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## CHAPTER 1

### INTRODUCTION

Dyslexia is associated with difficulty or problem with words specifically in reading, spelling and expressing thoughts on paper (Greene, 2006). Dyslexic children are physically and mentally normal but have unusual difficulties in reading, spelling and writing. According to a local press the New Straits Times (2009), it is estimated about 5% of school going children in Malaysia are dyslexic. The word dyslexia is derived from the Greek word “dys” meaning poor or inadequate and “lexis” means words or language (British Dyslexia Association, 2008). Along with the difficulties mentioned above, dyslexia also affects memory, concentration, sometimes mathematics, music and self-organization (Hornsby, 1995). According to some psychologists dyslexia is not a disease (Vicari et al, 2005; Shay Witz, 2003; Berninger et al., 2008). This is supported by Sariah Amirin (The Berita Harian Press, 2009), the President of Dyslexia Association, Malaysia in the quotation below: *“Dyslexia is not a disease it occurs in children with normal vision and nothing to do with the hearing, sight and brain damage. It happens because the brain lacks of a function to translate the image seen or heard into something meaningful.”* Recently, there have been a number of researchers looking at the benefits of multimedia educational courseware and addressing various educational issues in the market. This indicates that multimedia applications are widely used within the educational domain. Among others, the use of multimedia as secondary learning tool could play an important role to motivate students’ interest hence improving their performance in learning. The main objective of this research was to study the problems faced by dyslexic children and to evaluate the effectiveness of using multimedia application as an alternative solution in order to overcome the problems faced by them. It is estimated that 1 in 10 people has dyslexia. Dyslexia exists in all cultures and across the range of abilities and backgrounds. Dyslexia often runs in the family. There is no ‘cure’ but lots of practical things can help overcome some of the barriers it presents. Dyslexia is a learning ‘difference’, which means that the brain can approach things in a different way to other people. Dyslexia can affect the way people communicate, and is different for everyone. It is not just about reading and writing and it has nothing to do with intelligence. Dyslexia is classed as a disability under the Equality Act. Dyslexia is a neurodevelopmental disorder causing challenges to individuals in terms of word recognition, spelling, and decoding. It is one of the common learning abilities, affecting 5–10% of the global population. The academic environment can be challenging for dyslexic individuals (DIs). Identifying dyslexia in the earlier stages can protect individuals from adverse effects, including reduced quality of life, low self-esteem, and frustration. Diagnosing dyslexia demands clinical, educational, and behavioral assessments. Traditionally, trained professionals conduct standardized tests of reading fluency, phonological awareness, and rapid automatized naming.

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## CHAPTER 2

### LITREATURE SURVEY

Yazeed Alkhurayyif , Abdul Rahaman Wahab Sait , "A Review of Artificial Intelligence-Based Dyslexia Detection Technique"Diagnostics 2024, 14(21),2362. <https://doi.org/10.3390/diagnostics14212362>, Published: 23 October 2024 . The review findings revealed various DRTs for identifying critical dyslexia patterns from multiple modalities. A significant number of studies employed principal component analysis (PCA) for feature extraction and selection. The authors presented the essential features associated with DD. In addition, they outlined the challenges and limitations of existing DRTs. Impact: The authors emphasized the need for the development of novel DRTs and their seamless integration with advanced DL techniques for robust and interpretable DD models.[1]

Alqahtani, N.D.; Alzahrani, B.; Ramzan, M.S. "Deep learning applications for dyslexia pre-diction". Appl. Sci. 2023, 13, 2804. <https://doi.org/10.3390/app13052804> Published: 22 February 2023 . This review paper analysed the prediction performance of deep learning models for dyslexia and summarizes the challenges researchers face when they use deep learning models for classification and diagnosis. Using the PRISMA protocol, 19 articles were reviewed and analysed, with a focus on data acquisition, preprocessing, feature extraction, and the prediction model performance. The purpose of this review was to aid researchers in building a predictive model for dyslexia based on available dyslexia-related datasets. The paper demonstrated some challenges that researchers encounter in this field and must overcome.[2]

