# AI-Driven Behavioral Assessment and Intervention for ADHD

Project ID: 24-25J-261

## Project Proposal Report

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November 2024

## Declaration of The Candidate & Supervisor

DECLARATION

This declaration confirms that the proposal is the original work of the author and does not include, without acknowledgment, any material previously submitted for a degree or diploma at any other university or institution of higher learning. It also certifies that the proposal does not contain any material previously published or written by another person, except where proper acknowledgment has been made within the text. The statement reflects the author's commitment to academic integrity and originality in the work presented.

| Name | Student ID | Signature |
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The above candidate has carried out research for the bachelor's degree dissertation under my supervision.

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**Signature of the supervisor:**

28/11/24

**Date:**

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**Signature of the co-supervisor:**

05/12/24

**Date:**

# Abstract

Attention Deficit Hyperactivity Disorder is the most common neurodevelopmental disorder in which children face serious difficulties with regard to maintaining focus, controlling impulses, and managing their behavior, all significant obstacles to educational and social success. This project describes the design of an intelligent ADHD management system based on AI to provide comprehensive support tailored to the individual's needs and adaptive for these children. The platform provides a captivating app that uses machine learning, data science, and software engineering custom-built to address each child's unique requirements. The system incorporates expert insights from Dr. Kamalini Wanigasinghe, who specializes in cognitive disorders and has more than 20 years of experience in the field. This ensures that all intervention strategies are both ethical and effective.

All these applications constantly collect and analyze behavioral data such as attention span, response times, and completion rates that monitor progress. Advanced AI systems adapt the interventions dynamically using reinforcement learning to personalize the task's difficulty and suggest appropriate activities. It also predicts some future problems through the performance trends of the child, thereby suggesting improved preventive measures for possible risks. NLP-based personalized feedback is then directed to the child as well as the parent for better programming effectiveness.

A simple yet functional interface summarizes essential accomplishments and specifics on what could improve, while notable developments or worries are communicated to caregivers through automated alerts. This element further enables the periodic retraining of AI models so that the system grows together with the child. By incorporating these elements, the system provides thorough, continuous assistance and fixation on children, which overcomes the deficits of ADHD typical methods of management and enhances their optimization over time.

The achievement of the project is based on the collaborative endeavor of specialists from various fields such as psychology, machine learning, and programming. Ethnographic data collection methods include participation with focus groups and specialized schools (primary sources) and Kaggle sites (secondary data sources). In terms of assisting AI in implementing dynamic intervention approaches within the strategic vision of the project, this part of the research indicates a step forward in terms of the management of ADHD in a paradigm of personalization and programmability for the child and the caregiver.



Key Words - ADHD management, Personalized interventions, AI-driven solutions, Progress monitoring, Machine learning, Child development, Behavioral data analysis

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# 1. Introduction

## 1.1 Background

ADHD is among the most common neurodevelopmental disorders of childhood in many parts of the world. The core symptoms characterizing ADHD involve problems of inattention, hyperactivity, and impulsivity. [1] With clinical presentation in inattention, hyperactivity, and impulsivity, ADHD might have a very pernicious effect on the academic performance, social function, and quality of life in an affected child. Pooled estimates from population surveys suggest that 5.3% of the global population meet criteria for ADHD. [4] Psychotherapeutic management in general consists of behavior therapy, academic support, and involvement of family members. However, traditional approaches to ADHD management are often rigid, homogeneous, and ill-suited to meet the unique and dynamic needs of a particular child.

Technological advancement, especially in the use of Artificial Intelligence, will provide a way of managing ADHD with customized, adaptive, and responsive solutions. The aim of this work is to develop an AI-driven suite for ADHD management which overcomes the disadvantages of a traditional approach. The system will use data science and machine learning software engineering methodologies to provide personalized interventions and continuous monitoring of improvement in the child, feeding information to both the child and the caregiver. Emerging AI solutions and natural language processing have created opportunities in the area of cognitive therapies aimed at people suffering from cognitive dysfunctions. [6]

There can be other relevant reasons as well which may help the adjustment of the child with ADHD and hence that leads to self-destructive behaviors and their remedies. [5] The application is implemented with several innovative features to achieve its goals. It gathers and analyzes behavioral information such as attention, the completion rate of tasks, and response time in order to track the child's learning process. The machine learning algorithms will extract the patterns from this data and generate dynamic variation of the intervention strategies; for example, changing the difficulty of activities or introducing new ones. Machine learning methods ensure the application learns and grows as the child progresses, in turn providing support over a period of time.

One key objectives of the project involves the use of Natural Language Processing to provide real-time and customized feedback based on a child's responses. It also has a practical dashboard that visualizes progress, shows achievements, and points out improvement needs. Automatic alerts will be used to notify caregivers or educators of unusual children's developmental progressions, thus preventing late interventions. Efforts at predicting conclusions or reactions in response to treatments has been very few and the existing models do not appear to be ready for integration into clinical settings. The use of clinical predictors, which may be combined with other type of predictors, seems to improve the performance of the models. [11] The app also makes use of predictive analytics for the early identification of prospective problems and proactive advice on the prevention of these.

This project is in collaboration with medical professionals, including a specialist in cognitive disorders, Dr. Kamalini Wanigasighe, to ensure the system works within the bounds of ethical considerations and evidence-based approaches. The data were collected by a primary source, through observations in specialized schools, and secondary data from a platform, Kaggle.

This project aims to work toward an individualized and adaptive ADHD management system in such a way that integrates the use of AI with domain know-how, considering individual peculiarities of each child. The introduction has therefore expressed promise for AI-based solutions towards paradigm-shifting treatments to enable adaptive and personalized supportive features that change with the moving level of development.

## 1.2 Literature Review

ADHD is a subject of concern to researchers and practitioners in psychology, child development, and educational support systems. Most of the professionals consider ADHD a disorder that is widespread among children, but it seems reasonable to look back at how we can stop such a disease in order to prevent deficits of the cognitive skills which are bound to be affected due to the earlier onset of the disorder. [5] Most traditional ADHD management practices make use of pharmacological, behavioral, or structured intervention approaches. However, these strategies are often general and static in nature, allowing for different levels of success depending on the individual. Such a gap has driven scientists to examine how modern digital tools, in particular the Internet and artificial intelligence (AI) and machine learning, may enhance disease management.

- **ADHD Management: The Traditional Way**

Among the common methods of treatment, CBT, parent training, and classroom interventions are frequently used. It has been established that these methods improve behavioral outcomes (Barkley, 2015), however they fail to be dynamic and address the needs of ever-changing children. Furthermore, the absence of instantaneous assessment and feedback restricts the possibility of interventions according to progress shown by the child (Pliszka et al., 2007).

