tier III - 120+ / Multi-Campus Institutions

Large institutions with administrative needs

Annual Fee per Institute, not per student

MARKET & VALUE

27

Special Education
Schools

704

Special Education
Institutes



Target Market

Sri Lankan Special Education
Schools & ASD centers



Value Proposition

Only Sri Lankan Curriculum-
Aligned English Learning ASD
platform

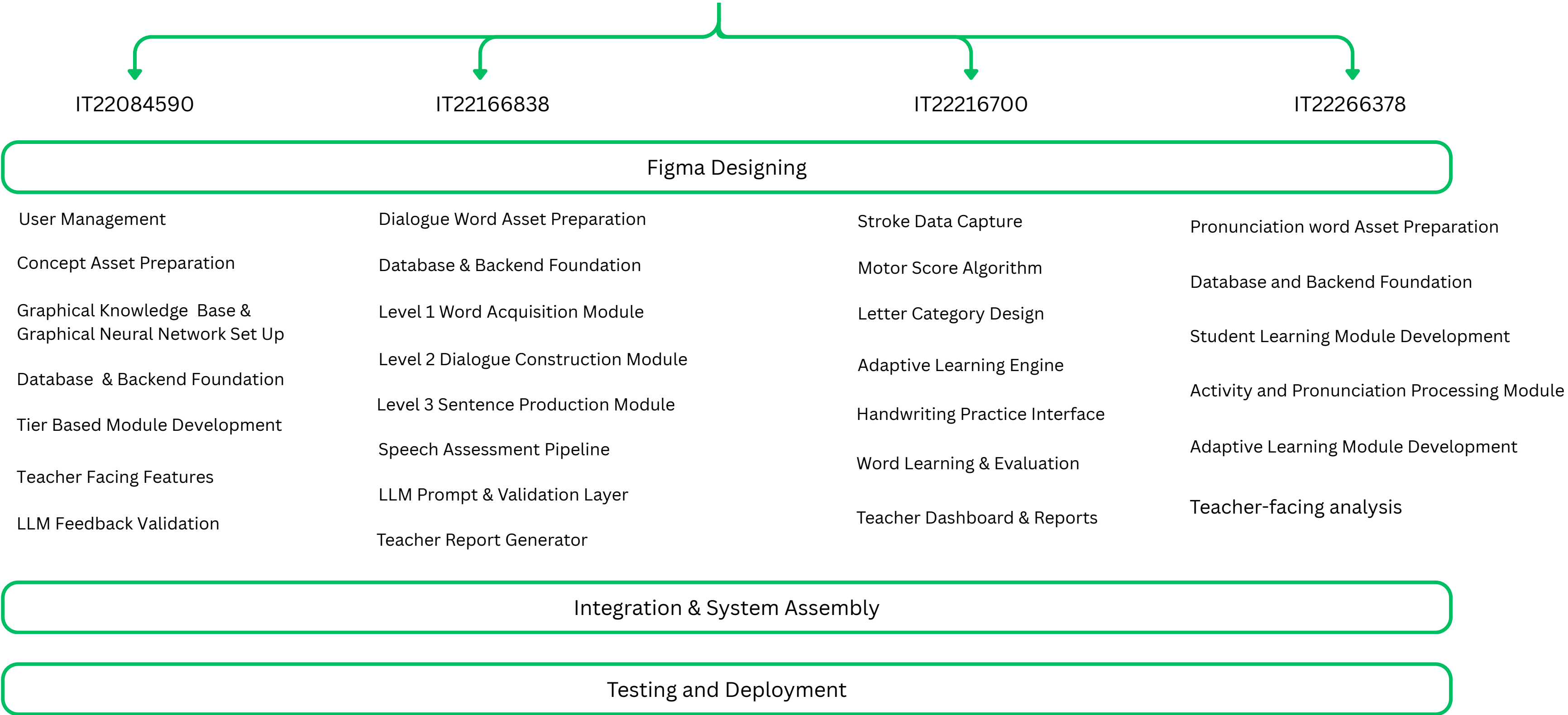


IP Rights

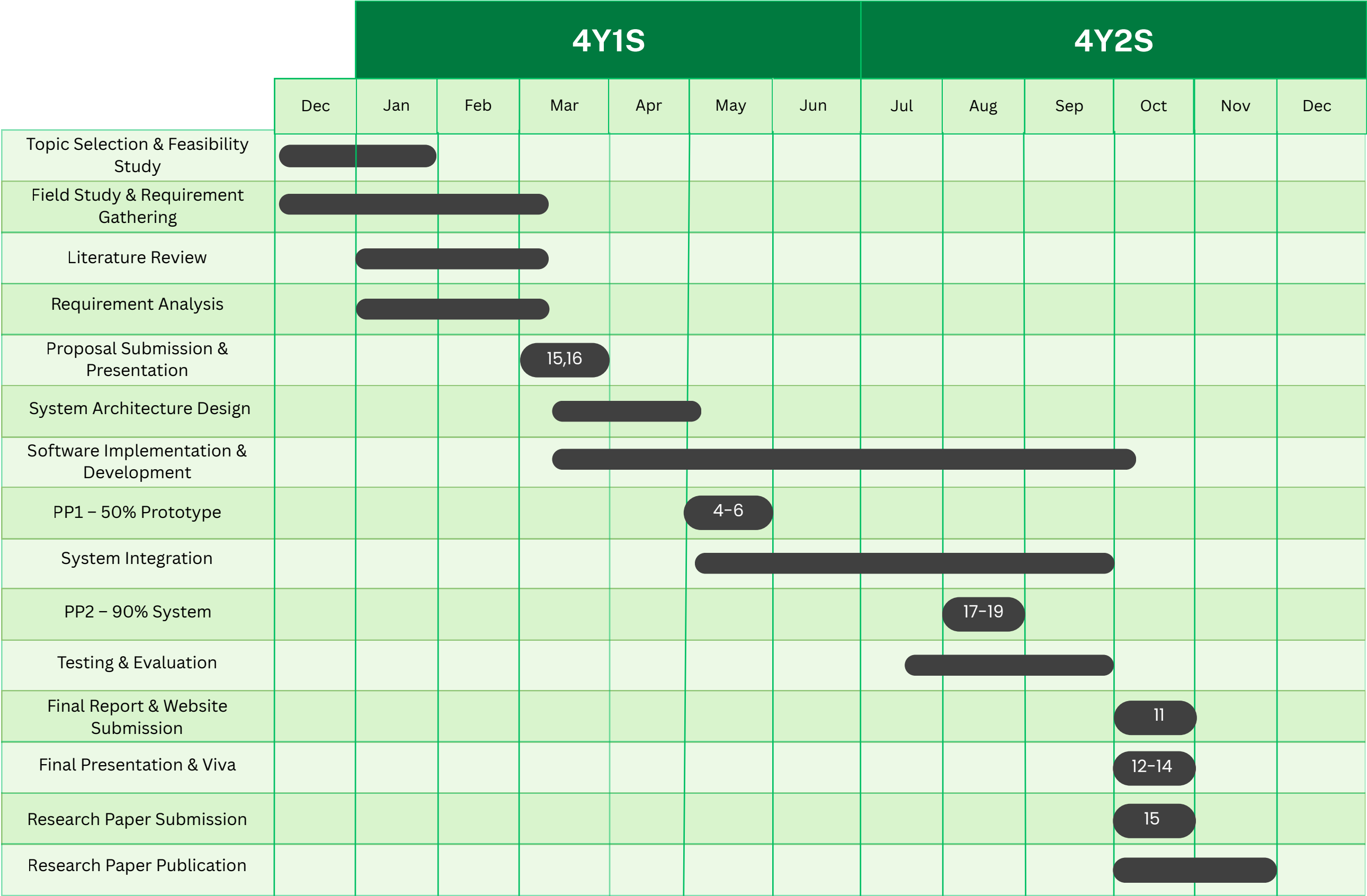
Code, GKB schema & model
weights

ADAPTIVE ENGLISH LANGUAGE LEARNING FOR ASD CHILDREN IN SRI LANKA

WORK BREAKDOWN STRUCTURE



ADAPTIVE ENGLISH LANGUAGE LEARNING FOR ASD CHILDREN IN SRI LANKA





THANK
YOU