Velmurugan S ."Predicting Dyslexia with Machine Learning: A Comprehensive Review of Feature Selection, Algorithms, and Evaluation Metrics ". This literature review explores the use of machine learning-based approaches for the diagnosis and treatment of dyslexia, a learning disorder that affects reading and spelling skills. Various machine learning models, such as artificial neural networks (ANNs), support vector machines (SVMs), and decision trees, have been used to classify individuals as either dyslexic or non-dyslexic based on functional magnetic resonance imaging (fMRI) and electroencephalography (EEG) data. These models have shown promising results for early detection and personal-ized treatment plans. However, further research is needed to validate these approaches and identify optimal features and models for dyslexia diagnosis and treatment.[3]

S Santhiya and C S KanimozhiSelvi " A study on dyslexia detection using machine learning techniques for checklist, questionnaire and online game based datasets ".The proposed article presents methodologies and techniques used for detecting dyslexia. The primary contribution of this paper is a comparative analysis of various machine learning algorithms for diagnosing dyslexia, including. . The proposed study examines recent advances in detecting dyslexia using machine learning and deep learning approaches and identifies prospective research areas for the future.[4]

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## CHAPTER 3

### PROBLEM STATEMENT

Dyslexia is a learning difficulty that affects a child's ability to read, write, and process language, often remaining undiagnosed due to a lack of accessible assessment tools. This project aims to develop an AI-driven system for detecting and assessing dyslexia in specify age group , providing targeted learning support through gamification and multisensory techniques, including visual, auditory, and physical interactions. The system will dynamically adapt to each child's progress, offering a personalized learning experience that helps them overcome reading and cognitive challenges. Additionally, we will build a functional prototype that integrates these features, ensuring practical application and accessibility. By empowering educators, parents, and dyslexic children with a scientifically backed and interactive solution, this project aspires to enhance early detection, foster confidence, and support long-term learning success.

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## CHAPTER 4

### OBJECTIVES

- Developing an AI-based system capable of detecting and assessing dyslexia in specify age group by analyzing cognitive, linguistic, and behavioral data. This will include speech patterns, reading difficulties, writing inconsistencies, and other indicators commonly associated with dyslexia.
- Providing customized educational content, exercises, and adaptive interventions tailored to the diagnosed severity of dyslexia in each child. The system will adjust its approach based on real-time assessment results, ensuring an individualized learning path.
- Integrating gamification techniques, such as reward-based learning, interactive challenges, and engaging activities, to motivate children and enhance their learning experience. By making the learning process enjoyable, the system aims to improve participation and retention.
- Implementing continuous monitoring of a child's learning progress through AI-driven analysis, dynamically adjusting the difficulty level and type of educational activities. This ensures that children receive appropriate challenges while avoiding frustration or disengagement.
- Design and implementing a working prototype that demonstrates the AI-driven dyslexia assessment and learning support system. This prototype will serve as a proof of concept, allowing for real-world testing and validation by educators, parents, and specialists.
- Developing an affordable, easy-to-use tool that can be deployed in schools, homes, and learning centers. The system will be designed for intuitive use by parents, teachers, and educational professionals, ensuring widespread accessibility and practical application.

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## CHAPTER 5

# METHODOLOGY

The project aims to develop an AI-driven system for detecting and assessing dyslexia in children within a specified age group. It focuses on providing an accessible diagnostic tool and a personalized learning aid. The system analyzes cognitive, linguistic, and behavioral data to ensure early identification and intervention. A prototype will be built to integrate these capabilities into an interactive platform for educators and parents.

- Dataset Collection and Preparation

Data collection is a critical component of the project, incorporating both public datasets, such as those from Kaggle, and custom data gathered through collaborations with educational institutions. The collected data includes text samples, audio recordings, and behavioral metrics like eye movement and cursor tracking. Preprocessing techniques such as noise reduction, text normalization, and structured formatting are applied to enhance data quality.

- Model Design for Dyslexia Detection

The dyslexia detection model is designed to process multimodal data inputs using machine learning techniques. Text data is analyzed through Natural Language Processing (NLP) models like BERT, while speech patterns are evaluated using Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs). Behavioral data is processed using attention-based networks to detect significant patterns. The trained model classifies children as dyslexic or non-dyslexic based on identified linguistic and phonological markers.