- **The Role of Technology in ADHD Management**

Recent technological advances have introduced digital aids in the form of mobile applications and wearables to manage ADHD. he design of wearable applications supporting children with Attention Deficit Hyperactivity Disorders (ADHD) requires a deep understanding not only of what is possible from a clinical standpoint but also how the children might understand and orient towards wearable technologies, such as a smartwatch. [7] These are enabling behavioral tracking and outcome measurement, and can therefore give caregivers and educators insights (Wang et al., 2019). Yet, from above and at current state-of-the-art applications, most applications are primarily data logging and do not have dynamic adaptation functions that can adapt interventions according to the real-time analysis results of child behavior. social media platform like Twitter, has become a source of comfort for these individuals to discuss mental health issues openly, as they seek connection and support from people of the same community. Therefore, social media platform can be utilized for early detection of various mental illnesses and intervene suicidal actions. [8]

- **Artificial Intelligence in Personalized ADHD Interventions**

AI has become a powerful tool for healthcare applications that facilitate personalized and adaptive interventions. Machine learning algorithms can be used to process big data to uncover patterns and trends and can provide insights that can never be obtained by static systems. Reinforcement learning has been

recognized as a promising approach to dynamically adapt intervention strategies, depending on the performance of the child (Pena et al., 2020). Additionally, predictive models can forecast future

challenges, allowing caregivers to take preventive measures. AI-based tools have been explored in various contexts, including cognitive training and educational support, showing potential for improving personalized learning and engagement. [9]

Studies by Garcia et al. According to (2021), the effectiveness of AI-based adaptive learning systems in enhancing learning characteristics of children with learning disabilities has been shown to improve educational achievements. Such systems adjust task difficulty in accordance with the user's behavior, which is a property that can be utilized very efficiently in the context of ADHD management, to keep the user engaged and promote skill development.

Natural Language Processing (NLP) is also one of the potential fields in the AI based ADHD management. NLP allows systems to interpret and respond to user inputs in real time, enhancing the personalization of interventions. E.g., conversational agents and chatbots have been employed to give feedback, positive reinforcement, and counseling to children, to make the intervention more interactive and immersive (Singh et al., 2018).

- **Predictive Analytics for ADHD Risk Management**

Predictive analytics makes use of statistical and machine learning methods to interpret prior data and predict the future. In ADHD control, this ability may help to foresee challenges that a child could have to face (i.e., attention deteriorating, impulsivity increasing) with the behaviour of a child in the moment. Prediction models also offer clinical guidance for caregivers in the form of actionable advice and are a vital part of active ADHD monitoring systems (Rao et al., 2022).

Editional tables and charts were produced and used to describe the data that were obtained from included studies. A bar graph showing 10% of the most common predictive types was shown. When sufficient data was obtained, we also conducted meta-regression analyses to examine the association between AUC and the following variables: (1) type of validation performed (internal vs. external); (2) broad age group covered in the studies (children and adolescents; adults; or did not specify age group); (3) type of model developed (diagnostic; prognostic; or treatment-responding models); (4) number of predictors that were included in models; (5) Predictors used [clinic/socio demographic, Any biomarker including neuroimaging, EEG, MEG, proteomics, genetics, cognitive or a combination of these]; (6) Modality of the predictors each of the predictor’s modality focusing on a single type (unimodal) and focusing on different types (multimodal); and (7) the studies applied. [11]

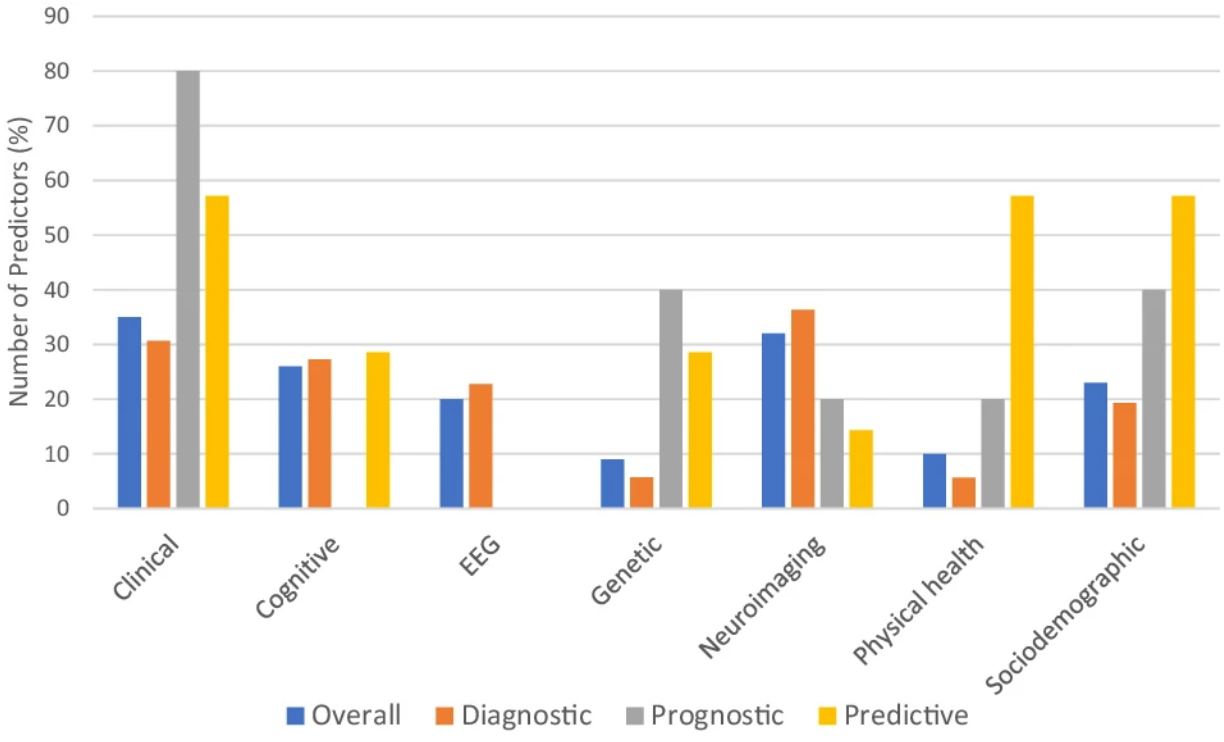


*Figure 1.2.0 : Most frequently reported predictors across prediction model types.*

- **Integration of Domain Expertise and Technology**

The collaboration between healthcare professionals and technologists is crucial for developing effective ADHD management systems. Domain experts contribute to the understanding of the specific features and requirements associated with children with ADHD and help ensure the technology corresponds to evidence-based practices and ethical considerations (Kovacs et al., 2017). For this project, the involvement of Dr. Kamalini Wanigasighe, a specialist in cognitive disorders, provides a solid foundation for the development of ethical and effective interventions.