- Personalized Learning Aid Development

An interactive educational platform is developed to integrate the detection system with a personalized learning aid. The system continuously adapts learning activities based on the child's progress, ensuring effective engagement through gamification features such as points, rewards, and progressively challenging tasks. The platform provides real-time feedback and detailed progress tracking, offering educators and parents insights into the child's development.

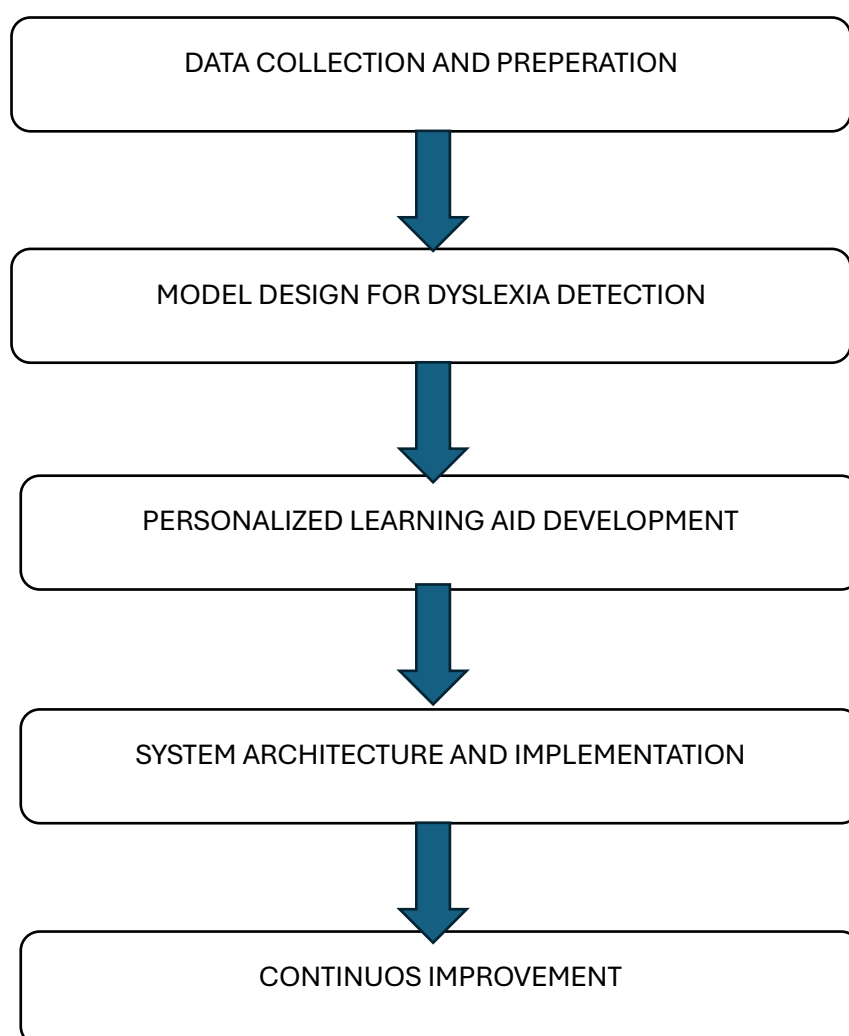
- System Architecture and Implementation

The implementation involves a structured pipeline comprising data collection, preprocessing, model training, and integration into a user-friendly interface. Technologies such as TensorFlow, Keras, and NLP tools are used

for model development, while React and Node.js power the web-based learning platform. Speech recognition APIs and AI-driven analytics further enhance the system's capabilities.

- Continuous Improvement

Continuous improvement is ensured through performance monitoring, with dashboards displaying progress trends and behavioral insights. Adaptive learning paths help refine interventions, keeping the experience engaging and effective. This AI-powered approach bridges the gap between dyslexia diagnosis and tailored educational support, fostering confidence and long-term learning success for affected children.