- **Limitations of Existing Systems**

Although much progress has been achieved in the introduction of tech into the management of ADHD, present systems typically do not possess the flexibility to respond adaptively to the evolving requirements of the child. Moreover, most of the applications are narrowed down to monitoring and offer nothing else than that, be it any actionable feedback or predictive information, etc. These restrictions highlight the importance of an integrated solution that incorporates real-time data analysis, adaptive learning, and predictive modelling for the effective management of ADHD.

According to the literature AI-based systems have the promise to transform ADHD management by means of tailored and adaptive interventions. In an attempt to overcome the constraints of traditional approaches and present technology-based solutions, this work aims to create an end-to-end ADHD management application, which adapts to the development of the child across the different phases of its growth and offers long-term, efficient support.

## 1.3 Research Gap

The research points to the lacunae in the traditional and existing ADHD management systems, which lie in their lack of personalization, real-time monitoring, and predictive analytics. Current tools are not able to adapt dynamically to the progress of a child, underutilize AI capabilities like NLP and reinforcement learning, and have scanty data collection. This project develops an AI-driven adaptive solution that integrates domain expertise for personalized and effective ADHD interventions, addressing these gaps.

*Table 1.3.0 : Research gap*

| **Component** | [1] | [5] | [9] | [11] | **Proposed System** |
|---|---|---|---|---|---|
| Monitoring Child's interactions | ✅ | ✅ | ✅ | ✅ | ✅ |
| Personalized Feedbacks | ❌ | ✅ | ✅ | ❌ | ✅ |
| User Dashboard | ✅ | ❌ | ✅ | ✅ | ✅ |
| Future Predictive Insights | ❌ | ❌ | ❌ | ❌ | ✅ |
| AI-Driven Recommendations | ❌ | ❌ | ❌ | ❌ | ✅ |
| Alert and Notifications | ✅ | ✅ | ✅ | ✅ | ✅ |

### 1. Limitations of Traditional Methods for the Management of ADHD

Conventional methods of management, like behavioral therapy and structured interventions, adopt a one-size-fits-all approach. Child and teacher insight into strategy use in the classroom on a practical, day-to-day level may provide an opportunity to better understand how different strategies might benefit children, as well as the potential barriers or facilitators to implementing these in the classroom.[10] These lack the personalization and dynamic adaptation that each individual child and his changing needs have been demanding. These interventions cannot offer real-time feedback and continuous progress monitoring either, thus limiting their effectiveness in sustaining long-term support.

### 2. Deficiencies in the Current Use of Technology in ADHD Applications

Although many different kinds of digital tools and applications have been developed around ADHD, their functionalities range basically between behavioral tracking and very simple analytics. Most of the existing applications are not really using deep AI capabilities, such as dynamic adaptation through reinforcement learning or predictive analytics, that can really help in greatly improving intervention strategies. The applications also generally lack integration with domain expertise, which ultimately compromises their

reliability in delivering evidence-based recommendations. It is important to increase our understanding of sex effects in ADHD and whether certain symptoms are more predictive of clinical diagnosis and pharmacological treatment (including whether sex differences in such predictors exist), as it can lead to improved identification of females with the disorder. [12]

## 3. Lack of Real-Time Data Analysis and Feedback

Current systems do not provide real-time analysis of behavioral data; thus, delays occur regarding the detection of significant changes or challenges in a child's progress. Real-time feedback mechanisms are not present to allow for the proper timing and effectiveness in interventions by caregivers and educators according to the immediate needs of the child.

## 4. Limited Integration of Predictive Analytics in ADHD Management

At a behavioral level, children with ADHD often face academic failure, repeating grades, or dropping out. The economic burden of ADHD, affecting medical, educational, familial, and financial domains. ADHD increases the risk of conduct disorders, poor social skills, academic struggles, and family tension. [9] While predictive analytics has been widely applied in various healthcare domains, the adoption of the same into ADHD management remains limited. The present systems rarely anticipate the challenges that may arise in the future or provide proactive strategies to deal with potential risks, leaving caregivers unprepared to manage emerging behavioral issues effectively.

While NLP can interpret and respond to user inputs in real time, it is underutilized in current ADHD management systems. By integrating NLP, systems could enhance personalization, improve engagement, and provide more meaningful feedback based on the child's interactions.

## 5. Lack of Collaboration Between Technology and Domain Expertise

Most of the existing systems are developed with limited contribution from medical experts specializing in ADHD. When asked about their knowledge of ADHD, teachers tended to focus on the core symptoms of ADHD. All teachers directly mentioned difficulties with attention, focus or concentration, and most directly or indirectly referred to hyperactivity. [10] Because collaboration is at a minimal level, the tool's ethical and practical usability is bounded, thus providing solutions which may not fit into specific needs and characteristics that this kind of child would represent.

Most of the applications for ADHD are based on some predefined intervention strategies which are not updated with time as per the progress of the child. Such a static approach neglects the child's developmental trajectory, hence the system cannot continue to support the child relevantly.

## 6. Limitations in the Collection of Comprehensive Data

ADHD management demands an understanding of the holistic behavior of the child, which requires metrics on attention span, response times, and task completion rates. Most of the existing tools lack the capability to gather and analyze such comprehensive data; therefore, their interventions are not very effective.

The various shortcomings of the prevailing methods for ADHD management underline the need for an intelligent, adaptive system that is underpinned by domain expertise, real-time data analysis, predictive

modeling, and personalized interventions. It is only when these needs are met that a holistic dynamic solution can be created that will meet the special needs of children with ADHD. Therefore, this project tries to plug these gaps by integrating current state-of-the-art artificial intelligence techniques with inputs coming from specialists in cognitive disorders: thus assuring a well-structured and effective system.

## 1.4 Research Problem

ADHD is a common neurodevelopmental disorder with significant everyday impairments for the individuals affected. Advances in therapeutic interventions have extended treatment options beyond traditional pharmacological methods to include new and novel treatments. [6] Traditional diagnostic and treatment techniques for ADHD are generally static, highly subjective measures based on caregiver or teacher impressions, which may not be a sound basis for identifying a child's needs. In addition, these methods cannot have the flexibility in light of the emerging challenges in children with ADHD while growing and developing. Traditionally, ADHD diagnosis and management are subjective based on the perceptions of the caregivers, teachers, and clinicians themselves.

Although these may be useful, they do not reflect the subtlety and dynamic nature of ADHD symptoms. These approaches are generally episodic, with data coming from intermittent observations or questionnaires, and can only give a snapshot of the child's behavior at any one time. For this reason, they are unable to detect key patterns or triggers that emerge over time. Moreover, these techniques lack the elasticity to accommodate the dynamic challenges that children with ADHD face with increasing age and responsibilities in more varied environments. [3]

These are often static methods, and thus they cannot help clinicians to understand the cause behind a child's difficulties fully; hence, the specific interventions that the child receives may not exactly match his or her needs. For example, even though a child's attention ability improves in structured settings, it may deteriorate in non-structured settings-a pattern conventional assessments may miss. This gap can result in generalized, "one-size-fits-all" interventions that fail to produce optimal outcomes.

However, while technological advancement has thrown up its digital tools in support, often these solutions are narrow-scope and fail to enable personal attention. Most current platforms will take a generic route of proposing training exercises or behavior tracking without using sophisticated analytics aimed at understanding what a particular child needs. [2] Second, these systems are generally not easy to adapt according to different changes in the child-behavior, learning process-even such other environmental factors as changing their routine or causing stress on a child.

Another serious deficiency in the present systems is that none of them are able to predict what challenges a child in the future is likely to face. For example, the transition of a child suffering from ADHD from primary school to secondary school brings greater academic and social demands, so symptoms are manifested unlike in earlier years. The different tools developed so far are rarely equipped to foresee such challenges and adjust their strategy of intervention accordingly. This lack of foresight is one of the core limitations in being able to support proactively.

Also, most of them do not present caregivers with insights in actionable formats sourced from real-time data. Where recommendations are not meaningful or data-driven, caregivers are often left to make sense of raw information-an inherently complex task. This also leads to inconsistencies in decision-making and further lessens the effectiveness of the digital intervention on comprehensive symptom management of ADHD.

In this regard, there is a dire need for an intelligent scalable solution that should involve AI and ML in order to provide personalized, adaptive, and data-driven support. It would track the continuous interaction of a child in different environments, such as home, school, and therapy sessions. [7] It would analyze the behavioral patterns in real time, detect triggers, track progress, and readjust recommendations dynamically to meet the needs of the child.

The AI-driven platform would go beyond the conventional manner of presentation in which:

Continuous Monitoring: The process of observing child behaviors, especially attention span, impulses, and response to certain stimuli.

Behavioral Analysis: Advanced trend and correlation identification algorithms take a holistic approach to understanding symptoms of ADHD in the child. Personalized Recommendations: Intervention strategies, including impulse control exercises, mindfulness activities, and routines for physical engagement, tailored to a specific child's strengths and challenges. Predictive Insights: The capability to foresee possible difficulties-for instance, periods of heightened impulsivity with transitional or stressful events-enabling caregivers to take action pre-emptively.

Caregiver Actionable Feedback: Easy-to-use dashboards and reports to support turning data into crystal clear, actionable recommendations for enabling decisions from the point of care in their practice.

This system would integrate AI-driven analytics with dynamic adaptation to overcome the shortcomings of the presented approaches and would therefore provide a holistic framework for managing ADHD. The proposed system is bound to bring a revolution in the way ADHD is presently perceived and treated and ensures better outcomes for children and their families. This would tend to their immediate needs as well as provide a possible cornerstone in the child's long-term development wherein he or she would excel with their ADHD.

# 2. Objectives

## 2.1 Main Objective

To develop an AI-driven, adaptive ADHD management system that provides personalized and effective support by integrating real-time monitoring, predictive analytics, and dynamic intervention strategies, ensuring continuous progress tracking and tailored recommendations for children with ADHD. According to historical data of child system will predict future challenges child might exposed and prevention mechanisms for those challenges. This will help for teachers and caregivers to know future impacts and treat children before they affected.

## 2.2 Sub Objectives

- **Data Collection and Analysis**

Gather detailed data on children’s behavioral patterns, including attention span, task completion rates, and response times, through application interactions and observational studies. Perform data preprocessing and feature engineering to extract meaningful insights, ensuring high-quality inputs for train AI models.

- **Monitoring Child's Interactions**

Track and analyze the child's interactions with application activities, identifying patterns and trends in engagement and learning progress. Use the collected data to continuously refine the intervention strategies and ensure they align with the child's evolving needs.

- **Create user-Friendly Interfaces**

Adaptive interfaces are recommended for the ADHD assessment tool so that caregivers and teachers can effectively use the tool. This will include use of simple icons and displaying child's progress using pie charts and line charts to be more user-friendly. When making predictions the necessary parameters will have to pass by teachers to make correct predictions. User-friendly dashboard will help to find those parameters at first shot without delays.

- **AI-Based Adaptive Intervention**

Develop machine learning algorithms to dynamically adapt intervention strategies based on the child's performance and progress. Child progress will be displayed on monitoring dashboard.

- **Future Predictive Insights**

Use predictive analytics to forecast potential future challenges the child may face in their developmental journey using child's historical data. Provide proactive recommendations to caregivers and educators to mitigate risks and enhance the child's long-term growth.

- **AI-Driven Recommendations**

Generate personalized feedback for the child and actionable insights for caregivers, highlighting strengths and areas needing improvement. Leverage NLP to interpret the child's inputs and behaviors, delivering highly customized recommendations in real time.

- **Evaluation and Testing**

The effectiveness of the developed machine learning model was evaluated through a comprehensive testing process. The evaluation focused on several metrics, including ADHD symptoms detection accuracy, user engagement, and treatment outcomes. An experimental setup was established, involving a sufficient number of participants, control groups (if applicable), and an appropriate duration for the study. Statistical analyses and validation techniques were applied to assess the results' significance and reliability.