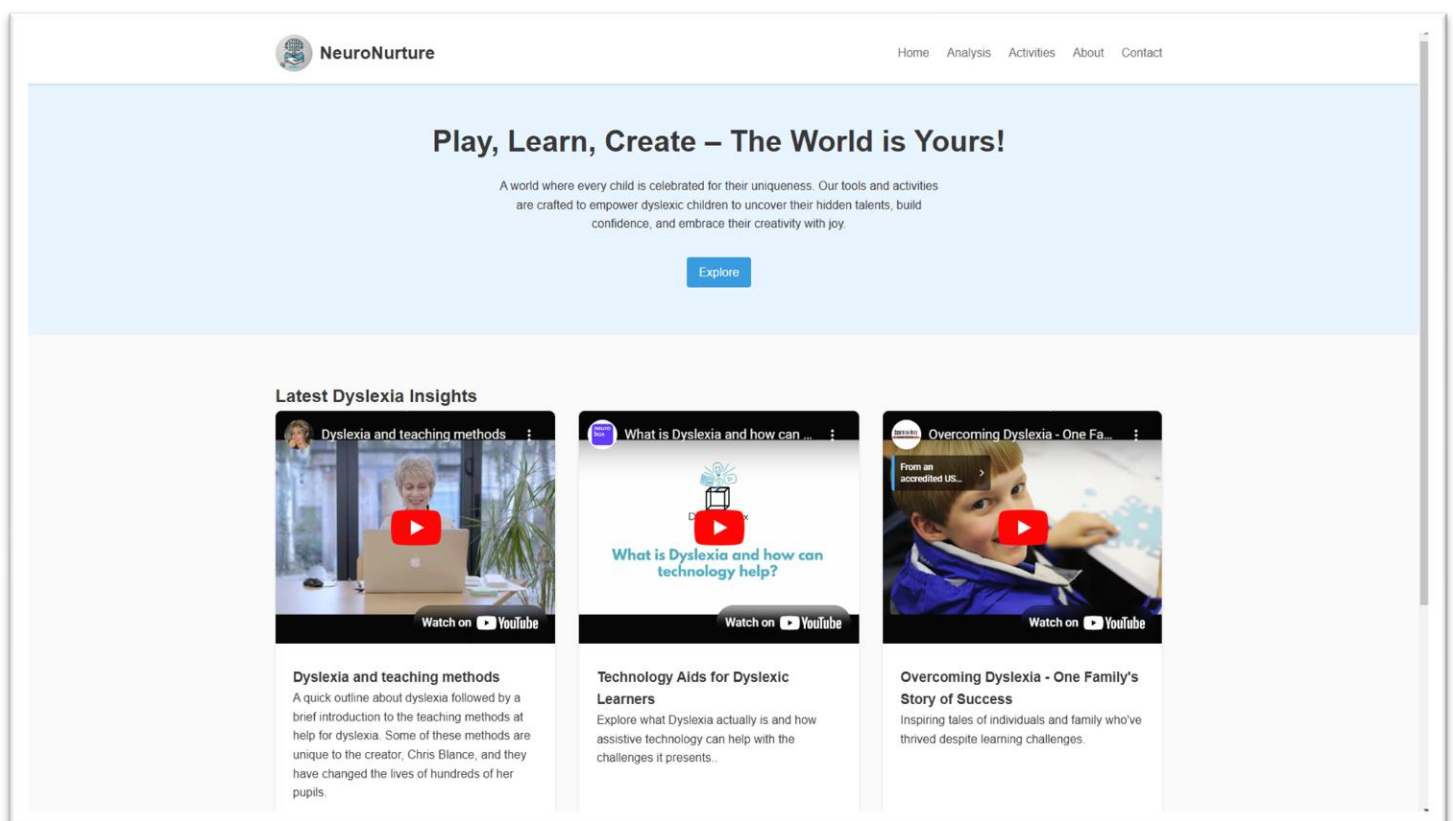


**Fig No : 1 : Block Diagram**

## CHAPTER 6

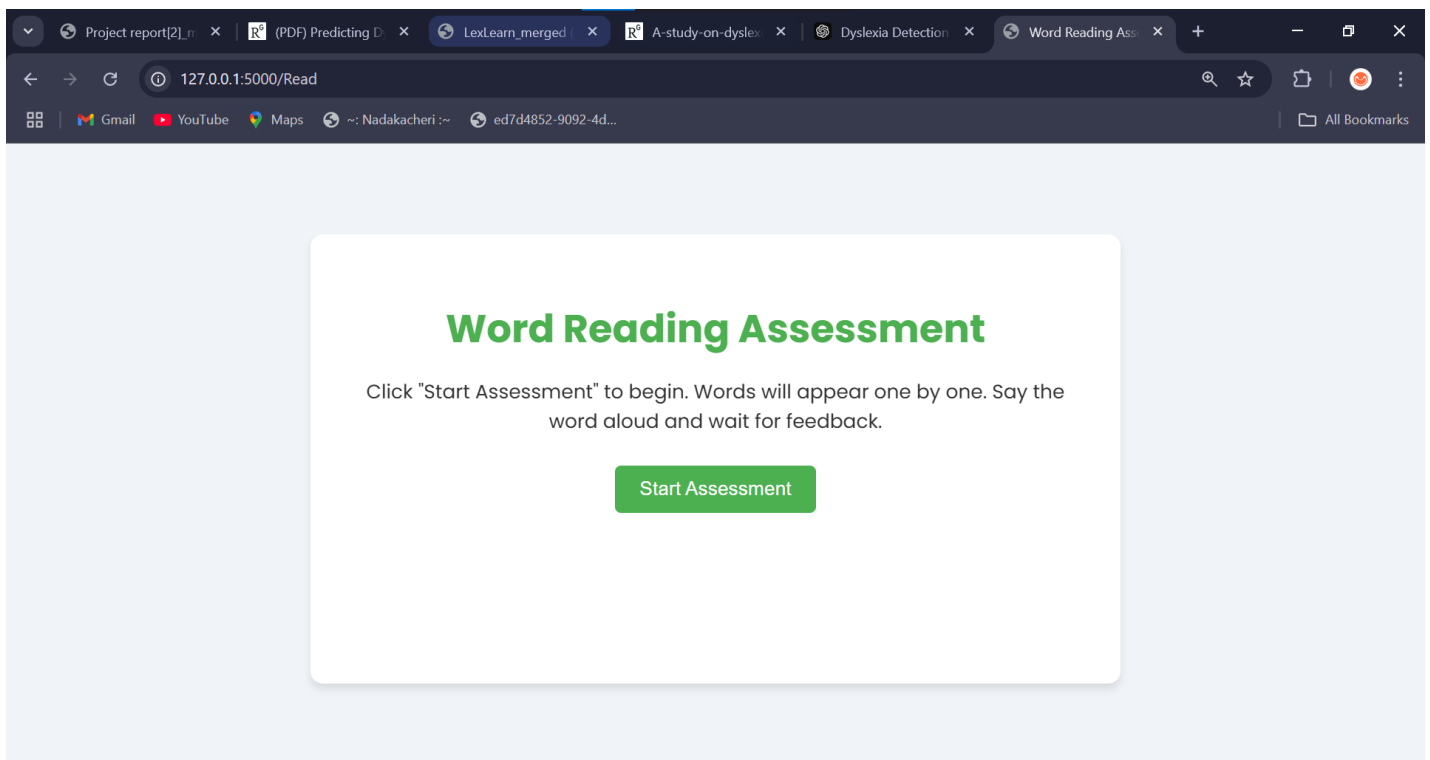
# RESULTS AND DISCUSSIONS

Our dyslexia detection system is currently in the early stages of development, with approximately 25% of the project implemented. So far, we have successfully designed and developed the landing page and an initial webpage for dyslexia assessment. These components serve as the foundation for the full system, aiming to provide an accessible platform for early dyslexia screening. The landing page introduces the purpose of the system, while the assessment webpage includes interactive elements that will later be integrated with AI-based evaluation techniques.



**Fig No : 2 : Screenshot : Neuronurture Landing page window**

Since the model is not yet fully implemented, we have not conducted a full performance evaluation of dyslexia detection. However, our focus remains on refining the user experience and ensuring that the platform is intuitive for educators, parents, and children. Future phases will involve developing the machine learning model, incorporating speech and text analysis, and integrating personalized learning aids. As development progresses, we aim to rigorously evaluate the system's accuracy, precision, and effectiveness in supporting dyslexic learners.



**Fig No : 3 : Screenshot : Reading Assessment window**



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