# 3. Methodology

## 3.1 Overall System Diagram

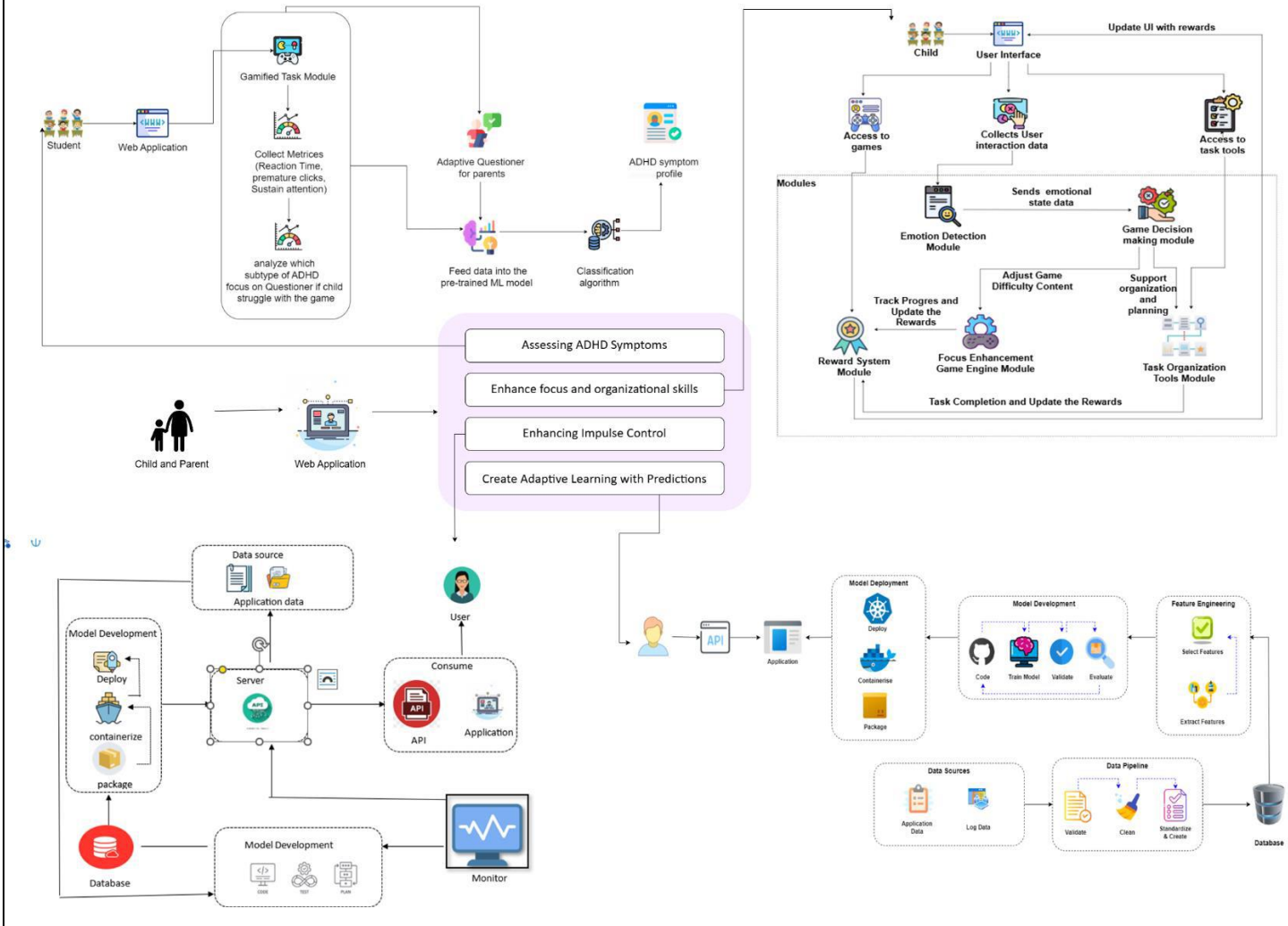


*Figure 3.1.0 : Overall System Diagram*

## 3.2 Individual System Diagram

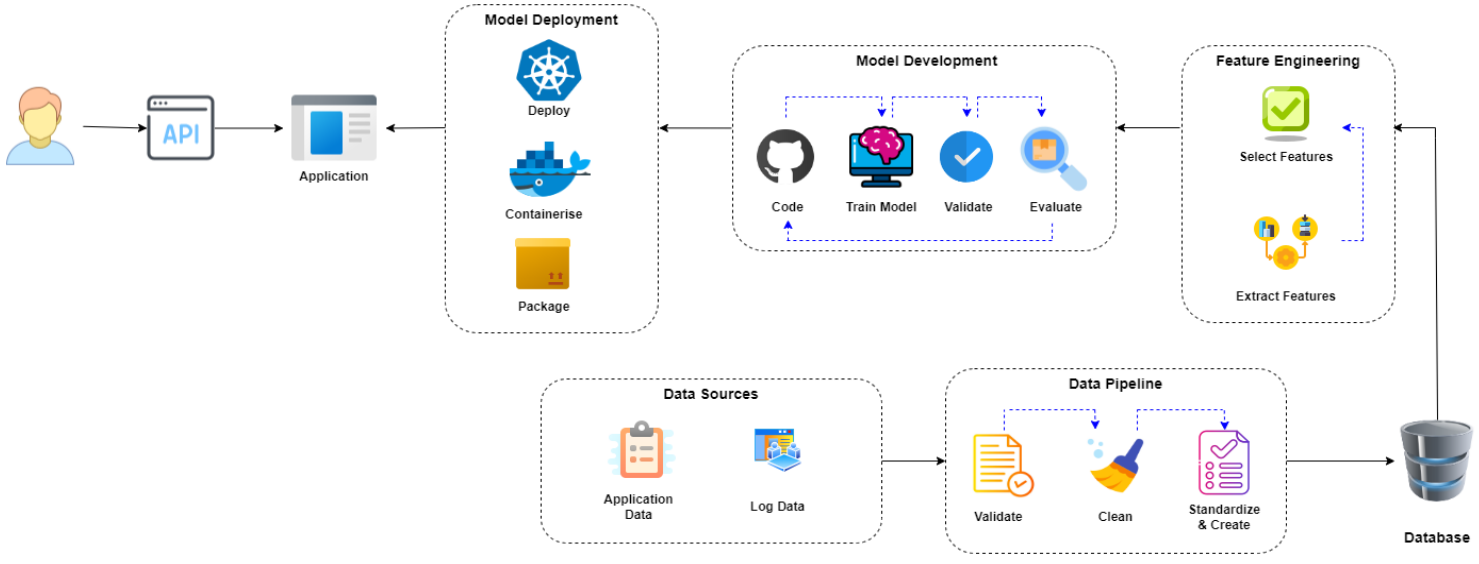


*Figure 3.2.0 : Individual System Diagram*

The development of the ADHD management system includes a structured and methodical process, starting with collection of data to train machine learning model. Relevant data is first collected from primary data sources such as primary schools and hospitals. This information then goes through a data pipeline that filters out the irrelevant parameters and retains only the information needed to train the ML model. At this stage, the data is also standardized for consistency and quality, after which it is stored securely in a database for further use. To ensure security and privacy of data we store data in encrypted format in database.

The prepared data will go through feature engineering processes that can filter out necessary features for the model. Therefore, the dataset is to be used in train multiple ML models; each of such will undergo intensive validation and verification for its suitability to select the most appropriate model through comparisons of metrics like accuracy, precision, recall, and F1-score. The final model is placed in a version control system like GitHub, so that updating, integrating, and reproducing it for future needs are very easy.

The selected final model is then integrated with the web application to realize the predictions. This provides the application the ability to give real-time insights, depending on what the user is interacting with, in an enhanced functionality and user experience. For portability and adaptability of the application across environments, it will be containerized with Docker. In this way, it isolates an environment that should be very smooth for running applications, no matter the infrastructure that is behind.

After containerization, the application will be deployed to Kubernetes to ensure high availability and reliability. Its self-healing feature it will constantly keep up with the desired amount of pods, meaning that your system will not face down-time even when an expected disruption happens.

The application is then made accessible to users via an API, which provides a clean interface to interact with. It also leverages Docker containerization and Kubernetes deployment to maintain the scalability and reliability of the system under varying workloads. This ensures that the proposed system for ADHD

intervention management is robust, efficient, and scalable, enabled by state-of-the-art technologies in machine learning and cloud computing.

# 4. Software Specifications

## 4.1 Functional Requirements

- **User Authentication and Management:**

  The system shall allow caregivers, educators, and administrators to create and manage user accounts. Through role based access control (RBAC) we can further increase the authorization inside of the application.

- **Data Tracking and Collection:**

  The system shall collect and store data relative to the child's interaction with tasks, such as attention span, task completion rate, and response time. Data collection and extract features seems to be most critical part of the system because all the functionality is based on this data collection.

- **AI Adaptive Learning:**

  By means of AI models, the system will be able to predict which challenges a child may face in the near future and thus intervene on time. System will predict future challenges that child might get according to historical data of child and progress of child and provide better prevention mechanisms as well.

- **User Interface and User Experience:**

  Design a simple, enjoyable, and interactive interface intended for a child, which should also be appealing and at their age, with easy maneuverability through tasks. Provide user-friendly dashboard to caregivers and teachers who make the use of child’s data and make predictions and prevention mechanisms from the system.

- **Data Privacy and Security:**

  The system shall guarantee secure encryption and storage of every piece of personal and behavioral data. Since this information are highly sensitive we need to store and deal with data in encrypted manner.

- **System Integration and Compatibility:**

  Use cloud storage for agile data storage and ensure unlimited access to historical and real-time data. Version controlling system will be used for code reusability and code maintenance.

## 4.2 Non-functional Requirements

- **Performance**

  Able to conduct complex analyses without significant delays, ensuring smooth and efficient user experience. Even on mid-range devices, the program must be prompt and quick and Responsive.

- **Scalability**

  The system should be able to scale according to an increasing number of users, data points, and interactions without performance degradation. It should scale to accommodate growth in the number of children, caregivers, and educators who are using the system. In high traffic period system should scale up number of instances and in low traffic period system should decrease number of instances of system.

- **Availability and Reliability**

  Uptime of 99.5% is required for the system to be up and running, available to caregivers, educators, and children most of the time. It must be a fault tolerant system to handle failures gracefully and assure minimum downtime of system. If the system fails, it must recover within 30 minutes without losing any critical data.

- **Usability**

  The system should be intuitively designed and well-documented so that it can be used with the least technical training by caregivers, teachers, and children. People with low technical knowledge should be able to use the system.

- **Maintainability and Extensibility**

  The code base of the system should be modular and well-documented, with easy updating and maintenance possible over time. The system should be designed in a way that will allow it to accommodate new additions without having to overhaul the whole system.

- **Portability**

  The system shall be web-based, accessible through multiple platforms via a web browser. It shall operate under most major web browsers. For portability and adaptability of the application across environments, it will be containerized. In this way, it isolates an environment that should be very smooth for running applications, no matter the infrastructure that is behind.

## 4.3 Software Requirements

1. **Frontend – React.js**

   Purpose : Build UI interface of system and build user-friendly dashboard for teachers and caregivers.

2. **Backend – Node.js**

   Purpose: Include application logic, Handle API requests, Connect application frontend to database, Integrate system with machine learning model

3. **Database – MongoDB**

   Purpose: Store system data such as activity logs, historical data and predictions

4. **Cloud – AWS**

   Purpose: Provide infrastructure to host the system

5. **Machine Learning – Python/ TensorFlow/ pyTorch**

   Purpose: Develop and train predictive models that predict future challenges and prevention mechanisms

6. **Monitoring – Prometheus/Grafana**

   Purpose: Monitor child performance and Visualizes metrics in dashboards

7. **Containerize – Docker**

   Purpose: Package application with dependencies to enhance application portability

8. **Container Orchestration – Kubernetes**

   Purpose: Manage and scale deployed application across clusters

# 5. Commercialization Plan

## 1. Identify the Target Market

The primary target market for this system includes primary school students in Sri Lanka, and eventually, other South Asian countries where awareness of ADHD and access to diagnosis and interventions remain limited. The system is specifically aimed at schools, clinics, and parents in underserved areas with little or no access to specialized ADHD products. With the rising adoption of educational and healthcare digital solutions and telehealth services, the market potential is significant. By estimating the number of children diagnosed with ADHD in Sri Lanka and the broader South Asian region, we can identify a substantial user base and capitalize on growth trends in digital health and education technologies to address this critical gap effectively.

**Primary Audience:**

- Parents and caregivers of children with ADHD.
- Educational institutions, including primary schools and special education centers.
- Healthcare providers, such as pediatricians, psychologists, and therapists specializing in ADHD.

**Secondary Audience:**

- Non-profit organizations and government agencies focused on mental health.
- Health insurance companies offering services for behavioral health.

## 2. Value Proposition

The ADHD management system offers:

- **Personalized ADHD interventions** driven by AI, improving outcomes for children.
- **Real-time progress monitoring** and adaptive strategies for better management.
- **Future predictions** which will help teachers and caregivers to treat children
- **Predict preventive mechanisms** for caregivers and educators, streamlining support efforts
- **Cloud-based accessibility** with robust performance and minimal downtime.

- A **cost-effective alternative** to traditional ADHD intervention programs.

## 3. Revenue Streams

- **Subscription Model**

  Monthly or annual subscription fees for parents and caregivers to access premium features. This offer different subscription tiers:

  *Basic:* Progress Tracking, Generalized Reports, User-Friendly Interface, Automated Alerts
  *Premium:* Advanced AI-Powered Insights, Future Predictive Analysis, Dedicated Support

- **Freemium Model**

  Free access to basic features to build a user base, with paid upgrades for advanced AI-driven analytics and interventions.

- **Licensing to Educational Institutions**

  Provide licenses to schools to use this application with many of the students, at cheaper prices.

- **Partnerships with Healthcare Providers**

  Revenue through partnerships with hospitals, clinics, and therapists who integrate the system into their services.

## Pricing Strategy:

## Basic Plan

- **Price:** Free
- **Features:**
  ✓ Interactive screening of ADHD symptoms.
  ✓ Basic inattention and hyperactivity monitoring.
  ✓ Progress reports are limited and only available in-app.
  ✓ Basic tips on how to manage ADHD-related behaviors
  ✓ Suitable for parents or teachers who do not require professional-level assessments for their child or student.

## Premium Plan

- **Price:** $9.99 per month (or $99.99 annually)
- **Features:**
  ✓ Advanced ADHD screening, including deep insights with the help of AI.
  ✓ Monitoring the attention span, hyperactivity, and task completion rate of the child in great detail..
  ✓ Unlimited access to progress reports with personalized recommendations..
  ✓ Predictive analytics to identify future challenges and suggest preventive strategies.

✓ Provide customer support for app-related issues.
✓ Best suited for parents or educators who need in-depth ADHD management tools and insights.

## Group Plan

- **Price:** Custom pricing based on group size (starting at $49.99 per month for up to 10 users).
- **Features:**
  ✓ Bulk access for schools, clinics, or therapy groups with group tracking capabilities.
  ✓ Centralized dashboard for monitoring multiple children's progress and generating reports.
  ✓ Institution-grade feature set, including Group activity tracking and aggregated performance analysis
  ✓ Create Custom Intervention Strategies for an Individual Student within the Group
  ✓ Access to Premium Features on all users within a Group Plan
  ✓ Account management for organizations and technical support
  ✓ Suitable for schools, clinics, or support groups that need to manage ADHD interventions at scale.

## 4. Marketing Strategy

1. **Digital Marketing:** Use social media marketing and Google Ads and SEO strategies
2. **Collaboration with Experts:** Partner with child psychologists, caregivers and ADHD specialists to promote the system.
3. **Community Engagement:** Host webinars and workshops for parents and educators about ADHD management, Build an online community for users

## 6. Scaling and Growth Plan

1. **Phase 1 (0-6 months):**

   Launch the application with a focus on individual users (parents/caregivers) and gather feedback and refine features based on early user data.

2. **Phase 2 (6-12 months):**

   Target schools and clinics with institutional licensing packages and build partnerships with healthcare providers and therapists.

3. **Phase 3 (12-24 months):**

   Expand to international markets, focusing on developed nations with established ADHD awareness and Introduce local customization features.

4. **Phase 4 (24+ months):**

   Collaborate with insurance companies to include the system in mental health coverage plans and develop additional features, such as integration with wearable devices for real-time physiological monitoring

# 6. Budget

*Table 7.0 : Budget*

| Component | Amount |
|---|---|
| Cloud deployment | Rs.10000 |
| Travelling charges | Rs.10000 |
| Internet charges | Rs.20000 |
| Computational resources | Rs.5000 |
| Monitoring systems (AWS CloudWatch, Grafana) | Rs.10000 |
| **Total** | Rs.55000 |

# 7. Work Breakdown Structure

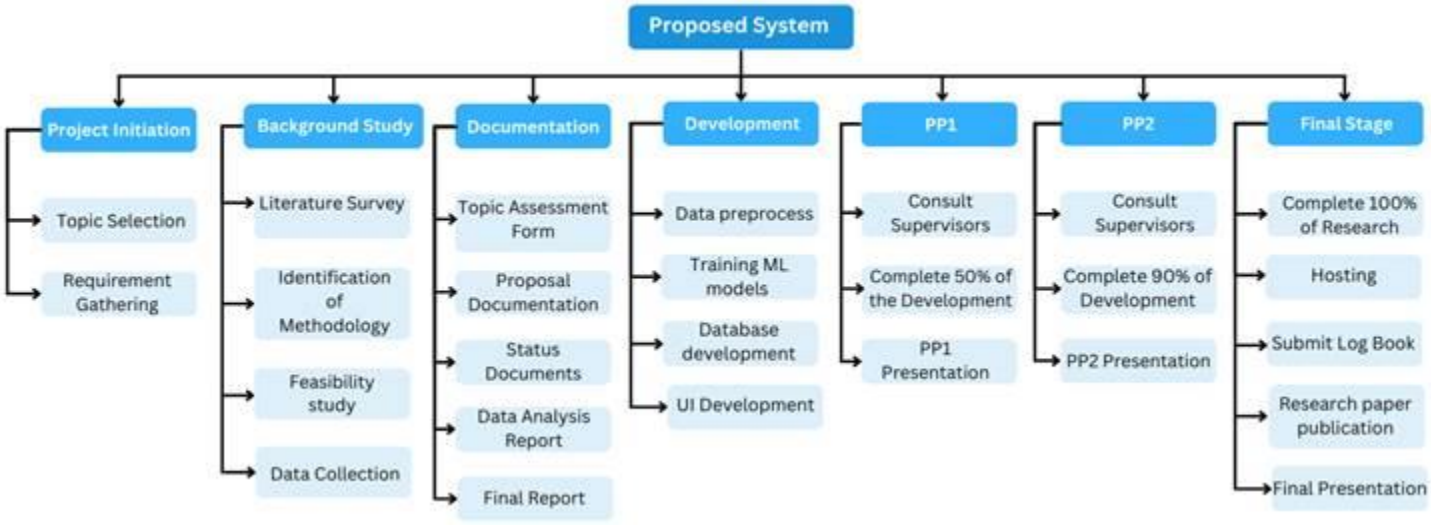


*Figure 8.0 : Work breakdown structure*

# 8. Gantt chart

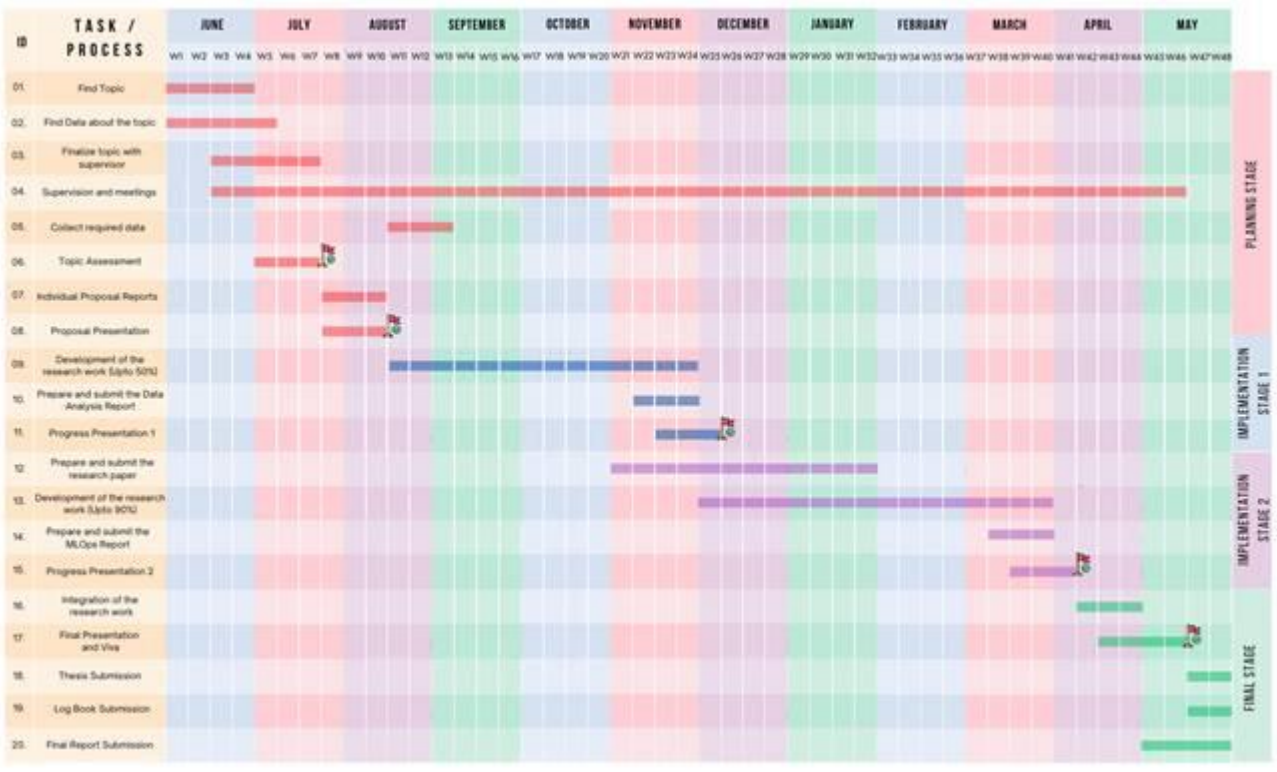


*Figure 9.0 : Gantt chart*

# 9. References


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# 10. Appendices

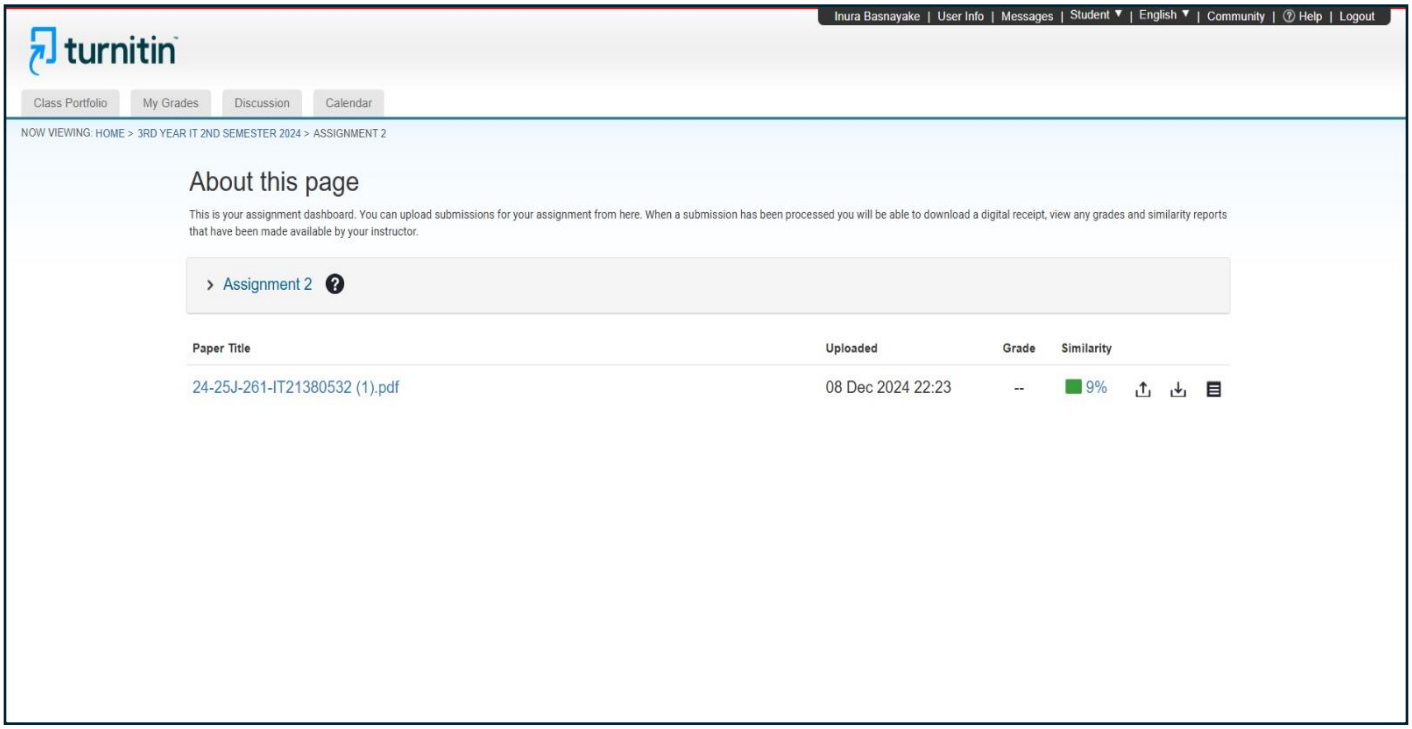


*Figure 10.1: Turnitin report*